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9TH ICEBIT 2025

# PROCEEDING:

## 9TH INTERNATIONAL CONFERENCE ON EDUCATION, BUSINESS, ISLAMIC AND TECHNOLOGY 2025 (9TH ICEBIT 2025)





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# PREFACE

Assalamu'alaikum warahmatullahi wabarakatuh, and warm greetings to all distinguished authors, presenters, reviewers, keynote speakers, participants, and guests.

On behalf of the Organizing Committee, it is my great honour and pleasure to welcome you to the 9th International Conference on Education, Business, Islamic and Technology 2025 (9th ICEBIT 2025), held on 28th–29th December 2025 at the H-Elite Hotel, Kota Bharu, Kelantan, Malaysia.

The ICEBIT conference series has consistently provided a multidisciplinary platform for the exchange of innovative ideas, scholarly research and collaborative networks in the fields of education, business, Islamic studies, and technology. This year's edition continues that tradition by bringing together academicians, researchers, industry professionals, and thought leaders from across the globe.

The world today is witnessing rapid transformations driven by digital innovation, socio-economic challenges, and evolving educational paradigms. Against this backdrop, interdisciplinary research becomes critical in generating insights that can shape responsive and sustainable solutions. The 9th ICEBIT 2025 proceedings represent an impressive collection of high-quality research contributions that address these pressing global and local issues. These works not only reflect rigorous academic inquiry but also embody pragmatic relevance for policy, practice, and future research.

I would like to express my heartfelt appreciation to all authors for their invaluable contributions, to the reviewers for their rigorous evaluation, and to the organizing and technical committees whose dedication has made this conference a success.

It is my sincere hope that this conference and its published proceedings will inspire continued scholarly collaboration, foster new partnerships, and contribute meaningfully to the global knowledge community.

Thank you for your participation and continued support.

**Assoc. Prof. Dr. Adi Anuar Azmin**
Conference Chairman
9th ICEBIT 2025

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# A SYSTEMATIC REVIEW OF PEDAGOGICAL IMPACTS ON STORYTELLING APPROACH IN SECONDARY EDUCATION

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***Abstract***: *This systematic literature review (SLR) examines the impact of storytelling on secondary school learning, focusing on studies published from 2021 to 2025. Although storytelling has long been used in early childhood education, its role at the secondary level is still developing. Using the PRISMA protocol, 1,124 articles from Scopus, Web of Science, and ERIC were screened. After applying eligibility and quality criteria, 30 high-quality studies were analyzed thematically. Findings reveal that storytelling contributes to learning in five key areas. Cognitively, it supports understanding, critical thinking, and problem-solving, particularly in STEM subjects. Emotionally, it enhances motivation, empathy, and inclusive classroom experiences. Linguistically, it improves literacy, creative writing, and oral communication. Culturally, storytelling foster's identity formation, civic awareness, and inclusivity, giving marginalized groups a voice. Pedagogically, it inspires innovative lesson designs, interactive resources, and student-centered assessment practices. Challenges remain, including limited teacher training, cultural adaptation, and evaluation frameworks. The review suggests systematic professional development, culturally responsive curricula, and narrative-based assessment models. Overall, the review concludes that storytelling is a powerful, inclusive pedagogy that can enrich secondary education. It prepares students with critical competencies for the 21st century by integrating cognitive, emotional, linguistic, and cultural dimensions of learning.*

***Keywords:*** *Storytelling pedagogy, Secondary education, Cognitive development, Emotional engagement, Identity formation, Pedagogical innovation*

## Introduction

Storytelling serves as an engaging pedagogical method, particularly beneficial for secondary school students who are developing abstract thinking and higher-order cognitive abilities (Gunawardena & Brown, 2021). Incorporating storytelling techniques into secondary education can transform the classroom environment, fostering increased student engagement and motivation (Anrasiyana, 2021; Steinfadt, 2013). The use of storytelling has the potential to cultivate a more inclusive and supportive learning atmosphere. Rather than traditional didactic methods, narratives can capture students' attention, making learning a more active and participatory process. This is because storytelling has been proven to keep students active and have more confidence in showing their abilities (Anrasiyana, 2021). Moreover, the integration of storytelling aligns with the developmental needs of secondary school students, who are increasingly capable of processing complex themes, interpreting symbolic meanings, and reflecting on moral and ethical dilemmas. Storytelling is also a helpful tool that can be used for students who are learning English as a second language and help them produce higher

quality writing and story structure (Mead, 2002). Stories create confidence and fluency through speaking skills (Sharma, 2018). When students are given the opportunity to participate in telling a story with their peers, it improves their confidence in their pronunciation and communication skills.

This research incorporate with the secondary students. As adolescents transition from concrete operational thought to more abstract reasoning, narratives can act as a bridge, making complex concepts more accessible and relatable (Wandhe, 2024). The innate human affinity for stories can be leveraged to enhance learning outcomes in diverse subject areas (Smeda et al., 2014). In this developmental stage, students are refining their capabilities in critical thinking, problem-solving, and creative expression, all of which can be stimulated through well-crafted narratives (Rahmawati, 2014). Adolescents also navigate significant personal and academic challenges, and pedagogical strategies that incorporate storytelling can foster emotional resilience, empathy, and a sense of connection, addressing their social and emotional needs alongside academic goals. Furthermore, identity formation is a critical aspect of adolescent development; stories that reflect diverse experiences and perspectives can promote self-awareness, cultural understanding, and a sense of belonging (Kim et al., 2021).

**Rational to SLR**

***Problem Statement***

In the current landscape of education, secondary school students often face challenges in engaging with abstract concepts, developing critical thinking, and maintaining motivation across core subjects such as science, mathematics, and history. Traditional teaching methods frequently lack the emotional and cognitive appeal needed to captivate students, particularly in culturally diverse and linguistically complex classrooms. Storytelling has long been recognized as an effective pedagogical approach, capable of enhancing comprehension, empathy, and student engagement. Despite these claims, the integration of storytelling in secondary education remains inconsistent, with limited empirical synthesis of its actual impact across cognitive, emotional, and social dimensions of learning.

Although numerous studies have explored storytelling in early childhood and primary education, there is a noticeable gap in consolidated evidence regarding its effectiveness at the secondary level. Most existing research is fragmented, discipline-specific, or anecdotal in nature. There is a lack of comprehensive systematic reviews that critically analyze and synthesize empirical findings on how storytelling influences academic outcomes, communication skills, identity development, and learner motivation among secondary school students. This gap hinders the development of informed teaching strategies and policy decisions that could optimize the use of storytelling in adolescent learning contexts.

Traditional literature reviews (LR) often lack the methodological rigor required for an unbiased and comprehensive synthesis of existing research. One of the main disadvantages is the absence of a structured and transparent procedure for selecting and analyzing studies. This can result in selective reporting and subjective interpretations, where the author may unintentionally favor sources that align with their viewpoint while excluding contradictory findings. Additionally, traditional reviews rarely include detailed documentation of the databases searched, keywords used, or criteria for inclusion and exclusion, making the process difficult to replicate. The lack of standardized quality appraisal further weakens the reliability of the conclusions drawn. As

a result, traditional LRs may offer an incomplete or skewed perspective of the research landscape, which limits their usefulness in evidence-based decision-making. Systematic literature reviews (SLR) offer several advantages over traditional reviews, particularly in their methodological transparency, reliability, and comprehensiveness. SLRs follow a predefined protocol often based on frameworks such as PRISMA which ensures a clear and replicable process for identifying, selecting, and analyzing relevant studies. This structured approach minimizes the risk of bias and improves the objectivity of the findings. SLRs also include quality assessment criteria to evaluate the methodological soundness of each included study, thereby enhancing the validity and credibility of the review. Moreover, SLRs are comprehensive in scope, typically covering multiple databases and using well-defined search terms to ensure that all relevant literature is captured. As a result, SLRs provide a more balanced and accurate synthesis of the evidence, making them particularly valuable for informing practice, policy, and future research directions.

Compared to existing systematic literature reviews, the current SLR provides a more targeted and updated perspective on the impact of storytelling in secondary school education. While previous reviews have largely focused on early childhood or primary settings, this review specifically addresses storytelling at the secondary level, an area that has received limited attention despite its growing relevance. Furthermore, this SLR incorporates a broader and more current range of studies (from 2021 to 2025) across diverse subject areas, including science, language, and social studies, enhancing its cross-disciplinary relevance. It also introduces a multidimensional thematic framework that categorizes the impact of storytelling into cognitive, affective, linguistic, creative, and socio-emotional domains, providing a deeper and more comprehensive understanding of its educational value. Unlike some existing SLRs that primarily summarize findings, this review critically evaluates the quality and methodologies of the included studies and offers actionable insights for educators and policymakers. This enhances its effectiveness as a practical and scholarly contribution to the field of narrative pedagogy in secondary education. The Systematic Literature Review (SLR), therefore, serves as a rigorous and structured approach to collect, analyze, and synthesize research using transparent and replicable procedures at each step (Higgins et al., 2011). The main objective of this review is to systematically examine the impact of storytelling in secondary education by organizing existing empirical evidence under thematic categories such as cognitive development, emotional engagement, language acquisition, cultural identity, and pedagogical innovation.

This SLR provides several meaningful contributions for both academic and practical communities. Researchers may better understand the thematic trends and pedagogical outcomes associated with storytelling, enabling more targeted and evidence-based classroom interventions. For policymakers, the findings emphasize the value of integrating narrative-based strategies into curriculum frameworks to enhance student engagement and holistic learning. Ultimately, this study aims to offer insights that support the design of more inclusive, reflective, and student-centred educational policies and practices.

### *Research Question*

The research question is a vital component of any Systematic Literature Review (SLR). As highlighted by Shaffril et al. (2021), it serves as the primary reference point throughout the review process, assisting researchers in identifying relevant keywords, selecting appropriate

databases, and guiding the data extraction phase. In the present SLR, the research question was constructed using the PICo framework, which is commonly adopted in developing qualitative research questions (Lockwood et al., 2015). Before applying PICo, several preliminary ideas were explored based on prior SLRs in education and narrative learning, such as Enciso et al. (2023) and Heinemeyer et al. (2022). By applying PICo, three key components were identified: secondary school students (Population), storytelling and its impact on learning (Interest), and educational settings in secondary schools (Context). Therefore, the formulated research question for this review is: ***What is the impact of storytelling in learning experience for secondary school students in classroom settings?***

## Methodology

### *Review Protocol – PRISMA*

This Systematic Literature Review (SLR) refers to the PRISMA protocol (Preferred Reporting Items for Systematic Review and Meta-Analysis). PRISMA was developed by Moher et al. (2009) and later refined by Page et al. (2021). PRISMA aims to provide clear methodological guidelines for conducting SLRs, with one of its main advantages being a systematic search strategy and quality control over the selected materials. Although PRISMA was initially designed for use in the health and medical fields, Page et al. (2021) emphasized its flexibility and applicability across other disciplines. Based on the PRISMA framework, the researcher developed this SLR methodology using four main steps: formulating the research question, conducting a systematic search strategy, assessing the quality of articles, and extracting and analyzing the data.

### *Formulation of Research Question- PICo*

The research question is a crucial component that guides the researcher in achieving the stated objectives of this systematic review. To ensure clarity and relevance, the PICo framework proposed by Lockwood et al. (2015) was employed in developing the research question. PICo stands for P = Population, I = Interest, and Co = Context. In this review, P refers to primary school students, I refer to instructional practices, and Co refers to the teaching and learning of mathematics. These three components served as the foundation for formulating the main research question, which is:

1. What is the impact of storytelling in learning experience for secondary school students in classroom settings?

By using the PICo framework, the researcher ensures that the review remains focused on synthesizing relevant empirical evidence within a clearly defined educational context.

### *Systematic Searching Strategy*

To ensure that this SLR undertakes a comprehensive search process, the researcher implemented a systematic search strategy, which was guided by three main processes: identification, screening, and eligibility. These stages form the core structure of the PRISMA approach and are essential in filtering relevant studies from a vast pool of academic literature. The identification phase involves locating potentially relevant articles through predefined databases using specific keywords. The screening process then removes duplicates and

evaluates titles and abstracts for relevance. Finally, the eligibility phase involves a thorough review of full-text articles based on inclusion and exclusion criteria to ensure that only high-quality and relevant studies are included in the final analysis.

**Table 1 The Search String**

| Database | Search string |
|---|---|
| Scopus | ( TITLE-ABS-KEY ( "storytelling" OR "narrative approach*" OR "story-based learning" OR "narrative technique*" OR "story-driven instruction" OR "digital storytelling" OR "oral storytelling" OR "educational storytelling" OR "narrative pedagogy" ) ) AND ( TITLE-ABS-KEY ( "secondary school*" OR "high school*" OR "middle school*" OR "lower secondary" OR "upper secondary" OR "secondary education" OR "teenage student*" OR "adolescent learner*" OR "school-aged youth" ) ) AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) AND ( LIMIT-TO ( SUBJAREA , "SOCI" ) ) AND ( LIMIT-TO ( EXACTKEYWORD , "Storytelling" ) ) |
| WoS | TS=("storytelling" OR "narrative approach*" OR "narrative technique*" OR "story-based learning" OR "narrative pedagogy" OR "story-driven instruction" OR "digital storytelling" OR "oral storytelling" OR "educational storytelling") AND TS=("secondary school*" OR "high school*" OR "lower secondary" OR "upper secondary" OR "middle school*" OR "secondary education" OR "teenage student*" OR "adolescent learner*" OR "school-aged youth") |

### *Identification*

The researcher identified several main keywords based on the formulated research question. Three keywords were selected: storytelling, narrative pedagogy, and secondary school. These keywords were then expanded by incorporating synonyms, related terms, and variations of the main keywords such as narration, story-based learning, high school students, and adolescents. Using these refined keywords, the researcher conducted two main search processes: manual searching (through handpicking and snowballing techniques) and advanced database searches using structured search strings. These search strings were applied in three major academic databases, Scopus, Web of Science (WoS) (refer to the search string below). In addition to Scopus and WoS, the researcher also included one education-focused database, ERIC, and strengthening the comprehensiveness of the search. In eric researchers practice manual searching techniques namely handpicking. From these three sources, a total of 1124 articles were initially retrieved and moved to the next stage of the SLR process which is screening process.

### *Screening*

Screening is the second stage in the systematic search strategy and serves as a process to establish clear criteria for selecting articles. This step is essential for two main reasons: first, to reduce the number of articles that need to be reviewed in depth, and second, to ensure that only

articles relevant to the SLR topic are included. In this study, three primary screening criteria were applied. First, only articles published between the years 2021 to 2025 were selected to ensure currency and relevance. Second, only journal articles were included, excluding other publication types such as conference proceedings, book chapters, and reports. Third, only articles published in English were considered, to maintain consistency in language and interpretation. Based on this screening process, a total of 1058 articles were excluded, leaving 66 articles to proceed to the next stage which is eligibility.

***Eligibility***

Eligibility is the second-level screening process conducted to ensure that each selected article is truly relevant to the research question and objectives of the study. In this stage, the researcher carefully reviewed the titles and abstracts of the shortlisted articles. During this process, a total of 35 articles were excluded for two main reasons: (1) the articles did not clearly discuss the impact of storytelling in learning, and (2) the focus was primarily on digital storytelling, rather than traditional storytelling, which is the main emphasis of this SLR. The remaining 31 articles were then carried forward to the quality appraisal stage for further evaluation.

**Table 2 Screening and Eligibility Criteria**

| | |
|---|---|
| Timeline publication | 2021-2025 |
| Document Type | Article journals |
| Language | English |
| Focus study | Impact of storytelling in learning for secondary students |
| Types of data | Primary |

***Quality Appraisal***

Quality appraisal is important process as SLR emphasizes on the on the quality of the selected article. For this purpose, six quality criteria proposed by Abouzahra et.al (2020) were referred (Refer to table 3). For each criterion, three options of answer were available namely yes (represent 1 mark), partially (represent 0.5 marks), and No (represent 0 mark). An article will be considered of sufficient quality and included in the systematic literature review (SLR) if its total score exceeds 3.0 (50%). Based on the process, one article was excluded due to failure to

meet at least 3.0 marks in the article's quality assessment. A total of 30 articles were brought to the next steps.

**Table 3 Quality Appraisal Criteria**

| Research design | Assessment criteria |
|---|---|
| Qualitative | QA1. Is the purpose of the study clearly stated? |
| | QA2. Is the interest and usefulness of the work clearly presented? |
| | QA3. Is the study methodology clearly established? |
| | QA4. Are the concepts of the approach clearly defined? |
| | QA5. Is the work compared and measured against other similar works? |
| | QA6. Are the limitations of the work clearly mentioned? |

***Data Extraction and Analysis***

The authors carefully reviewed the remaining selected articles. Guided by the established research question, the first author extracted relevant qualitative data primarily from the results and discussion sections, while additional sections were referred to as needed for contextual clarity. Although many of the reviewed articles employed quantitative or mixed-method designs, the focus of this SLR remained qualitative, hence the descriptive statements and narrative interpretations were extracted, rather than raw numerical or statistical outputs. All extracted data were then organized and tabulated systematically and subsequently validated by a second reviewer to ensure data relevancy and minimize potential selection bias.

This SLR adopts a qualitative synthesis approach, which aligns with the perspectives of Dixon-Woods et al. (2005), who argued that complex educational phenomena are best understood through diverse methodological lenses. Accordingly, the present review employed inductive thematic analysis, a method well-suited for interpreting meaning from varied forms of narrative data (Flemming et al., 2019). Thematic analysis, as defined by Braun and Clarke (2006), enables researchers to identify recurring patterns of meaning in qualitative data especially pertinent in educational contexts where experiences, perceptions, and reflective practices are central.

The study refers to the thematic analysis process outlined by Braun and Clarke (2006). initially, the authors immersed themselves in the dataset to develop familiarity with the content. This was followed by the generation of initial codes, which were then organized into potential themes and sub-themes. Through iterative discussion and refinement, five main themes: Cognitive Impact, Affective and Emotional Engagement, Language and Communication Development, Identity Formation and Cultural Understanding, and Pedagogical Innovation and Classroom Practice and 15 sub-themes were finalized. Several preliminary sub-themes were removed to maintain coherence and clarity. Definitions and conceptual boundaries for each theme were established, and the thematic framework was validated by two independent experts in educational pedagogy and curriculum design. The following sections report and discuss the results according to these themes and sub-themes, as summarized in Tables 4 and table 5.

**Table 4: The Themes and Sub-Themes**

| | |
|---|---|
| Cognitive Impact | CUDL = Conceptual Understanding & Deep Learning<br>CRT = Critical & Recursive Thinking<br>DSR= Data & Scientific Reasoning |
| Affective and Emotional Engagement | ME= Motivation & Enjoyment<br>EEC= Empathy & Emotional Connection<br>CCI= Classroom Climate & Interest |
| Language and Communication Development | LEW= Literacy & Expressive Writing<br>VFOS= Verbal Fluency & Oral Skills<br>CNS= Creative Narratives & Storytelling |
| Identity Formation and Cultural Understanding | CVA= Civic & Ethical Awareness<br>CHI= Cultural & Heritage Identity |

| | |
|---|---|
| | NII= Narrative Identity & Inclusion |
| Pedagogical Innovation and Classroom Practice | CLD= Curriculum & Lesson Design<br>PT= Participatory Tools<br>SCA= Student-Centred Assessment |

## Results

### *Background of The Selected Studies*

Between the periods 2021 and 2022, the United States topped the list in contributions with three articles in 2021 and one contribution in 2022. Two articles were from Indonesia in 2021 and one article from Canada and Spain the same year. In 2022, one article was from the United Kingdom, while Trinidad & Tobago also provided one article, together with the US contribution.

In 2023 and 2025, its international coverage was expanded. In 2023, the two American articles led the way, followed by China, Iran, Turkey, Malaysia, and USA–Colombia collaboration each submitting one article. In 2024, Italy became the leader with three articles, followed by Indonesia and China each submitting two articles, while UK, Chile, Romania, Sweden, and Malta each submitted a single article. Up to 2025, the contribution was made up of two by Chile, one by China (with USA collaboration), United States (with China collaboration), and India. Overall, during the period of 2021–2025, the USA contributed six articles, Indonesia contributed four, China contributed three, and Italy contributed three, while others contributed one or two articles.

### The Developed Themes

Based on the thematic analysis, the following five main themes were identified: Cognitive Impact, Affective and Emotional Engagement, Language and Communication Development, Identity Formation and Cultural Understanding, and Pedagogical Innovation and Classroom Practice, the five core domains influenced by storytelling in education. These main themes were further divided into 15 subthemes that reflect specific educational outcomes observed in secondary school students.

### Theme 1: Cognitive Impact

### *Conceptual Understanding & Deep Learning*

Storytelling has proven especially effective in enhancing conceptual understanding in science and STEM education. For instance, Tuveri, Steri & Fadda (2024) and Rawatee Maharaj-Sharma (2022) demonstrated how storytelling improved students' grasp of complex physics concepts such as gravitational waves. Sanei et al. (2023b), Su & Yang (2023b), and Syam et al. (2024) found that narratives helped students translate abstract climate science and AI processes into more relatable, understandable forms. Zhong & Craig (2025) showed that narrative activities increased clarity in comprehending scientific topics, while Yañez et al. (2025) used robotic storytelling to support abstraction and cross-curricular understanding. Lu et al. (2024) observed that storytelling enabled pre-service teachers to develop mental models related to sustainability, and Draves et al. (2021) noted that personal stories deepened sustainability understanding. Sum et al. (2023) further contributed to this domain by showing

how integrating storytelling with visual representations enhanced students' conceptual understanding of fractions.

In mathematics education, storytelling has helped bridge abstract concepts with everyday experiences. Irmayanti et al. (2024), Nicchiotti (2024), and Gerardo Reyes & Zúñiga (2024) highlighted how math storytelling made abstract ideas more accessible and meaningful. Leslie Dietiker et al. (2023) found that narrative structures bridged students' intuitive experiences with formal mathematical thinking, while Fatchurahman, Setiawan & Karyanti (2021) demonstrated that segmented stories improved comprehension and sequencing. Sum et al. (2023) also emphasized the effectiveness of storytelling in visualizing part-whole relationships in fractions.

In language, literature, and writing contexts, Aquilina et al. (2024) revealed that students internalized Shakespearean themes through creative retelling, and Tuncay Türkben & Havva Karaca (2023) found that narrative structures deepened understanding of literary components. Besser, Blackwell & Saenz (2022) noted how students mastered academic content through the creation of educational podcasts.

Storytelling also supported social justice and identity exploration. Enciso et al. (2023), Storm & Jones (2021), and Choudhary & Bakshi (2025) documented how narrative engagement enabled deep analysis of gender, power, and global justice issues. Casanova et al. (2021b) found that multimodal storytelling helped pre-service teachers understand concepts of equity, while Tripon (2024) linked STEM theory to real-world experiences of gender inclusion in rural contexts. In interdisciplinary and cultural contexts, Marijke Hecht (2023) emphasized the role of Indigenous narratives in deep learning, and Puttick & Woolner (2024) showed how personal storytelling facilitated understanding of climate adaptation. Björn Kindenberg (2024) used narrative strategies to help students engage with historical complexity, and Heinemeyer et al. (2022) reported that storytelling enhanced deep learning in geography and environmental topics.

***Critical & Recursive Thinking***

Storytelling fostered critical and recursive thinking by encouraging students to revisit, reflect on, and refine their ideas across diverse learning contexts. In language and narrative-based learning, Alessandra Boscolo et al. (2024), Enciso et al. (2023), and Sanei et al. (2023b) demonstrated how iterative storytelling practices such as revising superhero plots and constructing layered narratives cultivated critical thinking and questioning. Aquilina et al. (2024) highlighted how reconstructing Shakespearean stories required deep analytical reflection, while Choudhary & Bakshi (2025) showed that student drafts and peer critiques nurtured iterative self-awareness. Casanova et al. (2021b) reported that reflective storytelling helped reveal personal biases and positionality.

In mathematics and STEM contexts, narrative approaches also nurtured logical reasoning. Setyarini et al. (2021b) found that the PMI storytelling technique supported recursive oral expression, while Irmayanti et al. (2024), Nicchiotti (2024), and Gerardo Reyes & Zúñiga (2024) reported that math stories allowed students to reflect on multi-step problem-solving processes. Heinemeyer et al. (2022) observed that storytelling in math encouraged flexible

thinking and scaffolded logical structures. Similarly, Maharaj-Sharma (2022) demonstrated that story-based revisions in physics activated inferential thinking and conceptual reflection.

For themes related to identity, ethics, and civic learning, storytelling played a key role in prompting personal reflection. Storm & Jones (2021), Lu et al. (2024), and Tripon (2024) reported that narrative RPGs, teacher storytelling, and reflective journals encouraged students to re-evaluate their roles, values, and assumptions, especially around issues like gender and rural inclusion. Zhong & Craig (2025) emphasized that critical reflection on narrative structure and meaning boosted students' recursive thinking skills. In interdisciplinary and coding contexts, Yañez et al. (2025) found that students refined their computational thinking by revising robotic code to match evolving narrative goals. Kindenberg (2024) showed that rewriting historical narratives promoted recursive evaluation and deeper historical understanding.

***Data Scientific Reasoning***

Storytelling proved to be a powerful tool for enhancing data interpretation and scientific reasoning, especially within STEM and AI learning environments. Sanei et al. (2023b), Syam et al. (2024), and Zhong & Craig (2025) showed that embedding datasets and factual content within stories enabled students to collect, analyze, and structure information logically while constructing scientific arguments. Puttick & Woolner (2024) and Lu et al. (2024) highlighted how environmental and sustainability narratives helped students make sense of abstract scientific data and connect it to real-world contexts. Heinemeyer et al. (2022) embedded climate data into narrative-based inquiry, which enhanced students' scientific reasoning and decision-making processes.

In AI and computational thinking, Su & Yang (2023b) demonstrated that stories supported logical understanding of how AI systems operate, while Yañez et al. (2025) used computational storytelling to engage students in algorithmic sequencing and narrative-based decision-making. The AI literacy curriculum further emphasized this benefit, as storytelling encouraged students to critically interpret data and explore socio-scientific issues, thereby deepening their understanding of complex technical systems. Maharaj-Sharma (2022) illustrated how physics storytelling linked scientific discoveries with logical patterns of reasoning, fostering a deeper conceptual grasp of scientific inquiry.

**Theme 2: Affective and Emotional Engagement**
***Motivation & Enjoyment***

Storytelling significantly enhanced student motivation and enjoyment across various disciplines by making learning more relatable, engaging, and imaginative. In STEM and science education, Tuveri, Steri & Fadda (2024), Sanei et al. (2023b), Syam et al. (2024), and Draves et al. (2021) found that storytelling increased students' interest and excitement in learning science and climate-related content. Su & Yang (2023b) and Zhong & Craig (2025) reported that students found AI and computational tasks more engaging when delivered through stories, while Yañez et al. (2025) demonstrated that combining robotics with playful narratives heightened student effort and enthusiasm. Lu et al. (2024) observed increased enjoyment among pre-service teachers when sustainability was taught through creative stories.

Similarly, Storm & Jones (2021) and Tripon (2024) showed that role-play and service-learning narratives encouraged voluntary participation and meaningful learning.

In the domain of language and creative writing, Setyarini et al. (2021b) showed how the PMI storytelling technique made speaking tasks more enjoyable, and Aquilina et al. (2024) found that artistic retellings fostered sustained engagement. Students also demonstrated enthusiasm for math storytelling, as noted by Irmayanti et al. (2024), Leslie Dietiker et al. (2023), Nicchiotti (2024), and Gerardo Reyes & Zúñiga (2024), all of whom reported that integrating narratives into math instruction reduced anxiety and made abstract topics more approachable. Besser, Blackwell & Saenz (2022) also highlighted how podcast storytelling fostered excitement and ownership.

Creative storytelling activities further sparked imagination and joy in writing tasks, as seen in the work of Tuncay Türkben & Havva Karaca (2023), Choudhary & Bakshi (2025), and Enciso et al. (2023), who used superhero narratives to energize students. Casanova et al. (2021b) showed that storytelling not only benefited learners but also fostered fulfillment and creativity among pre-service teachers. Finally, Alessandra Boscolo et al. (2024) confirmed that storytelling approaches consistently increased students' intrinsic motivation and joy in learning.

***Empathy & Emotional Connection***

Storytelling emerged as a powerful medium for cultivating empathy and emotional connection across learning domains. In the context of social justice and marginalized voices, Marijke Hecht (2023), Sadati & Mitchell (2021b), and Casanova et al. (2021b) highlighted how narratives evoked empathy by humanizing the experiences of Indigenous communities, SGBV survivors, and oppressed groups. Enciso et al. (2023) and Storm & Jones (2021) found that students developed deeper emotional engagement through characters inspired by real struggles and roleplay activities that connected them with marginalized identities. Similarly, Tripon (2024) reported that rural-based narratives fostered both empathy and social justice awareness, while Choudhary & Bakshi (2025) noted that resilience-centered storytelling nurtured compassionate responses to adversity.

In science and environmental education, storytelling helped students emotionally relate to global issues. Puttick & Woolner (2024), Sanei et al. (2023b), and Lu et al. (2024) showed that narratives focusing on climate-affected communities and sustainability themes-built student empathy for distant realities. Su & Yang (2023b) observed that AI-centered dilemmas triggered emotional reactions, while Maharaj-Sharma (2022) found students identified empathetically with characters portraying scientists and researchers. Syam et al. (2024) added that young learners connected emotionally to science through story-based explorations.

Character development and emotional storytelling were also key to building bonds. Zhong & Craig (2025), Yañez et al. (2025), and Alessandra Boscolo et al. (2024) highlighted that students felt emotionally connected through collaborative story construction and relatable character dilemmas. Tuncay Türkben & Havva Karaca (2023) emphasized that personalized storytelling strengthened deep emotional attachment and classroom rapport.

Even in mathematics learning, Irmayanti et al. (2024) showed that embedding characters into math stories cultivated emotional trust and engagement, bridging affective and cognitive domains. Overall, these studies confirm that storytelling fosters authentic emotional resonance, encouraging students to connect with people, content, and contexts on a deeper level.

***Classroom Climate & Interest***

Storytelling positively transformed the classroom climate, fostering inclusive, interactive, and supportive learning environments. Several studies demonstrated how storytelling practices promoted collaboration and engagement. Tuveri, Steri & Fadda (2024) observed heightened attentiveness and participation in story-integrated science lessons, while Syam et al. (2024) reported improved teamwork and interaction in STEM classrooms. Yañez et al. (2025) and Lu et al. (2024) noted that collaborative storytelling activities enhanced student engagement and contributed to a positive, vibrant classroom atmosphere. Tripon (2024) found that service-learning narratives inspired community involvement and fostered a shared sense of purpose.

A major benefit of storytelling was its role in creating inclusive and affirming spaces. Storm & Jones (2021) used RPGs to build classrooms that affirmed diverse identities and encouraged mutual respect. Zhong & Craig (2025) and Irmayanti et al. (2024) reported that narrative tasks created a welcoming environment, especially for anxious or hesitant learners. Casanova et al. (2021b) also found that storytelling facilitated honest conversations around race and identity, enriching classroom inclusivity.

Additionally, storytelling helped reduce anxiety and encouraged emotional comfort and expression. Sadati & Mitchell (2021b) described how storytelling offered a safe space for open dialogue, while Besser, Blackwell & Saenz (2022) reported that podcast storytelling increased student comfort and reduced performance anxiety. Draves et al. (2021) added that connecting personal experiences to science through stories deepened student interest and helped foster emotional engagement. Heinemeyer et al. (2022) concluded that storytelling transformed the classroom into a trusting, collaborative learning community.

**Theme 3: Language and Communication Development**
***Literacy & Expressive Writing***

Storytelling significantly enhanced students' literacy and expressive writing skills, promoting creativity, coherence, and subject integration across disciplines. In terms of narrative development, Alessandra Boscolo et al. (2024), Enciso et al. (2023), and Storm & Jones (2021) showed that writing and extending multimodal stories, character journals, and narrative reflections helped build foundational literacy and expressive capacity. Students practiced narrative techniques and voice through character-driven writing, while Aquilina et al. (2024) found that dramatic retelling encouraged rich expressive writing.

Several studies emphasized the impact of subject-integrated writing. In science and STEM, Su & Yang (2023b), Syam et al. (2024), and Maharaj-Sharma (2022) used story-based writing to help students explain AI systems, reflect on scientific understanding, and describe physics phenomena like gravitational waves. Lu et al. (2024) highlighted improvements in persuasive and structured writing about sustainability, while Tripon (2024) used journaling and interviews to promote critical reflection. In math contexts, Irmayanti et al. (2024), Leslie Dietiker et al.

(2023), and Nicchiotti (2024) demonstrated that math-focused storytelling improved vocabulary, comprehension, and expressive fluency. Heinemeyer et al. (2022) added that reflective writing enhanced students' articulation of mathematical reasoning.

To develop clarity, coherence, and structured expression, narrative tools such as the PMI method (Setyarini et al., 2021b), story coding (Yañez et al., 2025), and podcast scripting (Besser, Blackwell & Saenz, 2022) supported sentence fluency, logical progression, and structured storytelling. Fatchurahman, Setiawan & Karyanti (2021) found that experience-based writing enriched narrative fluency, while Choudhary & Bakshi (2025) and Casanova et al. (2021b) emphasized coherence, equity, and voice in teacher-developed narrative writing. Tuncay Türkben & Havva Karaca (2023) further highlighted gains in fluency and sentence construction.

***Verbal Fluency & Oral Skills***

Storytelling activities meaningfully enhanced verbal fluency and oral communication skills by encouraging students to speak clearly, confidently, and reflectively across different learning contexts. Through oral storytelling and presentation, Su & Yang (2023b), Yañez et al. (2025), and Zhong & Craig (2025) found that students developed stronger public speaking, articulation, and self-expression by presenting narratives and engaging in story-based discussions. Setyarini et al. (2021b) showed that the PMI storytelling strategy helped improve spoken logic and clarity, while Besser, Blackwell & Saenz (2022) emphasized how podcast performances fostered structured oral communication.

Collaborative storytelling also supported dialogue and spoken fluency. Lu et al. (2024) observed that collaborative scripting and storytelling improved students' verbal interaction and fluency, and Tripon (2024) used interviews and participatory videos to provide authentic speaking practice. Casanova et al. (2021b) found that classroom discussions centered on social themes helped learners articulate complex ideas with greater precision.

In subject-specific applications, Irmayanti et al. (2024) demonstrated that storytelling allowed students to verbalize their mathematical reasoning more effectively, strengthening their ability to explain abstract concepts aloud.

***Creative Narratives & Storytelling***

Storytelling as a creative practice empowered students to develop original, expressive narratives that integrated academic content, real-life issues, and imaginative thinking. In subject-integrated storytelling, Tuveri, Steri & Fadda (2024), Puttick & Woolner (2024), and Syam et al. (2024) demonstrated how students interpreted scientific and environmental content through original stories. Sanei et al. (2023b) and Su & Yang (2023b) engaged students in creating data-driven and AI-focused narratives blending fact with fiction, while Lu et al. (2024) used sustainability themes to stimulate original storytelling. Irmayanti et al. (2024) and Leslie Dietiker et al. (2023) explored how students framed mathematical thinking using characters, plots, and fictional problem scenarios.

Numerous studies highlighted co-creation and original storytelling as core pedagogical strategies. Boscolo et al. (2024), Storm & Jones (2021), and Zhong & Craig (2025) emphasized

how collaborative story-building supported the articulation of complex concepts and fostered student agency. Yañez et al. (2025) applied story coding within robotics, promoting narrative structure and creativity, while Tripon (2024) facilitated storytelling clubs that connected personal experiences with social advocacy. Fatchurahman, Setiawan & Karyanti (2021) added that healing narratives improved storytelling competence in reflective contexts.
Several projects adopted multimodal and genre-diverse storytelling. Enciso et al. (2023) had students create superhero narratives tied to real-world issues, while Aquilina et al. (2024) promoted creative retellings of Shakespeare. Tuncay Türkben & Havva Karaca (2023) fostered narrative skills through structured creative writing, and Besser, Blackwell & Saenz (2022) integrated podcast scripting with storytelling frameworks. Casanova et al. (2021b) and Choudhary & Bakshi (2025) encouraged multimodal productions such as video stories, speculative fiction, and memoirs to deepen narrative expression. Heinemeyer et al. (2022) further supported creativity by having students reimagine environmental solutions through collaborative storytelling.

**Theme 4: Identity Formation and Cultural Understanding**
***Civic & Ethical Awareness***

Storytelling served as a compelling pedagogical tool for developing students' civic and ethical awareness, prompting reflection on real-world issues, moral responsibility, and social justice. In narratives focused on social justice and values, Boscolo et al. (2024), Enciso et al. (2023), and Storm & Jones (2021) presented students with civic dilemmas, superhero-based advocacy, and justice-oriented stories that encouraged critical engagement with themes of equity, discrimination, and moral complexity. Sadati & Mitchell (2021b) used stories to deepen students' ethical understanding of sexual and gender-based violence (SGBV), while Choudhary & Bakshi (2025) introduced narratives around migration and inequality to cultivate civic responsibility. Casanova et al. (2021b) highlighted how storytelling helped teachers reflect on systemic oppression and education's role in promoting justice.

Other studies emphasized climate justice and environmental ethics. Puttick & Woolner (2024), Heinemeyer et al. (2022), and Lu et al. (2024) found that co-authored climate stories empowered students as ethical actors in environmental issues and encouraged civic participation in ecological advocacy. Similarly, Tripon (2024) used service-learning narratives to promote gender equity and social awareness through community engagement.

In contexts involving technology and civic discourse, Su & Yang (2023b) and Zhong & Craig (2025) reported that storytelling enabled students to explore complex questions related to AI fairness, societal dilemmas, and ethical decision-making. Yañez et al. (2025) found that themes of inclusion and cooperation were naturally embedded in students' narrative creations. Maharaj-Sharma (2022) showed that ethical dimensions of scientific discovery could be illuminated through narrative framing, linking civic thought to scientific understanding.

***Cultural & Heritage Identity***

Storytelling provided a vital platform for students and educators to explore, express, and preserve cultural and heritage identity, fostering deeper connections to tradition, place, and community. In studies emphasizing Indigenous and traditional narratives, Marijke Hecht (2023) underscored the importance of preserving Indigenous voices in educational storytelling,

while Nicchiotti (2024) and Sadati & Mitchell (2021b) highlighted how traditional and resistance-based stories conveyed cultural heritage and gendered experiences. Casanova et al. (2021b) supported this by encouraging pre-service teachers to reflect on their own cultural identities through story creation.

Several works demonstrated how subject-based learning was enriched through cultural integration. Irmayanti et al. (2024) and Nicchiotti (2024) used cultural narratives to make mathematics more relatable for students from diverse backgrounds. Su & Yang (2023b) embedded local perspectives within AI-based storytelling, while Lu et al. (2024) promoted the inclusion of cultural traditions in sustainability narratives, linking environmental learning with heritage.

For many learners, storytelling also functioned as a medium for expressing local and personal cultural identity. Enciso et al. (2023) and Tripon (2024) showed how students explored community struggles and rural experiences to foster appreciation for their cultural roots. Heinemeyer et al. (2022) incorporated regional knowledge into climate storytelling, and Yañez et al. (2025) encouraged students to include cultural narratives even in computational tasks, demonstrating the flexibility of storytelling in honoring identity across disciplines.

***Narrative Identity & Inclusion***

Storytelling emerged as a transformative approach to support narrative identity formation and inclusion, allowing students and teachers to explore, affirm, and reconstruct their identities while amplifying marginalized voices. Marijke Hecht (2023) and Enciso et al. (2023) illustrated how stories highlighted the erasure of Indigenous narratives and helped students negotiate complex identities through superhero and community-based narratives. Storm & Jones (2021) and Sadati & Mitchell (2021b) showcased how queer-inclusive and gender-aware storytelling practices enabled students to express and reconstruct personal identities, while Boscolo et al. (2024) used community-rooted stories to help learners see themselves represented within the curriculum.

Personalized storytelling within academic contexts further supported identity development. Su & Yang (2023b), Syam et al. (2024), and Zhong & Craig (2025) demonstrated how learners embedded personal perspectives and local identity markers in AI, science, and narrative writing tasks. Irmayanti et al. (2024) revealed how math storytelling reshaped negative self-perceptions, helping students develop confidence. Fatchurahman, Setiawan & Karyanti (2021) emphasized storytelling's role in post-trauma identity reconstruction, while Nicchiotti (2024) highlighted reflection-driven identity support through narrative math expression.

Teachers also used storytelling to explore and construct professional identities. Lu et al. (2024) and Casanova et al. (2021b) reported that teachers crafted inclusive educator identities through reflective story engagement. Tripon (2024) worked with rural women and STEM students to co-construct empathetic narratives about becoming educators, while Choudhary & Bakshi (2025) encouraged inclusive reflection through personal storytelling. Yañez et al. (2025) and Heinemeyer et al. (2022) found that collaborative narrative construction promoted ownership and supported inclusive identity formation among both learners and educators.

## Theme 5: Pedagogical Innovation and Classroom Practice

### *Curriculum & Lesson Design*

Storytelling played a significant role in reimagining curriculum and lesson design, offering a rich framework to integrate academic content with creativity, inclusivity, and real-world relevance. Many studies emphasized cross-curricular storytelling integration. Boscolo et al. (2024), Zhong & Craig (2025), and Sanei et al. (2023b) provided structured frameworks that embedded storytelling across science, technology, and humanities. Puttick & Woolner (2024), Su & Yang (2023b), and Yañez et al. (2025) demonstrated how narrative techniques were used in climate, AI, and coding lessons to create cohesive, cross-disciplinary learning experiences. Syam et al. (2024) and Lu et al. (2024) similarly showed how STEM and teacher education modules were designed around storytelling. Maharaj-Sharma (2022) and Sum et al. (2023) applied narrative strategies specifically to physics and mathematics to improve comprehension and engagement with complex concepts.

In terms of culturally relevant and equity-centered curricula, Hecht (2023) critiqued curricular structures that marginalize Indigenous narratives, while Enciso et al. (2023), Storm & Jones (2021), and Sadati & Mitchell (2021b) developed storytelling activities that reflected students' cultural realities and emotional well-being. Casanova et al. (2021b) and Choudhary & Bakshi (2025) designed equity-focused instruction through multimodal narratives and civic role-play,

Where as Kindenberg (2024) advocated historical narrative approaches for more engaging history instruction.Several studies provided pedagogical planning models using storytelling as a central instructional tool. Leslie Dietiker et al. (2023), Nicchiotti (2024), Gerardo Reyes & Zúñiga (2024), and Irmayanti et al. (2024) all presented ways to embed storytelling into mathematics instruction, with models focused on narrative aesthetics, recursive thinking, and early math learning. Fatchurahman, Setiawan & Karyanti (2021) structured lesson phases around healing narratives, while Tuncay Türkben & Havva Karaca (2023) developed a story-based framework for improving writing instruction. Tripon (2024) combined storytelling and service-learning to support rural teacher preparation, offering both pedagogical and social development. Heinemeyer et al. (2022) proposed storytelling as a transformative alternative to teacher-centered instruction, promoting co-constructed learning experiences.

### *Participatory Tools*

Storytelling was amplified through participatory tools, offering learners immersive, interactive platforms to co-construct knowledge and express creativity. In the realm of technology-enhanced storytelling, Sanei et al. (2023b), Su & Yang (2023b), and Heinemeyer et al. (2022) incorporated coding environments, multimedia, and digital platforms to help students present science, climate, and AI concepts through story. Yañez et al. (2025) used Bee-Bot robots and storytelling applications to merge early coding skills with narrative construction, providing a playful, integrative learning experience.

Student co-creation and agency were central in several initiatives. Enciso et al. (2023) facilitated storytelling through community workshops co-developed with artists, encouraging collaborative authorship and participatory learning. Casanova et al. (2021b) empowered pre-service teachers to create multimodal narratives using video, voiceovers, and collage, offering diverse pathways for storytelling expression that reflected personal and social identities.These

participatory storytelling tools helped students actively engage with content, exercise creativity, and take ownership over their learning processes while integrating technology in meaningful, accessible ways.

### *Student-Centered Assessment*

Storytelling opened pathways for student-centered assessment, emphasizing growth, creativity, and reflection over traditional testing methods. Many studies used narrative artifacts and creative outputs as core assessment tools. Boscolo et al. (2024), Su & Yang (2023b), Sanei et al. (2023b), and Zhong & Craig (2025) evaluated student understanding through story creation, coding narratives, and creative participation. Similarly, Leslie Dietiker et al. (2023) and Maharaj-Sharma (2022) assessed depth of mathematical and conceptual understanding through narrative-based outputs. Yañez et al. (2025) and Besser, Blackwell & Saenz (2022) integrated peer/self-review and multimodal products such as robotics storytelling and podcasts into their evaluation frameworks.

Others focused on formative, reflective, and personalized evaluation strategies. Storm & Jones (2021), Tripon (2024), and Irmayanti et al. (2024) employed reflective dialogue, journaling, and interviews to monitor student progress, while Lu et al. (2024) emphasized peer feedback and self-reflection as ongoing assessment. Sum et al. (2023) embedded assessment within storytelling activities to observe thinking processes and address misconceptions in real time. Fatchurahman, Setiawan & Karyanti (2021) and Nicchiotti (2024) also included emotional and reasoning-based evaluations using storytelling products.

Some projects designed alternative, creative assessment models grounded in narrative. Tuncay Türkben & Havva Karaca (2023) used rubrics and portfolios to measure creativity and skill growth, while Gerardo Reyes & Zúñiga (2024) assessed students' logical reasoning via story structures. Casanova et al. (2021b) and Choudhary & Bakshi (2025) aligned assessments with justice, ethical reflection, and narrative clarity, and Heinemeyer et al. (2022) replaced traditional exams entirely with reflections and peer evaluations.

## Discussion

Literature reviewed contains contradictory evidence in the effects of storytelling on education. It is indeed the case that on one level, such a large body of research like Yañez et al. (2025), Zhong and Craig (2025), Lu et al. (2024), Casanova et al. (2021b); Storm and Jones (2021); Su and Yang(2023b); and Heinemeyer et al. (2022), report revolutionary potential of storytelling as a pedagogy. This research consistently pinpoints its impact on cognitive, affective, linguistic, cultural and pedagogical levels. For example, Yañez et al. (2025) present empirical evidence regarding how storytelling can influence critical thinking, formation of cultural identity, emotional activation, and innovation within the classroom simultaneously. Zhong and Craig (2025) and Lu et al. (2024) demonstrate that collaborative and digital storytelling practices are effective tools for intellectual development as well as cultural learning, while Casanova et al. (2021b) highlights its incorporation into pedagogy in class to facilitate reflective and participatory learning. In summary, these research studies point to the fact that when integrated systemically, storytelling enhances the intellectual, emotional, social, and cultural well-being of learners and provides curricular and educational renewal in the long term.

Alternatively, a second set of studies illustrates more limited or broken influences, as seen in Draves et al. (2021), Hecht (2023), Kindenberg (2024), Maharaj-Sharma (2022), Setyarini et al. (2021b), Sadati and Mitchell (2021b), and Tuveri et al. (2024). These are informative though more niche contributions focused on individual elements of storytelling such as cognitive development (Draves et al., 2021; Hecht, 2023) or affective engagement (Setyarini et al., 2021b; Sadati & Mitchell, 2021b) that do not generalize to cultural or educational settings. Kindenberg (2024), for example, situates storytelling in mathematics education and Maharaj-Sharma (2022) in science, but the effects are individually context-specific and less generalizable. While these studies legitimize the potential of story, their scope remains limited, consistently emphasizing narrative as added approach over a core pedagogy.

These contrasting findings underscore the importance of holistic integration in leveraging storytelling's potential. The studies demonstrate that storytelling is most effective when designed to address multiple domains cognition, affect, communication, identity, and pedagogy in an interconnected manner. Conversely, the yellow-coded studies reveal the risks of applying storytelling in isolation, which may lead to partial or fragmented outcomes. This comparison suggests that the transformative promise of storytelling lies not in its fragmented use but in its systemic adoption as a multidimensional educational practice capable of shaping thinking, nurturing emotions, developing language, fostering cultural identity, and driving pedagogical innovation.

In relation to the systematic review themes, the evidence corroborates that cognitive development and emotional engagement (Theme 1 and Theme 2) are continuously developed when storytelling is employed holistically, while language and communication development (Theme 3) thrives through dialogic and collaborative storytelling methods. Identity formation and cultural sensitivity (Theme 4) become most salient when stories are placed in social and historical contexts, and pedagogical innovation (Theme 5) most evident when storytelling is combined with digital technology, reflective practices, and learner-centeredness. The findings thus validate that the learning potential of storytelling is optimally fulfilled when all five themes are taken together in relation to each other, offering a holistic approach to classroom implementation and further research.

The systematic review of literature provides strong evidence that storytelling is a successful pedagogical approach in secondary education. Through thematic synthesis of findings from diverse research, five overarching areas of impact were identified: Cognitive Impact, Affective and Emotional Engagement, Language and Communication Development, Identity Formation and Cultural Understanding, and Pedagogical Innovation and Classroom Practice. These themes were then outlined in fifteen subthemes, describing the complex effect of storytelling on students' academic understanding, emotional connection, communication skills, identity, and instructional design.

The review revealed that storytelling not only constructs rich conceptual knowledge and critical thinking, but also connects students, fosters empathy, and generates inclusive school communities. Storytelling facilitates literacy and verbal communication, shapes cultural awareness, and inspires student-centred measurement. Moreover, participatory narrative technologies are emerging as creative means of activating students in meaningful and authentic learning processes.

While it holds benefits, however, the literature also suggests challenges, including the need for teachers' systematic training, culturally responsive materials, and assessment alignment. Thus, while it has great potential, its use must be context-specific and pedagogically sound. This review still proves to the use of storytelling as an instructional pedagogy that can enhance significantly secondary school learners' learning and calls for further research to optimize its use in multiple education settings.

**Recommendation for Future Research**

This review highlights the diverse benefits of storytelling in enhancing secondary students' learning outcomes across cognitive, affective, linguistic, identity, and pedagogical domains. However, several research gaps warrant further investigation. First, longitudinal studies are recommended to examine the sustained impact of storytelling on students' learning retention, critical thinking, and identity formation over time. Second, there is a need for more empirical studies in diverse cultural and linguistic settings, particularly in under-researched regions such as Southeast Asia and Africa, to understand how local narratives influence students' engagement and learning.

Future research should also explore comparative studies between storytelling and other pedagogical approaches (example, inquiry-based learning or flipped classrooms) to determine relative effectiveness across different learning outcomes. Additionally, quantitative measures and mixed-method designs should be expanded to include standardized assessment tools that evaluate storytelling's effect on academic achievement and metacognitive skills.

The integration of digital storytelling tools, including AI-driven platforms and multimedia apps, also requires deeper investigation, especially in terms of accessibility, student autonomy, and digital literacy. Lastly, more attention should be given to the professional development of teachers in storytelling pedagogy, focusing on training models that build narrative competence and culturally responsive teaching practices.

**Suggested to Policymakers**

Given the overwhelming evidence from contemporary research, educational policymakers are urged to embed storytelling as a core pedagogical strategy across curricula, from STEM to the humanities. Storytelling has demonstrated cognitive benefits such as enhanced conceptual understanding, recursive thinking, and scientific reasoning. It fosters affective engagement, boosting student motivation, empathy, and classroom inclusivity. Furthermore, it supports language development, including expressive writing, verbal fluency, and narrative creativity and critical for 21st-century communication skills.

Storytelling also plays a vital role in identity formation, helping students connect with cultural heritage, reflect on civic values, and build inclusive learning environments. In terms of pedagogical innovation, storytelling encourages student-centred assessment, promotes participatory learning through digital tools, and offers frameworks for equitable, interdisciplinary lesson design.

Therefore, it is recommended that national curriculum standards incorporate storytelling across subject areas; teacher training programs include narrative-based instructional strategies; and assessment policies expand to include story-based evaluations. Support for digital storytelling infrastructure and community-driven narrative projects should also be prioritized to amplify local and marginalized voices. Embracing storytelling not only improves learning outcomes but also nurtures a more empathetic, inclusive, and reflective generation of learners.

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# FROM CLASSROOM TO CONSTRUCTION SITE: ENHANCING THE EMPLOYABILITY OF MALAYSIAN POLYTECHNIC GRADUATES THROUGH AUTHENTIC CIVIL ENGINEERING DESIGN CHALLENGES

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***Abstract:*** *This study investigates the impact of authentic, industry-aligned civil engineering design challenges on enhancing the employability of Malaysian polytechnic graduates, focusing on readiness for a BIM-driven industry. A quantitative, cross-sectional design was employed. A structured online questionnaire, developed from a review of literature, was distributed via purposive sampling to civil engineering lecturers across all Malaysian Polytechnics (N=132). The instrument demonstrated high reliability (Cronbach's alpha = 0.91). Data were analysed using descriptive statistics and Pearson correlation. Lecturers perceived graduate readiness for BIM-centric roles as moderate (mean=2.45/4.00). While design challenges were recognized as highly effective for developing employability skills (mean=3.72/4.00), their implementation was inconsistent. A strong positive correlation ($r = 0.82$, $p < 0.01$) was found between project authenticity and lecturers' confidence in graduate employability. The primary barrier was insufficient industry collaboration (mean=2.10), followed by curricular and technological constraints. The study concludes that authentic design challenges are powerful pedagogical tools but their potential is hindered by systemic barriers. A multi-stakeholder framework involving sustained industry partnerships, curriculum restructuring, and targeted investment is essential to bridge the industry-education gap and enhance graduate employability. This research provides empirical evidence and an actionable model for transforming TVET education in the construction sector.*

***Keywords:*** *Employability, Project-Based Learning, Civil Engineering Education, Industry Collaboration, BIM*

## Introduction

The global construction industry is undergoing a digital revolution, fundamentally altering project delivery methods and required skill sets. In Malaysia, this transformation is propelled by strategic national policies such as the Construction Industry Transformation Programme (CITP) and the BIM Strategic Plan 2021-2025 (CIDB, 2021). These initiatives mandate the adoption of Building Information Modelling (BIM), integrated project delivery, and other digital technologies to enhance productivity, sustainability, and global competitiveness. Consequently, the industry now demands a new breed of civil engineering technicians who are not only technically proficient but also digitally literate, adept at collaboration, and capable of solving complex problems in technology-rich environments (Ismail et al., 2020; Rahman et al., 2020).

As the nation's premier technical and vocational education and training (TVET) institutions, Malaysian Polytechnics hold the critical mandate of producing industry-ready graduates. Their diploma programs are designed to supply the workforce with practical, skilled technicians who can contribute immediately upon employment. However, a persistent and concerning gap exists between the competencies cultivated in the classroom and the skills demanded on the modern construction site (Salleh et al., 2021; Wu & Luo, 2022). Traditional, lecture-based instructional models, which prioritize theoretical knowledge and standardized assessments, often fail to cultivate the practical problem-solving, collaborative, technological, and adaptive skills essential for success in a BIM-driven industry (Sacks & Pikas, 2013; Becerik-Gerber et al., 2011).

A promising pedagogical solution that aligns perfectly with the polytechnic ethos is the integration of authentic, industry-sponsored design challenges into the core curriculum. Rooted in experiential learning theory (Kolb, 1984) and situated cognition (Lave & Wenger, 1991), this approach moves beyond simulated exercises to engage students in complex, open-ended projects that mirror real-world professional practice. By grappling with genuine project briefs, realistic constraints (budget, time, regulations), and the requirement to produce tangible deliverables (e.g., BIM models, structural calculations, project reports), students undergo a transformative learning process (Giel & Issa, 2014). They develop not only deeper technical competence but also the crucial soft skills—communication, teamwork, project management, and innovation—that are highly valued by employers (Aziz et al., 2016).

While the pedagogical benefits of project-based learning (PBL) are well-documented in broader educational literature (Blumenfeld et al., 1991; Thomas, 2000), its effective implementation within the unique, structured, and often resource-constrained environment of Malaysian polytechnics remains critically underexplored. Previous research has focused on awareness and readiness (Ismail et al., 2020; Ahmad et al., 2019) but has stopped short of empirically investigating the direct link between specific pedagogical interventions and perceived employability outcomes. This study addresses this significant gap by moving beyond the identification of the problem to investigating a practical solution. It specifically explores the role of authentic civil engineering design challenges in enhancing graduate employability from the invaluable perspective of the key facilitators and implementers: the polytechnic lecturers. The conceptual framework guiding this study is presented in Figure 1.

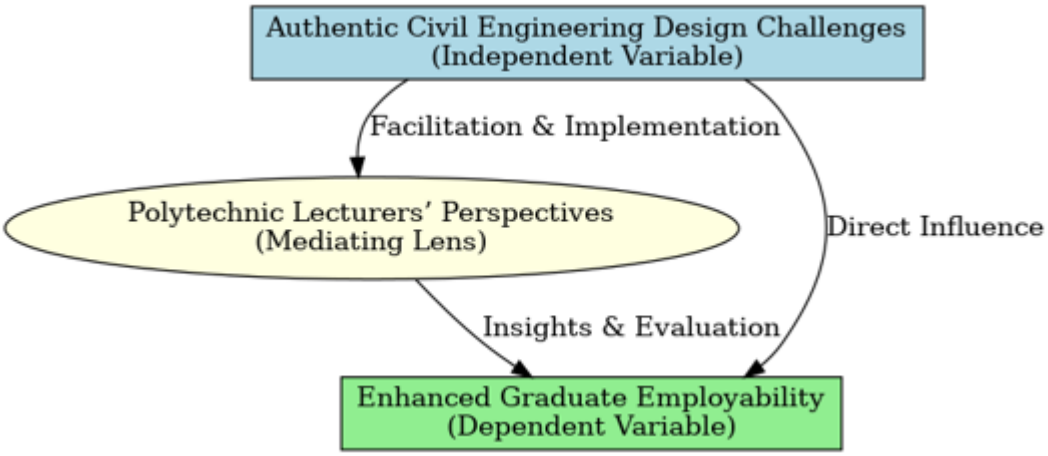



**Figure 1: Conceptual Framework of the Study**

Therefore, this study is guided by the following research objectives:

1. To evaluate lecturers' perceptions of graduate readiness for the BIM-driven Malaysian construction industry.
2. To assess the current usage and perceived effectiveness of design challenges within the civil engineering curriculum.
3. To identify the critical barriers and success factors for implementing authentic, industry-aligned projects.

## Literature Review

### *The Employability Skills Gap in Civil Engineering*

The concept of employability has evolved to encompass a multifaceted blend of assets including knowledge, skills, attitudes, and meta-competencies that make a graduate valuable to employers (Hillage & Pollard, 1998). For civil engineering technicians, industry stakeholders consistently report a significant gap between graduate capabilities and industry expectations. This gap is particularly pronounced in digital competencies, especially proficiency in BIM software and workflows, which are now considered essential rather than optional (Rahman et al., 2020; Wu & Luo, 2022). Beyond technical skills, employers emphasize the need for strong capabilities in problem-solving, critical thinking, communication, teamwork, and an understanding of commercial and practical constraints (Succar, 2009; Sacks & Pikas, 2013).

The root of this disconnect often lies in academic curricula that remain siloed and prioritize theoretical knowledge and summative examination-based assessment over integrated, practical application. This leaves graduates underprepared for the collaborative, iterative, and technologically advanced nature of modern construction projects, where BIM serves as a central repository and process rather than just a modeling tool (Becerik-Gerber et al., 2011).

### *Authentic Design Challenges as a Pedagogical Bridge*

Authentic learning is an instructional approach that allows students to explore, discuss, and meaningfully construct concepts and relationships in contexts that involve real-world problems

and projects relevant to the learner (Herrington & Oliver, 2000). In civil engineering education, authentic design challenges are complex, open-ended projects based on actual industry scenarios. They are characterized by key elements such as direct client or industry involvement, realistic constraints (e.g., budget, timeline, building codes, sustainability goals), and the production of tangible, professional-quality deliverables such as design calculations, BIM models, construction schedules, and project reports (Giel & Issa, 2014).

This methodology effectively bridges the theory-practice divide by transforming students from passive recipients of knowledge into active, engaged participants in their own learning journey. Research consistently shows that such challenges significantly enhance student motivation, deepen conceptual understanding, foster critical thinking, and directly develop the competencies outlined in industry skill frameworks (Becerik-Gerber et al., 2011; Kolb, 1984). For polytechnic education, which is inherently practical and vocationally-oriented, this approach is not just an add-on but is fundamentally aligned with its core mission of producing job-ready graduates.

### *Barriers to Implementation in Polytechnic Contexts*

Despite the compelling evidence supporting authentic learning, its integration into polytechnic curricula faces significant, multi-level hurdles that explain the inconsistency in its application. At the lecturer level, effective facilitation of PBL requires a shift from being a knowledge transmitter to a learning facilitator. Lecturers need not only up-to-date technical mastery of tools like BIM but also pedagogical training to design, guide, and assess complex, often interdisciplinary, projects (Ahmad et al., 2019; Smith et al., 2016). Many academics, especially those without recent industry experience, lack the confidence or training to manage this transition. At the institutional level, rigid, content-heavy curricula leave little room for the deep, often time-consuming exploration that authentic projects require. Lack of time for curriculum development, inadequate funding for software licenses and hardware (e.g., computers capable of running BIM software), and a lack of institutional incentives for teaching innovation are major constraints (Mohd-Rahim et al., 2022; Salleh et al., 2021). Most critically, at the strategic level, a lack of sustained and structured industry engagement poses the greatest barrier. Without formal partnerships, it is extremely difficult to source genuine project briefs, secure ongoing mentorship from professionals, and provide students with feedback that reflects real-world standards (Evensen & Hmelo-Silver, 2000; Thomas, 2000). This absence of industry connectivity undermines the very "authenticity" that gives these challenges their power.

## Methodology

### *Research Design*

This study employed a quantitative, cross-sectional survey design. This approach was selected to efficiently collect data on the perceptions, practices, and attitudes of a large and geographically dispersed population of civil engineering lecturers across all Malaysian Polytechnics at a single point in time (Creswell & Creswell, 2018). The design is appropriate for identifying patterns, relationships between variables, and providing a snapshot of the current state of practice regarding the use of design challenges.

### *Instrument Development*

The research questionnaire was developed through a comprehensive review of literature on employability, project-based learning, and technology adoption in education (e.g., Giel & Issa, 2014; Salleh et al., 2021; Thomas, 2000). The survey instrument was structured into four distinct sections:

Section A: Demographic Profile. This section collected data on respondents' positions, years of teaching experience, academic qualifications, polytechnic location, prior industry experience, and involvement in industry-sponsored projects.

Section B: Perception of Graduate Employability. This section contained 5 items measured on a 4-point Likert scale (1=Very Poor, 4=Very Good). It assessed lecturers' perceptions of their graduates' readiness in areas like technical knowledge, BIM proficiency, problem-solving, teamwork, and understanding of industry practices. Cronbach's Alpha for this section was 0.87.
Section C: Usage and Effectiveness of Design Challenges. This section contained 6 items on a 4-point Likert scale (1=Strongly Disagree, 4=Strongly Agree). It evaluated the frequency of use of design challenges, their perceived effectiveness for developing various skills, and the level of authenticity (e.g., use of real briefs, industry software). Cronbach's Alpha for this section was 0.89.

Section D: Barriers to Implementation. This section contained 8 items on a 4-point Likert scale (1=Not a Barrier, 4=Major Barrier). It identified obstacles related to technology, pedagogy, institutional support, and industry collaboration. Cronbach's Alpha for this section was 0.91.
The instrument was validated for content and face validity by a panel of three experts: a BIM manager from a leading construction firm, a senior polytechnic educational technologist, and an academic researcher specializing in engineering education. A pilot study was conducted with 12 lecturers who were excluded from the main study. Feedback from the pilot confirmed the instrument's clarity, relevance, and appropriate length, and resulted in minor wording changes to two items. The overall reliability of the entire instrument was excellent, with a Cronbach's alpha of 0.91.

### *Data Collection Procedures*

The target population was civil engineering lecturers from all 36 Malaysian Polytechnics. A purposive sampling technique was used to ensure respondents were actively involved in teaching core civil engineering subjects (e.g., Structural Design, Construction Technology, BIM). The survey was distributed online via Google Forms over a two-month period. The link was disseminated through official channels by contacting the heads of the civil engineering departments at each polytechnic, who were requested to forward it to their teaching staff. It was also promoted through professional WhatsApp groups and communities of practice for polytechnic lecturers. Two follow-up reminders were sent at two-week intervals to improve the response rate.

### *Data Analysis*

Data from 132 complete responses were analysed using IBM SPSS Statistics version 28. The analysis proceeded in two stages:

Descriptive Statistics: Frequencies, percentages, means, and standard deviations were computed to summarize the demographic profile of respondents, their perceptions of graduate employability, the usage and effectiveness of design challenges, and the barriers to implementation.
Inferential Statistics: A Pearson product-moment correlation analysis was conducted to examine the strength and direction of the relationship between the level of authenticity in design challenges (a composite score from Section C) and lecturers' overall confidence in graduate employability (a composite score from Section B). The significance level was set at $p < 0.01$.

## Results

### *Demographic Profile of Respondents*

A total of 132 lecturers participated in the study, providing a representative sample from across the Malaysian polytechnic system. The majority of respondents (78%, n=103) were full-time lecturers, with 12% (n=16) holding senior lecturer positions and 10% (n=13) being department heads or coordinators. Teaching experience was well-distributed: 22% (n=29) had 1-5 years of experience, 45% (n=59) had 6-15 years, and 33% (n=44) had over 15 years of experience. A significant finding was that only 25% (n=33) reported having direct industry work experience within the last five years. Most critically, 70% (n=92) of respondents stated they had never been involved in an industry-sponsored student project, highlighting a stark lack of industry-academia integration.

### *Perceived Graduate Employability and Current Practices*

Lecturers' overall perception of their graduates' readiness for the industry was moderate (Mean=2.45/4.00, SD=0.82). A detailed breakdown of these perceptions across key competency areas is presented in Table 1. The data reveals that the lowest-rated skill was "Proficiency in BIM Software" (Mean=2.10, SD=0.90), indicating a clear deficit in the digital skills most demanded by the modern industry. "Technical Knowledge of Core Principles" was rated highest (Mean=2.85, SD=0.65), suggesting that the fundamental theoretical grounding is sound, but its application in a digital context is lacking. Skills like problem-solving, teamwork, and understanding of industry practices all fell within the moderate range. Regarding pedagogical practices, 90% of lecturers agreed or strongly agreed that design challenges are an effective teaching method for developing employability skills (Mean=3.72/4.00). However, there was a stark contrast between this belief and actual practice. Only 30% (n=40) reported using design challenges as a primary teaching method. The majority (60%, n=79) used them only occasionally, often as a supplementary activity or an end-of-semester project, rather than as an integrated core pedagogy.

**Table 1: Perception of Graduate Readiness (n=132)**

| Skill | Mean Score | Std. Deviation | Interpretation |
|---|---|---|---|
| **1. Technical Knowledge of Core Principles** | 2.85 | 0.65 | High |
| **2. Problem-Solving & Analytical Skills** | 2.50 | 0.78 | Moderate |
| **3. Proficiency in BIM Software** | 2.10 | 0.90 | Moderate |

| | | | |
|---|---|---|---|
| **4. Teamwork and Communication** | 2.55 | 0.72 | Moderate |
| **5. Understanding of Industry Practices** | 2.25 | 0.85 | Moderate |
| **Overall Perception of Readiness** | 2.45 | 0.82 | Moderate |

***Correlation Between Authenticity and Employability***

A Pearson correlation analysis was conducted to examine the relationship between the level of authenticity in design challenges (composite score of items related to real-world briefs, industry software, and client involvement) and lecturers' overall confidence in their graduates' employability. There was a strong, positive correlation between the two variables, *r* = .82, *n* = 132, *p* < .001. This highly significant result indicates that increases in the authenticity of projects are strongly associated with increased lecturer confidence in the job readiness of their graduates. This provides quantitative support for the hypothesis that deep industry integration is not merely beneficial but is a critical success factor for employability-focused education.

***Barriers to Implementing Authentic Design Challenges***

The analysis of barriers to implementing authentic design challenges revealed that the most significant obstacles are systemic rather than personal. As detailed in Table 2, the greatest barrier identified was "Lack of Structured Industry Partnerships" (Mean=2.10/4.00, SD=0.95). This directly corroborates the demographic data showing low industry engagement and points to a fundamental break in the academia-industry link. Other major barriers were "Overloaded Curriculum / Lack of Time" (Mean=2.18, SD=0.88) and "Insufficient Access to Software & Technology" (Mean=2.22, SD=0.92). Barriers related to lecturer training and institutional incentives were perceived as less prohibitive, suggesting that lecturers are willing to engage if the systemic enablers are first put in place.

**Table 2: Barriers to Implementation (n=132)**

| Barrier | Mean Score | Std. Deviation | Rank |
|---|---|---|---|
| **1. Lack of Structured Industry Partnerships** | 2.10 | 0.95 | 1 |
| **2. Overloaded Curriculum / Lack of Time** | 2.18 | 0.88 | 2 |
| **3. Insufficient Access to Software & Technology** | 2.22 | 0.92 | 3 |
| **4. Lack of Lecturer Training in PBL Facilitation** | 2.45 | 0.85 | 4 |
| **5. Lack of Institutional Incentives** | 2.60 | 0.80 | 5 |

**Discussion**

The findings of this study present a clear and compelling narrative about the state of employability preparation in Malaysian polytechnics. There is a pronounced dissonance between awareness and action, and between intent and implementation. Lecturers are acutely aware of the value of authentic learning and the shortcomings in graduate readiness, particularly in BIM proficiency, yet they are severely constrained by systemic barriers from implementing effective solutions.

The moderate perception of graduate readiness (Mean=2.45) aligns with and extends previous research on the industry-education gap in Malaysia (Ismail et al., 2020; Salleh et al., 2021). The notably low score for BIM proficiency (Mean=2.10) is especially alarming given its centrality to national industry policy (CIDB, 2021), confirming that polytechnic curricula have not yet caught up with industry's digital transformation. This finding echoes global concerns about the slow integration of digital skills into built environment curricula (Wu & Luo, 2022). The strong positive correlation ($r = 0.82$, $p < 0.01$) between project authenticity and perceived employability is a cornerstone finding of this study. It empirically validates the theoretical argument put forth by Herrington & Oliver (2000) that authenticity is the engine of effective, work-integrated learning. It demonstrates that the pedagogical value of a design challenge is directly proportional to its connectedness to real industry practice. This moves the discussion from *whether* to use PBL to *how* to implement it effectively—by forging genuine industry links. This result strongly supports the situated learning theory of Lave and Wenger (1991), indicating that learning embedded in authentic context and community ("communities of practice") leads to more robust and transferable competencies.

The ranking of barriers provides a crucial roadmap for intervention. The identification of "Lack of Structured Industry Partnerships" as the primary barrier is the most significant outcome. It indicates that the problem is not a lack of lecturer willingness or even a simple lack of resources, but a lack of a structured framework to facilitate collaboration. This absence forces lecturers to rely on ad-hoc, personal connections, which are unsustainable and inequitable. The subsequent barriers—overloaded curriculum and lack of technology—are often symptoms of this primary strategic deficit. Without industry partnerships, the pressure to cover traditional theoretical content remains high, and the justification for significant investment in specialized software and hardware is weakened. This finding is consistent with international studies on PBL implementation, which identify the lack of a supportive ecosystem as a critical failure point (Thomas, 2000).

Therefore, this study argues that the solution requires a fundamental shift from isolated initiatives to a systems-based approach. The proposed framework, derived from the findings, involves:

1. Strategic Partnerships: Polytechnics and industry bodies (CIDB, Master Builders Association Malaysia) must establish formal agreements that define roles, responsibilities, and benefits for collaboration, moving beyond ad-hoc engagements.
2. Curriculum Co-Creation: Industry partners must be involved in curriculum review committees to ensure learning outcomes align with workforce needs and to help embed authentic projects into the syllabus, creating dedicated space and credit for them.
3. Resource Sharing: Industry can support through software licenses, access to cloud collaboration platforms, and providing practicing engineers as guest mentors and project clients.
4. Faculty Development: With a structured framework in place, targeted training for lecturers on facilitating industry-linked projects becomes more relevant and effective.

**Implications for Practice and Policy**

This research has significant implications for multiple stakeholders:

- For Polytechnic Administrators: This study provides a clear mandate to prioritize and formalize industry engagement. It argues for curriculum flexibility, strategic investment in technology, and the creation of incentives for lecturers who innovate in pedagogy.
- For Policymakers (JPPKK, MOHE): The findings justify the creation of national policies and funding mechanisms that specifically encourage and reward structured industry-polytechnic collaboration, moving beyond general encouragement to mandated frameworks.
- For Industry: The study presents a compelling business case for industry to engage deeply with polytechnics as a strategic investment in human capital development, ensuring a pipeline of graduates with the specific skills they require.
- For Lecturers: The results validate their challenges but also highlight a path forward through targeted professional development in PBL facilitation and advocacy for institutional change.

## Conclusion

This study concludes that authentic, industry-aligned design challenges are a powerful pedagogical strategy for enhancing the employability of Malaysian polytechnic civil engineering graduates. However, their potential is currently unrealized due to systemic barriers, the most critical being the lack of structured industry partnerships.

The findings suggest that the path forward requires a concerted, multi-stakeholder effort to create a sustainable ecosystem for collaboration. This research provides an evidence-based framework for action, implicating all key players:

- Policymakers (JPPKK, CIDB, MOHE) must develop national-level frameworks, policies, and funding incentives that mandate and enable structured industry-polytechnic collaboration.
- Polytechnic Administrations must prioritize industry engagement as a strategic goal, revise curricula to create flexible space for authentic projects, and invest in the necessary technological infrastructure.
- Lecturers must actively seek professional development in PBL facilitation and begin advocating for and participating in curriculum modernization efforts.
- Industry must embrace its role as a co-educator, viewing sustained engagement with polytechnics not as charity but as a strategic investment in building a robust, future-proof talent pipeline.

By addressing these barriers through the proposed framework, Malaysian polytechnics can effectively bridge the gap from the classroom to the construction site, fulfilling their mandate to produce graduates who are not just qualified, but truly industry-ready.

## Limitations and Future Research

This study is limited by its focus on the lecturer perspective. Future research should incorporate the views of students, industry employers, and polytechnic administrators to provide a holistic triangulation of findings. Additionally, longitudinal studies tracking the employability outcomes of graduates who experienced authentic design challenges compared to those who did not would provide even stronger evidence of efficacy. Finally, action research projects that

implement and evaluate the proposed multi-stakeholder framework in specific polytechnics would be a valuable next step.

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# MEDIATING EFFECT OF ACADEMIC SPIN-OFFS ON ACADPRENEURSHIP AND FOOD SECURITY IN NIGERIA

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***Abstract: Purpose****: This paper examines the mediating effect of academic spin-offs [ASO] on the relationship between acadpreneurship [AE] and food security [FS] in Nigeria.* ***Methodology****: Driven by the Endogenous Growth Theory [EGT] (Romer, 2011), the study adopted Cochran's (1977) finite sample size method to profile 662 graduate students in entrepreneurial universities in Nigeria. A purposive electronic close-ended version of the AESFSQ instrument was used for data collection. The proposed structural model was assessed through established GOF indices. While specified hypotheses were tested using SEM.* ***Findings****: The psychometric validation of the measurement model shows that it largely fits the sampled participants. The fit indices of the hypothesized structural model, $\chi^2$ / df ratio (2720.510 / 725) = 3.752, RMSEA (0.061), TLI (0.905), and CFI (0.612), equally provided further empirical support for the collected data. SEM direct hypothesis testing revealed that the standardized structural past estimates of* $H_{1ASOAE}$ *(β = .90, p = 0.000) and* $H_{2FSASO}$ *(β = .77, p = 0.000) are practically and statistically significant, indicating that AE and ASO can enhance FS. The indirect effect outcome of ASO on AE and FS shows that the product of the direct paths' standardized co-efficients is >0.08. Hence, ASO exists as a mediating variable. The bootstrapping outcome (IE = .69, SE = 0.043, p <0.05; 95% CI = 0.611 - 0.776) indicates that ASO has a significant partial mediating effect between AE and FS. This posits that ASO focused on agricultural sector can greatly reduce poverty, promote eco-friendly agricultural practices, increase the standard of living, and enhance FS in Nigeria. Ditto, to other nations.* ***Research Implications / Limitations****: This paper has multi-faceted implications. Firstly, it extends literature on entrepreneurship by providing theoretical insights into the empirical interaction between its understudied variables. Secondly, it opens up a wide range of research recommendations from academia for policymakers on FS. Thirdly, it is designed practically for researchers, students, as well as players in the agricultural industry and public service who are interested in AE phenomena such as the commercialization of research. Besides being cross-sectional, the non-inclusion of farmers as participants are some limitations that may have biased the study's outcomes. Hence, several recommendations and potential areas for further studies were made in light of these outcomes.*

***Keywords****: Acadpreneurship [AE], Academic Spin-Offs [ASO], Food Security [FS], Entrepreneurial Universities, Agricultural Industry, Nigeria.*

## Introduction

As custodian of knowledge, there is the increasing urge for the academia to re-align their mission with the 21st century challenges (Correia et al., 2024). The mission of the academia should not only be to teach and research (Belitski & Aginskaya, 2018), in recent years, there has been substantial demand for the academia involvement in economic and social development (Link et al., 2015; Pacheco et al., 2024). In specific, the commercialization of their research or discoveries (Presse & Terzidis, 2018), otherwise called academic entrepreneurship [AE], or *acadpreneurship* through academic spin-offs [ASO], given our study context. The motivation for acadpreneurship are driven by factors such as the need: for technology-based economies (Markuerkiaga et al., 2014), to establish entrepreneurial cultures among students and academics (Roncancio-Marin et al., 2022), to implement innovative strategic changes (Romano et al., 2025), to facilitate the transfer of technology from universities to firms, i.e., spin - offs (Siegel & Wright, 2015b), and for academia to become entrepreneurial universities (Ilie & Budac, 2025). Caputo et al. (2022) argue that the establishment of academic spin-offs [ASO] is the 'third mission' of the academia. We advocate that academia third mission is achievable through exploitation of research results or through industry collaboration.

Acadpreneurship [AE] is an emerging concept that connects the narrow and broader scope of the academia together (Correia et al., 2024). Literature has defined AE in a number of ways. Miranda et al. (2017) views it as a dynamic process through which individuals, often within the context of universities or research centers, leverage the knowledge generated within research activities to create new venture or spin-off companies. Formica et al. (2008) refer to these individuals as academic entrepreneurs [henceforth, *acadpreneurs*] who are most often professors, Ph.D. students or post-doc researchers with the intent to set up a business in order to commercialize their laboratory discoveries or innovations. Karlsdottir (2023) says AE is part of the third mission or the emerging perspective of academia, where spin-offs are created from technological development to generate income. Fuchs et al. (2023) note that AE presents a paradigm shift in educational system such that researchers' knowledge and technological development is now considered as sources of entrepreneurial opportunities to the advantage of the university community, the academics, students, and society at large.

Acadpreneurship [AE] is an interdisciplinary context that has gained interest across the globe. However, far-reaching research on the multifarious implications of AE is imperative, given the food security [FS] status in Nigeria. World Food Summit in 1996 (FAO, 1996) describes food security [FS] as "when all people, at all times, have physical and economic access to sufficient, safe, and nutrition food that meets their dietary needs and food preferences for an active and healthy life". Aye et al. (2025) note that a food-secured individual is someone who has unlimited, reliable, and uninterrupted access to suitable food for continuous existence. Apparently, for food security objectives to be realized, dimensions such as physical availability of food, economic and physical access to food, food utilization, and stability must be fulfilled simultaneously (World Bank Group, 2025). However, this is often not be feasible or attainable because reports indicate that FS is one of many challenges facing the Southern Hemisphere, primarily in Africa, Asia, and Latin American (Kotur et al., 2024; Shoaib et al., 2022)]. GRFC (2024) note that in Africa, 46 million people or more faced hunger in 2020 compared to 2019.

WHO (2024) report revealed a 58% prevalence of moderate or severe food insecurity in Africa in 2023, a rate which is nearly double the global average.

International agencies [such as UN, World Bank, FAO] and government joint efforts to alleviate food crises are encouraging, but these have only achieved short-term results (Prosekov & Ivanova, 2018), as the challenges on food security prevails (Kotur et al., 2024; Oluwafemi et al., 2024; Tkemaladze, 2025). Despite the food aid programs, initiatives and interventions by these agencies, the number of malnourished and hungry people is growing globally (Beyene, 2023). The 11th Global Food Security Index (GFSI, 2022) reveals that the global food environment is witnessing reversed growth as compared to the food security gain experienced between 2012 and 2015. A report by FAO in 2023 shows that 28.9% [2.33 billion] people globally did not have regular access to food supply (FAO, 2024). GRFC (2024) reported that nearly 282 million people in 59 countries experienced acute food insecurity, representing a 24 million people increase from 2022 to 2023. In 2024, the World Bank noted that 83 million people in 45 countries were starving when compared to the previous year (World Bank Group, 2025). A recent study by Tkemaladze (2025) posit it that 820 million people globally are currently suffering from hunger.

Nigeria is assumed the 4th largest economy (Ndiomaluke et al., 2025) and most populous country in Africa, playing a significant role in regional and global affairs (Morakinyo et al., 2025). However, it faces various development challenges such as food security, corruption, and infrastructural deficient (Atobatele et al., 2025; Danlami, 2024). According to the 11th Global Food Security Index (GFSI, 2022) report, Nigeria ranked 107th overall out of 113 countries on food security. The Index is anchored on food affordability, availability, quality and safety, and sustainability. Out of 28 countries in Sub-Saharan Africa, Nigeria is ranked 25th with 12.7% prevalence of undernourishment, 35.3% of stunted children, 18.4 % of underweight children, and 7.8% of obese population. This is a downward trend, as shown in Figure 1, when compared to 2020 GFSI report. In a recent report by (FAO, 2025), an estimate of 33.1million people is projected to be food insecure in 2025. The estimate represents a 7 million people increase from 2024.

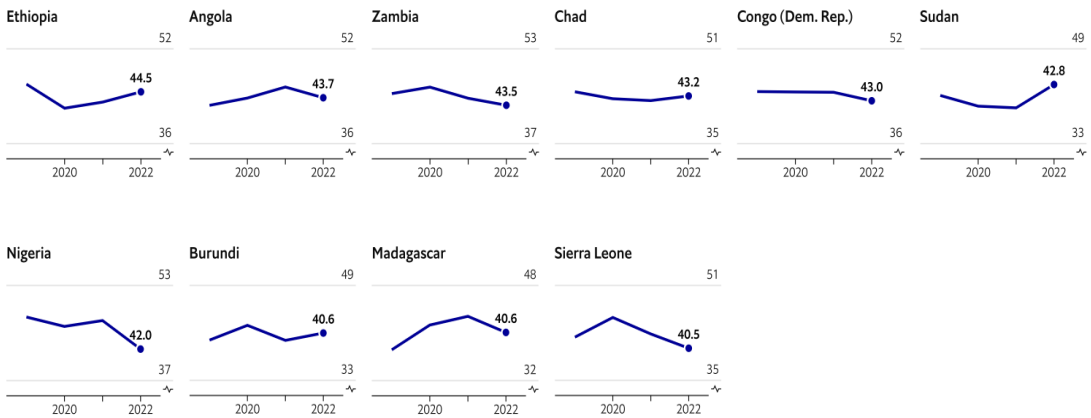



**Figure 1. Global Food Security Index Scores for Nigeria in Sub-Saharan Africa Source: Global Food Security Index 2022.**

The effects of food insecurity cannot be underestimated. It could lead to famines, persistent hunger which can cause malnutrition and stunted growth in children, defects in children

cognitive development, and others (Celik et al., 2023; Sultan et al., 2024). The mainstream opinion is that the synthesized tasks of modern agricultural practices, political will, and good logistics of product delivery will optimize food security (Prosekov & Ivanova, 2018). Our study posit that these measures alone may not be sufficient to ensure food security. Hence, we route a different perspective by focusing on the academia to kindle their entrepreneurial will to boost FS through the creation of academic spin-offs [ASO].

Research on entrepreneurship have consistently informed us that it is an interdisciplinary field of study imbued with innovativeness, resilience, risk taking, and adaptability (Ilie & Budac, 2025). However, there seems to be a dearth of research on the relationship between AE, ASO, and FS, except in Okoro (2023), which only examined entrepreneurship development and food security, but not acadpreneurship. Sultan et al. (2024) conducted a systematic review on the role of universities and integrated farming in ensuring food security in Malaysia. Oguegbe and Iloke (2023) carried out an exploratory study on agro-based entrepreneurship and FS in Nigeria, not acadpreneurship. Adisa et al. (2023) conducted an integrative review on AE, but not as a panacea to food security in Nigeria. Hence, our study seeks to overcome gaps regarding the scarcity of empirical studies by addressing the mediating effects of academic spin-offs [ASO] on the relationship between acadpreneurship [AE] and food security [FS] in Nigeria.

Our study represents a departure from the conventional practices wherein existing entrepreneurs in agricultural sector are provided with skills, programs, and aids to enhance agricultural practices. We seek to establish that academia can commercial their research by creating agricultural spin-offs to boost FS. Most of these agricultural spin-offs, such as Adaviv, Horta, Walaibiocontrol Co. Ltd., AgroSustain, Xampla, and so forth existed in other climes, none existed in Nigeria, which may have impacted Nigeria FS status in the Global Food Security Index GFSI (2022) report.

## Literature Review

### *Conceptual Review*

#### *Acadpreneurship*

A significant resolution reached at the Word Food Summit in Rome 2009 (FAO, 1996) highlights that emerging and developing countries should prioritize entrepreneurship as a tool to boost FS. Oguegbe and Iloke (2023)) proposed a new pattern of thinking that will focus solely on agriculture to salvage the dwindling FS status in Nigeria. Olaoye (2014) asserts that the arduous task of feeding the growing population in Nigeria would require technical strategies and diversification of the nation's resources into more impactful investments. Encouraging investments in AE would lead to more impactful academic spin-offs, which may necessarily resuscitate Nigeria's FS status.

Acadpreneurship [AE] is a blended word for academic entrepreneurship or the fusion of academics and entrepreneurship (Erdos, 2009; Garcez et al., 2025). Pioneered by Ivor Royston in 1978 (Toledano & Gonzalez-sanz, 2024), AE gained traction in 1980 with the adoption of the Bayh-Dole Act (Siegel & Wright, 2015b) wherein university are allowed to own the patents that arise from research grants. Also, the study on Triple helix Model by Etzkowitz (1983) is pivotal in understanding AE as a concept. The model suggests that industry, government, and academia are three helices of economic development. The pursuit of acadpreneurship comes in

two folds. Firstly; the use of academic research to identify problems (Garcez et al., 2025). Secondly, the expression of entrepreneurially virtuous behaviours to create entrepreneurial opportunities to solve identified problems that pursue the triple bottom line (Ramadini et al., 2025). The triple bottom line are social [people] welfare, environment protection / development, and economy [profit making] (Camelo-Ordaz et al., 2025). By so doing, policy makers view academia as a fundamental platform for economic growth, local, and regional development through the commercialization of their intellectual property or discoveries from their laboratories (Pacheco et al., 2024).

Wood (2011 p. 153) describe AE "as the efforts and activities that universities and their industry partners to undertake in hopes of commercializing the outcomes of faculty research". In essence, acadpreneurship [AE] implies identifying environmental needs and providing solution through a business enterprise (Garcez et al., 2025). In Oluwafemi et al. (2024), AE is about identifying, evaluating, and pursuing business opportunities either on or off the territorial space of a business. Sengupta (2021) asserts that AE is the valorisation of academic research, such that, the academic research are turned to marketable products through creation of spin-offs or university based companies; with the involvement of the academia / university researchers as stakeholders or part of the organizational structure (Miranda et al., 2018; Siegel & Wright, 2015a). Considerably, AE theory describes the perspective of commercialization of research in higher education to benefit the society (Ramadini et al., 2025).

What distinguishes *acadpreneurs* from the *conventional entrepreneurs* is that the former use academic research, which leads to the creation of opportunities, to bring something new to the economic space while still being linked in some ways to their university, faculty members or research students (Montonen, 2025; Pacheco et al., 2024; Sooampon, 2025). The latter only tend to focus on societal impact and proliferation of their products with no formal or informal link with the university (Djurayeva, 2025). Though, some scholars argue that being an academia and entrepreneur is mutually exclusive (Belitski & Aginskaya, 2018; Etzkowitz, 2016) due to time constraints, conflict of interest, impact on quality teaching, etc., but our paper argue in contrary. In an emerging 21$^{st}$ century that leverage on data-driven strategies to unlock new values (Dabić, 2021; Mäkinen & Esko, 2022), academic exercises should transcend beyond its conventional modus operandi (Sultan et al., 2024; Toledano & Gonzalez-sanz, 2024). Dhekney et al. (2025) suggested the need for academia involvement in industrial and economic development. Their involvement have been applauded as yielding positive narratives on economic, social, and sustainable development (Fuchs et al., 2023; Hirvonen & van Langenhove, 2021; Leišytė, 2021; Sengupta, 2021). Montonen (2025) argue that academia can drive technological advancement and social impact when they perform their third task, which is promoting entrepreneurship and the commercialization of research in the form of university spin-off companies. Supposedly, entrepreneurial activities channelled towards agricultural practices could boost FS, provide employment, reduce poverty, and enhance GDP.

### *Features of Acadpreneurship*

*1. Research Expertise*

Abiola and Adeniyi (2023) assert that acadpreneurs, given their research landscape, are poised with the requisite knowledge to proffer workable solutions to social and environmental challenges. Wang et al. (2021) assert that acadpreneurs [such as Faculties, postdocs, and

students] are imbue with certain skills to identify potential commercial opportunity and its embedded value potentials to stakeholders. Hence, they can help in repositioning agricultural research system, particularly, in Nigeria.

*2. Innovativeness*

The pursuit of AE is the pursuit of novel opportunities and the practical applicability of research outcomes to various stakeholders (Michele, 2017). According to Sooampon (2025), AE is an innovative process to transform scientific discoveries into commercialized products by the university or citadel of learning. In this regards, acadpreneurs uncover new commercial opportunities through their research (Ramadini et al., 2025) or through close bonds with particular industries (Mei et al., 2020), which often lead to the establishment of spin-offs or businesses where Faculties also form part of the organization structure to provide support (Bolzani et al., 2021).

*3. Collaboration*

Adisa et al. (2023) termed this concept as 'expanded developmental periphery'- whereby acadpreneurs reach across institutional boundaries to solve critical problems. Collaboration provides avenue to acadpreneurs to secure better funding and networking for resources. Research indicts that, through collaboration, acadpreneurs gain access to awards, research grants, finance, and consultancy jobs to launch spin-offs successfully (Walter et al., 2018). By collaboration, acadpreneurs are seen as interdisciplinary in a structured educational institution comprising a community of specialists performing different tasks bound by rules and regulations, such as intellectual honesty (Fini et al., 2020; Gupta & Mishra, 2024).

*4. Ethical Orientation*

Acadpreneurs are not only heroic (Sengupta, 2021), they are adjudged as having ethical connotations (Leišytė, 2021; Siegel & Wright, 2015b) in the discharge of their responsibilities. The society uphold this positive perception because of the standard of excellence that guide the profession and the philosophical principles of the universities in which they are engaged (Hirvonen & van Langenhove, 2021). Hence, acadpreneurs are legitimized as the moral compass for knowledge development and conduct research for the upliftment of the society (Al Ameri & Mohajeran, 2025).

***Academic Spin-Offs [ASO]***

Academia, with their vast intellectual resources, should be a breeding ground for innovative enterprises (Michele, 2017), otherwise, referred to as academic spin-offs [ASO]. Sultan et al. (2024) assert that universities play an indispensable role by conducting cutting-edge research that provide solutions to economic problems. Borges and Filion (2013) explains that academic spin-offs are technological ventures born inside a mother organization [university], and which receive a range of support from that organization. This is the basic principle of the Bayh-Dole Act (Balven et al., 2018). The Act stipulates that academia [especially, TTO personnel] and Faculty should work together to patent, licence, or start a new company aimed at commercializing an invention or discovery (Link et al., 2015). ASO refers to the start-up of a new business in the universities by researchers / academics [i.e., acadpreneurs], and the transfer

of specific technology and knowledge developed in the universities to that business, wherein they [i.e., acadpreneurs] participate in the ownership of the business (Bolzani et al., 2021; Toledano & Gonzalez-sanz, 2024).

What distinguishes academic spin-offs from the conventional start-ups is that the former is often initiated from a research discovery and not necessarily form a clearly defined product and market need (Michele, 2017). Academic spin-offs, unlike the conventional spin-offs are mostly created by professors, researchers, and graduate students, who are themselves entrepreneurs (Musleh et al., 2025). While academic spin-offs have been achieved in some sectors of the Nigerian economy, such as, Cassava Energy, a spin-off company engaged in the conversion of cassava to biofuel by University of Lagos (Udoisoh, 2024). Energy Kiosk is another academia spin-off by academia which serves as potential solution to bridge energy access amongst undeserved communities (Abiola & Adeniyi, 2023). Similar feet is zero to none in the agricultural sector. This is a huge oversight that both academia and government should consider to enhance Nigeria FS status. Aye et al. (2025) note that the agricultural sector is among the most vulnerable sectors in Nigeria. Thus, the urgent pursuit of ASO focused on agriculture to salvage the country's FS status.

### *Food Security [FS]*

In 1948, the Universal Declaration of Human Rights proclaimed that the right to food is a vital yardstick for adequate standard of living (Sultan et al., 2024). Thus, it is a constitutional right for every citizen to have sufficient food for consumption. Based on the 1996 World Food Summit, if all people, at all times have physical, social, and economic access to sufficient, safe, and nutritious diets that meets their consumption preference for sustainable living, then, food security is assumed to have been established (World Bank Group, 2025).

Ameh (2023) wrote that FS is a benchmark on how individuals, groups, or households get both the availability and accessibility to food for immediate consumption without compromising future consumption. According to Uduji and Okolo-Obasi (2023), FS is both the satisfactory supply and the capacity to produce the needed amount of food to the population unceasingly at a cost they can afford. Aluko (2020) describe FS as resilience to potential food supply shortages or disruption in the future. Aye et al. (2025) say that FS is ensuring that produced or imported food meets the dietary needs a country's population at national, regional, and local levels. Hence, FS is undoubtedly importance as it serves as the safety net to the society.

Oluwafemi et al. (2024) posit that 50% of the Nigerian population are living below the poverty line of $1.9 [N1, 600.00] per day. Global Food Security Index (GFSI, 2022) report placed Nigeria as 107$^{th}$ out of 113 countries, and 25$^{th}$ out of 28 Sub-Saharan African countries on food security, with a total average score of 42.0%. This makes Nigeria one of the least food secure country globally.

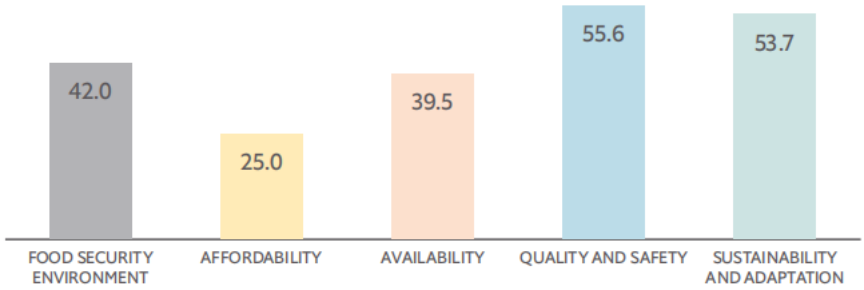



**Figure 2. Global Food Security Index Scores for Nigeria in Sub-Saharan Africa**
**Source: Global Food Security Index 2022.**

As shown in Figure 2, Nigeria highest scores across the four dimensions is 55.6 in the quality and safety category. However, the rising cost of food couple with majority of households living on poor per capita income creates affordability challenges for the population. Affordability had a score of 25, which apparently is the lowest score globally (GFSI, 2022). While government has waded in to salvage the situation through various programs, persistent hunger and poverty have continued to bedevil successive regimes, making it difficult for government alone to bring down food insecurity rising rate to a complimentary level. If necessary precautions are not implemented Nigeria may be left out to FAO call to eliminate hunger by 2030 (Oluwafemi et al., 2024). At this instance, GFSI (2022) recommends that developing and underdeveloped countries should embark on agricultural and development projects.

The world Food Summit in Rome, 1996 identified four potential pillars of FS which include availability, access, utilization, and stability (FAO, 1996). Two other pillars of agency and sustainability & adaptation (FAO, 2021) were added bringing FS pillars to six (Hassoun et al., 2025). However, according to the World Health Organization (WHO, 2004), the three pillars to determine FS are food availability, food access, and food use and misuse. In this study, four pillars are discussed.

**Availability**

This refers to the physical availability of food for consumption. Hassoun et al. (2025) note that food availability lay emphasis on food supply, which is often driven to a large extent on food production, stock levels, distribution, and net trade. Achieving FS requires that food gets to expected consumers through effective food distribution system. Okparavero et al. (2024) states that food distribution system should have adequate storage facility to reduce food waste, reliable transportation system, and effective marketing strategies. GFSI (2022) ranked Nigeria 108$^{th}$ globally and 26$^{th}$ in the Sub-Saharan region on availability. A score of 39.5 points indicate a very week FS status.

**Affordability**

Availability and affordability both impact FS, but they are distinct. World Bank Group (2025b) argue that an adequate supply of food does not literally translate to household level FS. While the former is driven by physical or digital proximity to food, the latter is driven by cost of the food (Igwe et al., 2024). Both interplay through the word ‘access’, but the access dimension of affordability is beyond physical, it includes consumer purchasing power and their preferences to foods of their choices (Uduji & Okolo-Obasi, 2023). Nigeria ranks last [113$^{th}$] in GFSI

(2022) report with a score of 25.0 points. This indicates very week FS status, and is major concern on FS in the country.

**Quality and Safety**

This is also known as the utilization dimension of FS. World Bank Group (2025b) describe utilization as the way the body makes the most of various nutrients in the food. Tweeten (1999) refers to utilization as the metabolism of food by individuals. Metabolism is a vital process that sustains healthy living. Metabolism helps to generate energy from consumed food, breakdown nutrients, and helps maintain growth (Alves et al., 2024). Thus, for FS to be achieved, the food consumed must be of good quality and safe to provide individual with the expected nutritional status when metabolized (Akem, 2022). Nigeria was ranked 79$^{th}$ overall and 7$^{th}$ in Sub-Saharan Africa in this category, making this dimension the highest among the four dimensions as shown in Figure 2. A score of 55.6 points indicate a good FS status.

**Sustainability and Adaptation**

The sustainability dimension emphasizes the stability of FS over time (Sultan et al., 2024). This implies that the availability, affordability, quality, and safety of food intake today should not jeopardize future intake (Tkemaladze, 2025). In this category, Nigeria ranks 57$^{th}$ and 8$^{th}$ around the globe and in Sub-Saharan African respectively, with 53.7 points, indicating a moderate FS status as shown in Figure 2.

**Theoretical Review**

Our study explores the Endogenous Growth Theory [EGT] (Romer, 2011) to explain the relationship between Acadpreneurship [AE], academic spin-offs [ASO], and Food Security [FS]. Developed in the mid-80s, by growth theorists like Kenneth Arrow, Paul Romer and Robert Lucas (Barro & Sala-i-Martin, 2004; Romer, 1994), EGT holds that investment in human capital, innovation, and knowledge are significant contributors to economy development (Romer, 1994). Hence, in our study, we posit that AE and ASO are critical components impacting FS trajectory in Nigeria. We allude that a sustained FS status is better owed to endogenous variables [e.g., policies that supports cutting-edge innovative research and knowledge transfer, which consequently result in a spin-off], rather than sole reliance on external forces [e.g., food aids from international agencies]. EGT focuses on academia as the determinants for economic viability (Adisa et al., 2023), such that AE act as catalyst for human capital, innovation, and knowledge transfer (Guerrero et al., 2016; Imene et al., 2025) within an ecosystem. Howitt (2007; 2010) claim that economies that cease to transform themselves are destined to fall off the path of economic growth. Research indicates that innovation-driven start-ups established by entrepreneurial universities can generate additional income and sustain economic growth (Fischer et al., 2018). Similarly, Ugbor et al. (2025) claim that human capital, innovation, and knowledge spill-overs are drivers of economic growth. Consequently, our study reassert previous research that have considered EGT to clarify AE (e.g., Sandström et al., 2018; Ugbor et al., 2025; Urbano & Guerrero, 2013).

## Hypotheses Development

Research has shown that one of the factors that may contribute to a new venture success is the academia (Abiola & Adeniyi, 2023). The academia is a citadel of knowledge that comprises of the professors, post-doc researchers, graduate students, and undergraduates (Formica et al., 2008). Camelo-Ordaz et al. (2025) contend that academics who are imbue with entrepreneurial orientation are more likely to develop product or business concept that can be explored for commercial, social, and economic benefits. The integrative review by Adisa et al. (2023) revealed that AE can significantly enhance socioeconomic development through the creation of spin-offs or technology transfer offices. Adisa et al. (2023) cited examples of academic students whose spin-offs have yielded positive impact such as NTim Cook [Apple Inc.], Larry Page and Sergey Brin [Google Inc.], Elon Musk [Tesla], and so forth.

Imene et al. (2025) interviewed students who received innovative label grant at Eltart University, Algeria; and found their willingness to transfer their entrepreneurial competencies to filed practices in the form of start-ups or spin-offs. Imene et al. (2025) study revealed that students considered their projects as a lever to support the economy in areas such as food security, education, water security, and health care. The study of Gunartin et al. (2023) on entrepreneurship skills and development among graduating students show great relevance on business start-ups. Musleh et al. (2025) argue that a blend of academic knowledge and entrepreneurial competencies can contribute to the creation of ventures for economic survival and growth. A study by Camelo-Ordaz et al. (2025) analyzed the effect of entrepreneurial team heterogeneity on university spin-offs. A positive effect was established indicating that the 'third mission' of the academia portends greater benefits to the economy.

According to Caputo et al., (2022), a successful ASO in the form of a rapidly growing technology, especially in an impoverished economic region is highly desirable for both the academia and policy makers. Okoro (2023) asserts that entrepreneurship development has a strong relationship with economic development of a society. Hence, it serves as an impetus to combat unemployment, social menace, and food insecurity. Egwu (2014) indicate that entrepreneurship development is a significant predictor of FS, job creation, poverty reduction, and sustainable economy. Sultan et al., (2024) investigated the role of universities and integrated farming in FS, and found that Student Farmer Entrepreneur program is positively correlated with FS. This revealed that the program is crucial for promoting FS because it increases agricultural productivity, enhances food production locally, encourages sustainable agricultural practices, and supports rural development.

Szulczewska-Remi (2022) indicates that AE presents opportunities leveraged on entrepreneurial process to create spin-offs that become an integral part of the academia, society, or community. Ramadini et al. (2025) alludes that AE is an approach to transforming knowledge into tangible results that benefit the society and the economy. Verma and Shrivastava (2021) posit that entrepreneurial activities focused on agricultural opportunities could contribute immensely to boost food productivity and security. Oguegbe and Iloke (2023) claim that agriculture induced SMEs are vital in the economic growth and emancipation of African countries like Nigeria. Oguegbe and Iloke (2023) note that an entrepreneurial-based agricultural sector will enhance effective utilization of agricultural resources, promote economic development, provide food for the populace, reduce poverty rate, and improve the GDP of a nation. Simane et al. (2025) found a significant relationship amongst regional growth,

FS, industrial growth, and employment generation. Given these empirical studies on AE, ASO, or FS, we hypothesize as follows:

***H*$_1$**: Acadpreneurship [AE] has a significant effect on academic spin-offs [ASO]
***H*$_2$**: Academic Spin-offs [ASO] have significant effect on food security [FS]
***H*$_3$**: Academic Spin-offs [ASO] mediate significant effect between acadpreneurship [AE] and food security [FS]

## Methodology

### *Study Participants*

Through purposive sampling, graduate students in entrepreneurial universities in Nigeria, whose research has the potential of being monetized were used as our study participants. According to Statista report, 242,333 graduate students enrolled in Nigerian Universities in 2018 / 2019 academic session (Sasu, 2022). Entrepreneurial universities are those who have established business and entrepreneurship schools / departments, or who teach entrepreneurship as a course (Etzkowitz, 2017). We chose entrepreneurial universities because they have the potentials to use academic research to create university based companies [i.e., ASO] that are marketable (Adisa et al., 2023; Miller et al., 2018; Ramadini et al., 2025).

### *Sample Size*

Given the sampling frame, 662 participants represent the sample size using Cochran (1977) formula on finite sample size determination. A threshold of 99% and ±5% was adopted as confidence level and margin of error respectively. The adequacy of the sample size is seemingly justified, using Tabachnick and Fidell (2013 p.123) recommendation, which posits that sample size [*N*] should be calculated with respect to the numbers of independent variables in a study, i.e., $N > 50 + 8m$ (where $m$ = number of independent variables).
Constructs Measurement and Scaling.

We adapted existing measurement instrument to develop Acadpreneurship, Spin-Off, and Food Security Questionnaire [AESFSQ]. AESFSQ has three constructs [AE, ASO, & FS] and 40 observable items as shown in Table 1. All constructs were anchored on a five point Likert-Scale with "*1*" denoting "Strongly Disagree" and "*5"* denoting "Strongly Agree" in the AESFSQ measurement instrument.

**Table 1. AESFSQ Measurement Constructs, Sources, and Items Adapted**

| Measurement Instruments | Items | Adapted Sources |
|---|---|---|
| Acadpreneurship Scale [AE] | | Pacheco et al., (2024) |
| Research Expertise [RE] | 5 | Sidrat & Boujelbene (2020) |
| Innovativeness [IN] | 5 | Todorovic et al., (2011) |
| Collaboration [CL] | 5 | |
| Ethical Consideration [EC] | 4 | |
| Academic Spin-Off Scale [ASO] | 5 | Onwualu (2016)<br>Balven et al., (2018)<br>Abiola and Adeniyi (2023) |

| | | |
|---|---|---|
| Food Security Scale [FS] | | Cafiero et al., (2018)<br>FAO (2022)<br>GFSI (2022) |
| Availability [AV] | 4 | |
| Affordability [AF] | 4 | |
| Quality and Safety [QS] | 4 | |
| Sustainability and Adaptation [SA] | 4 | |
| Total Items | 40 | |

***Instrument and Data Collection***

An electronic close-ended version of AESFSQ instrument, designed through Google Form as standard questionnaire, was used for data collection. More recent studies are opting for Google Form to reach respondents (e.g., Pacheco et al., 2024). Besides aiding computation into statistical software like the IBM SPSS version 28 used in our study, Sekeran and Bougie (2013 p. 159) argue that "electronic questionnaire is taking an increasing role in research with the increase in computer literacy". The Google Form was opened from 2/3/2025 to 20/7/2025. Prior to the main study, a pre-test was carried out in two entrepreneurial universities to ensure the quality and effectiveness of AESFSQ measurement instrument. Due to the peculiarity of the study, respondents were approached purposefully [physical and virtual] to solicit their consent as participants in our study. The informed consent afforded us the opportunity to explain the purpose and procedures of the study while guaranteeing the confidentiality of the information solicited. Thereafter, an electronic questionnaire was directly mailed to the participants. The pre-survey meeting with the participants provided our research team the opportunity to compile the list and emails of participants. Necessary follow-ups were made during the data collection period. Our study is cross-sectional. Hence, responses were solicited once from participants.

***Data Analysis***

A case of missing data was not established due to the electronic form adopted. However, we screened for outliers through multivariate Mahalanobis Square of Distance ($D^2$) using a critical value of 18.47 for analysis with four independent variable (Pallant, 2020; Tabachnick & Fidell, 2013). The descriptive statistics of participants' socio-demographic data was analyzed using percentages and frequency tables with the aid of the Statistical Package for Social Sciences (SPSS v. 28) data editor for windows. To validate the stated hypotheses, we deplored a Structural Equation Model (SEM) analysis for the estimates. SEM is a two-system approach instrumental for hypotheses and answering research questions (Hair et al., 2020). To confirm the factorial structure of AESFSQ measurement instrument, we first had to examine the reliability and validity of the items used to measure our theoretical constructs. We examined both internal consistency test; i.e., Cronbach's Alpha ($\alpha \geq 0.70$) [pilot and main study] and construct reliability test (CR $\geq$ 0.70) [main study]. We examined the validity of the measurement instrument through construct, convergent, discriminate validate, and average variance extracted (AVE) tests. In our analysis, we employed renowned Goodness-of-Fit [GOF] indices such as RMSEA $\leq$ 0.08; CFI > 0.90; TLI > 0.90; to access the theoretical framework (Browne & Cudeck, 1993; Marsh & Hocevar, 1985). The test of mediation was investigated through AMOS using non-parametric percentile bootstrapping approach with a sample of 2000 (Hair et al., 2019; Hayes et al., 2017; Preacher & Hayes, 2008). The

significance of the mediation analysis was further confirmed with 95%BootLLCI-ULCI.

## Results

### *Response Rate*

606 participants responded to the Google Form out of the expected 662 responses. However, 34 responses screened out based on satisficing responses as recommended by Ron et al. (2015 p. 688). Analysis of the Mahalanobis Square of Distance ($D^2$) revealed that only 3 responses [cases] were outliers because they were above the critical value of 18.47. Pallant (2020) notes that it is usual for large data set to have about 5 per cent of outliers. Hence, we did not remove these responses given the size of our data set that makes the outliers inconsequential. Besides, the 5% trimmed mean and mean values of each constructs are mostly similar [see Table 3]. Therefore, we analysed only 572 participants' responses. This translates to 94.38% usable response rate.

### *Participants' Socio-Demographic Characteristics*

A cross-tabulation of participants' socio-demographic characteristics, as shown in Table 2, revealed with respect to the female participants that 323 [56.5%] males took part in the survey. This implies that Nigerian universities enrol more male than female graduate students (Aderinto & Yenizzar, 2025). This is evident as our survey revealed more male Ph.D. [146; 26.0%] participants. 152 [26.6%] male participants spent between 5 - 7years on their academic research. This is about the maximum time duration for graduate programs in Nigerian academia, particularly, Ph.D. program (Abiodun-oyebanji, 2024). Most male participants [109; 19.1%] are employed as research associates providing research consulting services for firms in the industry. 66 [11.5%] male participants are CEO or directors of research spin-offs firms / academia business enterprises, while 84 [14.7%] male participants are holding managerial roles in similar kind of firms / enterprises.

**Table 2. Cross-Tabulation**
**Participants' Socio – Demographic Characteristics**

| | Gender | | | | | |
|---|---|---|---|---|---|---|
| | Male | | Female | | Total | |
| | Count | % | Count | % | Count | % |
| ***Academic Status*** | | | | | | |
| Post-Graduate Diploma | 29 | 5.1 | 31 | 5.4 | 60 | 10.5 |
| Sc. [Master] | 99 | 17.3 | 74 | 12.9 | 173 | 30.2 |
| Ph. D. | 149 | 26.0 | 106 | 18.5 | 255 | 44.6 |
| Post - Doc. | 46 | 8.0 | 38 | 6.6 | 84 | 14.7 |
| ***Academic Research Length*** | | | | | | |
| 1 - 4 years | 117 | 20.5 | 86 | 15.0 | 203 | 35.5 |
| 5 – 7 years | 152 | 26.6 | 116 | 20.3 | 268 | 46.9 |
| 8 – 10 years | 37 | 6.5 | 32 | 5.6 | 69 | 12.1 |
| Above 10 years | 17 | 3.0 | 15 | 2.6 | 32 | 5.6 |
| ***Academic Spin-Offs Position*** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| CEO / Director | 66 | 11.5 | 53 | 9.3 | 119 | 20.8 |
| Managerial Level / Role | 84 | 14.7 | 64 | 11.2 | 148 | 25.9 |
| Research Associates | 109 | 19.1 | 82 | 14.3 | 191 | 33.4 |
| Not Applicable | 64 | 11.2 | 50 | 8.7 | 114 | 19.9 |
| ***Industry Career Length*** | | | | | | |
| 1 - 3 years | 58 | 10.1 | 49 | 8.6 | 107 | 18.7 |
| 4 - 7 years | 68 | 11.9 | 64 | 11.2 | 132 | 23.1 |
| 8 - 10 years | 95 | 16.6 | 66 | 11.5 | 161 | 28.1 |
| 10 years Above | 60 | 10.5 | 38 | 6.6 | 98 | 17.1 |
| Not Applicable | 42 | 7.3 | 32 | 5.6 | 74 | 12.9 |
| **Total** | **323** | **56.5** | **249** | **43.5** | **572** | **100** |

Source: Field Survey (2025).

### *Constructs' Items Descriptive Analysis*

Table 3 shows that constructs' items were reasonably normally distributed given the mean and SD values of each construct. The skewness and kurtosis of the items mostly fell within the acceptable critical value of z = ±2.58; $p = 0.01$ (Pallant, 2020). The Normal P-P plot for each construct shows a reasonably straight diagonal line from bottom to top, suggesting no major deviations from normality (Tabachnick & Fidell, 2019). The Cronbach Alpha value of all 40 items ($\alpha = 0.951$) exceed the threshold of $\alpha \geq 0.70$, indicating good internal consistency (Cronbach, 1951) and the degree to which responses are consistent across the items within a measure. This suggests all items are measuring their underlying constructs (Hair et al., 2020). By inference, the reliability of our measurement instrument is suitable for practical research.

**Table 3. Average Mean, Standard Deviations, and Reliability**

| Constructs | Items | Mean | SD | 5% Trimmed Mean | Alpha (α) |
|---|---|---|---|---|---|
| Acadpreneurship [AE] | 19 | 78.00 | 9.26 | 78.39 | 0.951 |
| Academic Spin-Offs [ASO] | 5 | 15.17 | 3.47 | 15.39 | |
| Food Security [FS] | 16 | 61.21 | 9.62 | 61.51 | |

Source: SPSS Output Table (2025).

## Psychometric Validation

### *Assessing the Measurement Model Fit and Validity*

We followed a two-step SEM process to assess the hypothesized model validity [Hair 2019]. In the first step, the reflective measurement model fit was tested through Maximum Likelihood Estimates [MLE] method (Kline, 2015), using CFA statistical Goodness-of-Fit [GOF] indices and other elements of construct Validity (Browne & Cudeck, 1993; Marsh & Hocevar, 1985) as shown in Tables 4 and 5 respectively.

**Table 4. Model Results**

| Goodness-of-Fit Statistics | Measurement Model | Structural Model | Threshold | Remarks |
|---|---|---|---|---|
| | | 40 Items | | |
| **Chi-Square ($\chi^2$) / *df*** | 2674.271 / 724 | 2720.510 / 725 | Sensitive to size | |
| **Absolute Fit Measures** | | | | |
| P-value | 0.000 | 0.000 | $P > 0.05$ | |
| Normed Chi-square (CMIN/DF) | 3.693 | 3.752 | r < 5* | **Supported** |
| Root M. Sq. Err of Appr. (RMSEA) | 0.062 | 0.061 | ≤ 0.08** | **Supported** |
| **Incremental Fit Indices** | | | | |
| Comparative Fit Index (CFI) | 0.911 | 0.908 | > 0.92*** | **Reasonable Fit[a]** |
| Tucker-Lewis Index (TLI) | 0.907 | 0.905 | > 0.92*** | **Reasonable Fit[a]** |
| **Parsimony Fit Measures** | | | | |
| Parsimony Normed Fit Index (PNFI) | 0.614 | 0.612 | > 0.6**** | **Supported** |

Source: AMOS Output Table (2025)
[a]Cut-off values are relaxed for complex model (Hair et al., 2019; Marsh et al., 2004)
*Ratios not greater than 5 indicate a reasonable fit (Zainudin, 2014)
**Values of about 0.08 or less would indicate a reasonable fit (Browne & Cudeck, 1993)
***Values closer to 1 indicate a very good fit (Bentler, 1983; Zainudin, 2014)
****No commonly agreed cut-off, but > 0.06 indicates good fit (Shadfar & Malekmohammadi, 2013)

Both AE and FS are specified as second-order constructs, with their respective first-order latent factors having a minimum of four observable items [indicators] respectively, indicating that the model is statistically identified (Byrne, 2016). All 40 items have standard factor loading, each between $0.5 \geq x \leq 0.88$ values, indicating the fulfilment of unidimensionality assumption. That means, all items loaded highly on their respective constructs (Anderson et al., 1987; Hattie, 1985). The outcome of the measurement model demonstrated a reasonable data-fit with Normed Chi-Square ($\chi^2$/ *df* ratio; 2674.271 / 724) = 3.693, RMSEA = 0.062, CFI = 0.911, TLI = 0.907, and PNFI = 0.614. All values are mostly within CFA recommended threshold values (Byrne, 2016; Hair et al., 2019), suggesting that the measurement model largely fits the sampled participants. This submission was further verified by investigating the model construct validity through convergent validity, discriminate validity, construct reliability (CR), and average variance extracted (AVE). The outcome, as shown in Table 5, demonstrated expected statistical support for the hypothesized model. For instance, the convergent validity outcomes indicate that all 40 items of the measurement instrument converged and shared a high proportion of variance in common to measure the constructs under review (Cooper & Schindler, 2014). Also, the discriminate validity values indicate that when the constructs are analyzed separately, they are unrelated (Sekeran & Bougie, 2013). This implies that each construct captures different phenomena.

**Table 5. CFA Validity and Reliability Assessment Test**

| | CR | AVE | (α) | AE | ASO | FS |
|---|---|---|---|---|---|---|
| AE | 0.947 | 0.500 | 0.895 | 1 | 0.44** | 0.47** |
| ASO | 0.839 | 0.513 | 0.847 | 0.667* | 1 | 0.41** |
| FS | 0.945 | 0.522 | 0.918 | 0.689* | 0.639* | 1 |

| | Threshold | Remarks |
|---|---|---|
| Construct Reliability (CR) | CR ≥ 0.70 | Supported |
| Average Variance Extracted (AVE) | AVE ≥ 0.50 | Supported |
| Cronbach's Alpha (α) | α > 0.60 | Supported |
| **Convergent Validity** | CR > AVE | Supported |
| **Discriminant Validity** | MSV < AVE | Supported |

Legend: *Significance Level: *0.01 (2-tailed) = correlation estimates among constructs.*
***Maximum Shared Variance (MSV) = values above the diagonal are squared*
AE = Acadpreneurship, ASO = Academic Spin-Offs, FS = Food Security, CR = Construct Reliability, AVE = Average Variance Extracted.

### *Assessing the Baseline Structural Model Validity*

In the second step, we transited from the measurement model to the structural model to produce validated empirical results. This enabled us to investigate the causal relationship and specify the nature of relationship amongst our constructs. The structural model outcomes, as shown in Table 4 and depicted in Figure 3, revealed $p = .00$, Normed Chi-Square ($\chi^2$/ *df* ratio; 2720.510 / 725) = 3.752, RMSEA =0.061, CFI = 0.908, TLI = 0.905, and PNFI = 0.612. Minimal discrepancies existed between values of the measurement and structural model. This is due to the latter having fewer structural paths to run its course (Kline, 2015; Sharma et al., 2005). The *p*-value is expected to be non-significant (Hooper et al., 2008), but this is frequently unrealistic, often due to the sensitivity of the chi-square ($\chi^2$) to large sample size (Hair et al., 2019). Hence, reliance on other GOF indices; i.e., at least one absolute fit index and one incremental fit to examine the structural model validity. Holistically, the structural model results in Table 4 are within statistical allowance (Hu & Bentler, 1999; Shadfar & Malekmohammadi, 2013). The results imply that the hypothesized model represented the sampled population [i.e., data-fit], produced reasonable GOF statistics, and is theoretically valid.

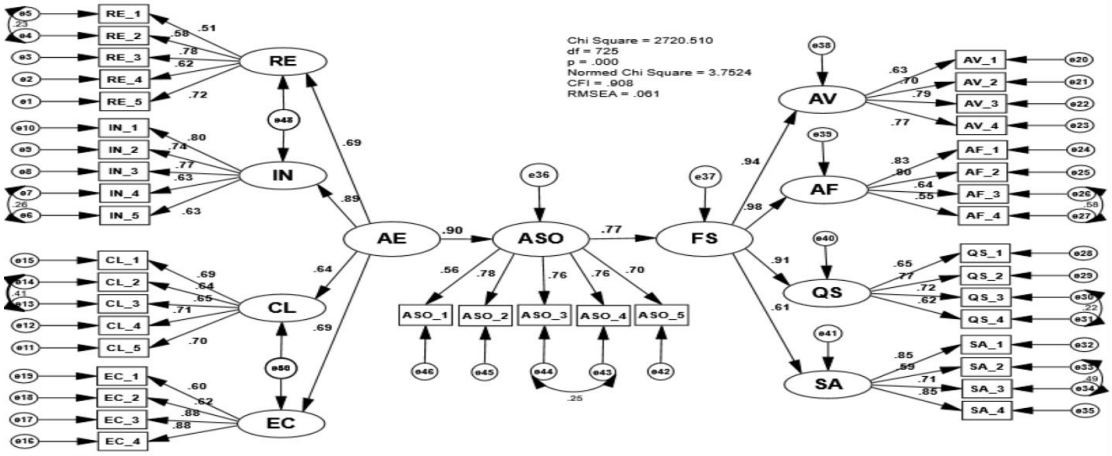



**Figure 3: Structural Model**

Notes: RE = Research Expertise, IN = Innovativeness, CL = Collaboration, EC = Ethical Orientation, ASO = Academic Spin-Offs, AV = Availability, AF = Affordability, QS = Quality and Safety, SA = Sustainability and Adaptation, AE = Acadpreneurship, FS = Food Security.

To further validate the data-fit of our hypothesized model, we inspected the structural model free parameters to determine their practical [$\beta > .15$] and statistical [$p < .05$] significance respectively [see, Figure 3]. The outcomes, as shown in Table 6, revealed

**Table 6. Estimates of the Hypothesized Structural Model**

| | Std. Reg. Estimates (β) | S.E. | C.R. | P |
|---|---|---|---|---|
| ASO ← AE | .90 | .141 | 11.574 | *** |
| FS ← ASO | .77 | .052 | 11.832 | *** |

Source: AMOS Output Table (2025)

Legend: AE = Acadpreneurship, ASO = Academic Spin-Offs, FS = Food Security, Std. Reg. Estimates = Standardized Regression Weights (β value), S.E. = Standard Error of Regression Weights, C.R. = Critical Ratio of Regression Weights, P = *p*-value at 0.05 significant level

that both hypothesized standardized structural path estimates are practically and statistically significance. Their path estimates, as shown in Table 6, are $\boldsymbol{H_{1ASOAE}}$: $\beta = .90$, $p = 0.000$ and $\boldsymbol{H_{2FSASO}}$: $\beta = .77$, $p = 0.000$, indicating that AE and ASO can practically and significantly enhance FS.

### *Test of Mediation*

One hypothesis was specified to test the mediating effect of ASO on the relationship between AE and FS. ASO was specified as a mediator to examine the indirect effect of AE on FS. Hair et al. (2019) contend that indirect effects are those relationships that involve a sequence of relationships with at least one intervening construct. According to Kenny and Judd (2014), '*part a'* [i.e., ASO ← AE] and '*part b*' [i.e., FS ← ASO] are the most essential steps required to establish mediation. Hence, we did not specify the direct effects, i.e., *part c [c']* in our model. However, Hair et al., (2019) established that if the product of the standardized co-efficient of

*'part a'* and *'part b'* is greater than 0.08, then mediation exits.

**Table 7. Mediation, Indirect Effects, and Bootstrapping Estimates**

| Relationship of the Variables | Indirect Effect (β) | Standard Error (S.E) | BootLL 95%CI | BootUL 95%CI | Mediation |
|---|---|---|---|---|---|
| FS ← ASO ← AE | 0.69 | 0.043 | 0.611 | 0.776 | Partial |

Source: SPSS Output Table (2025)
Legend: Independent variables (AE – Acadpreneurship), Mediator (ASO – Academic Spin-Offs), Dependent variable (FS – Food Security), β – Standardized Path Coefficients, S.E – Standard Error, LL – Lower Level, UL – Upper Level, CI – Confidence Interval
***Significance levels ($p < 0.05$).

We analyzed for indirect effect, as shown in Table 7, to determine if ASO has a full or partial mediation. The standardized co-efficient product [β] of '*part a'* [.90] and '*part b*' [.77] = .69, indicating the presence of a mediation effect between AE and FS. In addition, we observed that a previously significant direct estimate between AE and FS reduced with the presence of the intervening construct, indicating that variations in AE account for variations in the ASO as a mediator, which consequently led to variations in the outcome variable - FS. Baron and Kenny (1986 p. 1176) posit that once a mediation occurs in an equation, it is expected to change the initial relationship between independent variable and dependent variable or at least, reduce the relationship between independent and dependent variable. Hair et al., (2019) assert that a partial mediation will be assumed if the relationship between 'X' and 'Y' is reduced but remains significant when 'M' is included.

Since, "bootstrapping provides the most powerful and reasonable method of obtaining confidence limits for specific indirect effects under most conditions" (Preacher & Hayes, 2008 p.886), such as testing the significance of a mediating variable. Hence, we tested the significance level of the mediation effect through bootstrapping. Hayes (2013) say that if the confidence interval (CI) of indirect effect does not cross zero or zero is not included in the confidence interval, then mediation is assumed to be significant. Our indirect effect bootstrap outcome of AE on FS through ASO, i.e., ***H₃***: [Indirect Effect, β] IE = .69, SE = 0.043, $p$ <0.05; 95% CI = 0.611 - 0.776, is practically and statistically significant. Given these analyses, we submit that ASO has a significant partial mediating effect on the relationship between AE and FS.

### *Decision Rule*

The outcomes of ***H₁***, ***H₂***, and ***H₃*** have significant structural path coefficients. Hence, all specified alternate hypotheses were accepted as predicted, indicating the mediating effect of academic spin-offs on acadpreneurship and food security in Nigeria.

### *Discussion*

The uniqueness of our study is to establish an empirical relationship between AE, ASO, and FS. Most literature examined these constructs individually (Aye et al., 2025; Caputo et al., 2022; Garcez et al., 2025; Ilie & Budac, 2025). Hence, there is seemingly a dearth of research

on these constructs holistically, such as being pioneered by our study. However, fragmentarily, aspects of our findings are consistent with existing literature. For instance, the descriptive analysis of participants' socio-demographic characteristics aligns with Ayeni et al. (2024) and Sasu (2022) statistics on reduced gender disparity amongst graduate students in Nigeria. In our study, this is represented as 56.5% and 43.5%, in ratio 1.29:1, for male and female respectively.

The outcome of $H_{1ASOAE}$, shows that AE significantly predicts ASO. We established support for this fragmentary outcome in the literature. Ferretti et al., (2020) note that academia are not only seen as educators, but have evolved to modern-day researchers who contributes to societal and economic exploitation through their research discoveries, intellectual property [IP], or tacit knowledge. Correia et al., (2024) argue that AE has trajectorily arose the third mission of universities, which is the establishment of ASO or other related academia-industry linkage projects such as Technology Transfer Offices (TTO), consultancy services, incubation centers, university enterprises, professorial chairs, and so forth (Compagnucci & Spigarelli, 2020; De Jong et al., 2014; Onwualu, 2016; Todorovic et al., 2011). Our study found a positive significant interaction between AE and ASO, indicating that entrepreneurial opportunities or business enterprises can be successfully achieved when academia transfer innovative ideas, and share core technologies for industry use. Our findings show that research conducted by students and academia can be a starting point for entrepreneurial orientation, confirming prior studies. For instance, Pacheco et al. (2024) view academia transfer of knowledge and technology as a multidisciplinary approach that can influence entrepreneurial activities in higher education institutions. Adisa et al. (2023) revealed that AE can significantly enhance socioeconomic development through the creation of spin-offs or technology transfer offices. Hence, our results conform to the demand and inclusion of AE in public and economy service, as a third mission that must be embraced by academia in the 21st century.

Other fragment finding in our study also show that ASO can predict FS stability [$H_{2FSASO}$]. In Nigeria, and substantial parts of the Globe, maintaining FS has been quite a challenging task (Kotur et al., 2024; Oluwafemi et al., 2024; Tkemaladze, 2025). We argue that FS should not be left only at the beehive of government, it should be a multifaceted effort of theory, policy, and practice in synergy to place food at the request of every households at all times. Hence, we charted an empirical interaction between ASO and FS. Our results show that ASO is positively related to FS, confirming extant studies (Dhekney et al., 2025; Perez-Ruiz et al., 2013; Sultan et al., 2024). Our position was recently advocated for by Sharubutus (2025) who reiterated the need for Nigerian universities to establish ASO. The implication is that ASO can boost innovative agricultural solutions, enhance sustainable agricultural practices, lead to the development of new food technologies [e.g., precision agriculture, food processing quality and availability], and can impact policy or decision making related to FS. Statistics reveal that the establishment of ASO, such as Adaviv, an AI-assisted farm optimization MIT spin-off in other clime, have contributed immensely to their FS (Onyeaka et al., 2024). A full fleshed ASO or university spin-off is yet to materialize in Nigeria, except individual self-entrepreneurial efforts who moved their knowledge or discoveries from the laboratories to the market (Udoisoh, 2024). Oguegbe and Iloke (2023) claim that agriculture induced SMEs are vital in the economic growth and emancipation of African countries like Nigeria. Therefore, an entrepreneurial-based agricultural sector, in the form of ASO, will reduce poverty rate, provide food for the populace, and improve GDP of Nigeria.

Another findings from our study is that ASO will partially mediate a significant relationship

between AE and FS [$H_3$]. This explains that AE can indirectly stimulate FS, thus, contributing to economic growth. The implication is that ASO established through AE can yield broader research into agricultural challenges, leading to better trained graduates (Musleh et al., 2025), who can later impact FS through their contributions. Indirectly, AE can develop skilled workers through ASO entrepreneurial activities to support sustainable agriculture and food-related industries. Academia research, discoveries, and innovative outputs through commercialization [i.e., ASO] can shape FS policies. Existing research have highlighted the relevance of agricultural improved policy decisions on farmers and food system of a country (Dhekney et al., 2025). Siegel and Wright (2015a) emphasized that academia are encouraged to link their work more closely to the economic needs of the society. Wang et al. (2021) posit that if universities stay awake to their mission [i.e., creation of spin-off or the transfer of knowledge for commercial use], indirectly, they will become key players in promoting national and regional economic and social development, such as FS. AE through ASO can lead into forming partnership with companies, NGOs, and government agencies to enhance FS. The implication of such network is the sharing of agricultural knowledge, funding, and resources that supports FS. Indirectly, AE will enhance FS initiatives, when ASO begins to attract venture capital or agric-technology food innovations. Consequently, leading to healthier communities, improved nutrition awareness, and enhanced sustainable consumption pattern.

Given these findings, we thus advocate a paradigm shift, demonstrating the significant mediating effect of ASO on the interaction between AE and FS. We show that this effect have the propensity to improve long-term food availability, affordability, quality and safety, sustainability, reduce food waste, and boost rural economies. Thus, it becomes essential for universities to establish ASO, wherein academic research, innovations, or discoveries can be turned to marketable agricultural solutions.

### *Conclusion*

Literature is replete with studies on entrepreneurship, but shows dearth of research establishing interactions between acadpreneurship [AE], academic spin-offs [ASO], and food security [FS], particularly, in Nigeria. In our study, we established that AE, which is the commercialization of academic discoveries, innovation, or intellectual property through ASO can drive economic growth such as FS. Our results support our argument that if academia transfer their research findings and technologies to the industry by creating ASO, new agricultural business models, practices, products or services can evolve to enhance food security. Hence, we conclude that collaboration between the academia, industry, and government can bring research-based agricultural innovations to the market to improve the food basket of nation.

### *Implications of the Study*

The present study in intended to contribute to the discussion on different issues related to AE. This is focused on diverse perspectives based on experiences drawn from the entrepreneurial universities in Nigeria. Hence, the implications of our study comes in three hold folds - theoretical, policy, and practical implications.

### *Theoretical Implications*

Our research fill some lacuna in the literature. It added to body of knowledge on entrepreneurship, particularly, one that establishes an empirical interaction between AE, ASO, and FS. Most studies have only investigated the relationship between academia and entrepreneurship, or considered the relationship between academic entrepreneurship [AE] on spin-offs, but very few studies have examined the three variables [i.e., AE, ASO & FS] holistically (Oguegbe & Iloke, 2023), in order to examine their interaction effects. Our study pioneered this investigation, thus, providing further theoretical insights on their underlying dynamics and relationships. By implication, our results extend the literature on entrepreneurship, academic spin-offs, and food security.

### *Policy Implications*

The relevance of the academia is increasingly been sought after (Siegel & Wright, 2015b), with huge pressure to link their work more closely to the economic needs of the society (Martin, 2012). By implication, our results suggest that the interactions of AE, ASO, and FS will provide the opportunities for academia to influence policy formulation in the food industry or the agricultural sector. Indirectly, academia can help to improve policy decisions that benefit farmers, food producers and consumers. The creation of ASO can be a facilitation platform where different stakeholders partake in decision making to enhance food security. Hence, our integration of ASO as a mediator between AE and FS is multi-purposeful.

### *Practical Implications*

While our list is not exhaustive, we group the practical implications of our results in multi-layers; the individuals, the community / Society, and the government. The individual like the Faculty or students benefit through the commercialization of their research, indicating a form of economic empowerment. Besides, Faculty and students can use ASO to leverage on collaboration and partnership with other researchers, NGOs, and governmental agencies. Members of the community benefit with respect to employment opportunity through ASO, community development such as access to nutritious food, promotion of environmentally-friendly agricultural practices that enhances food sustainability, establishing training outreach and extension services that facilitate capacity building, providing research support for local and small scale farmers and so forth. Apart from the collaboration on policy making, practically successful ASO or start-ups can generate tax revenue for government. ASO can augment government's creation of job opportunities. ASO can stimulate economic growth through development of innovative-driven industries, thus, helping to address societal challenges such as food insecurity. Given these implications, we assert that acadpreneurs can play pivotal role in the agricultural sector to help reduce poverty, increase standard of living, and enhance FS in Nigeria. Ditto, to other nations.

## Limitations and Future Research

Limitations are evident in terms of common method bias, given that our study is cross-sectional. Future research may opt for longitudinal study through a case study approach on some ASO to investigate their variation effects on FS. Our study was limited by the scarcity of databases on AE, ASO, and FS as a one-stand literature. Hence, we fragmentarily sourced for

literature to holistically bring the three variables together in a single study. Future research is encouraged in this direction to verify our results. Our study did not consider any moderators. Moderating variables often have directional effect change on the outcome variable, in our case, FS. Our results should be interpreted in the light of different moderating variables such as intellectual property ownership [IP], patent and licensing issues, funding, climate change, and regulatory hurdles. Future research may consider a conceptual model to include any of these moderating variables that examines the interaction between AE and FS. Our study did not include farmers as participants, their input through interview or a qualitative methodological approach can provide insights into the FS of a nation.

## Recommendations

Some academia in Nigeria, through the establishment of Entrepreneurship and Skill Development Centres or Departments are promoting entrepreneurial spirit (Adisa et al., 2023). However, more effort is needed on the creation of academic spin-offs, particularly, in the agricultural sector to promote FS in Nigeria. A way to achieve a sustainable ASO can be through university-industry-government-community collaboration and partnerships to ensure efficient transfer of academic knowledge, discoveries and innovations.

Government should place priority on academic research, e.g., provide better funding opportunities and better welfare packages to stimulate the interest of the academia to engage in impactful research for the economy. As being encouraged by the National University Commission [NUC] to make entrepreneurship become a must offered course in higher institution of learning, further step can be taken to give academia the opportunity to mentor students to start a business of their choice as a major discipline, which can subsequently lead to the award of their degree certificate. This will place them better off on full supervision by their Faculties, and may possibly turn out as academic spin-off companies [ASO] affiliated to the university. Imene et al. (2025) disclosed that this practice can project academia in a more suitable position to establish spin-offs for societal benefits. Onwualu (2016) posited that steps should be taken to ensure that research projects for undergraduate and graduate [i.e., B.Sc., M.Sc., and Ph.D.] degrees should be tailored towards solving a regional, national, or global problem. Though, Oguegbe and Iloke (2023) posit that entrepreneurship in agriculture is still at its fancy stage, the outcome of this study should have significant push to the drive on acadpreneurship in our institutions of learning. It may further capture the minds of the Gen-Z cohort whose interests are focused on other sectors of the economy. If well implemented, AE may be a pathway to reinforce the crusade on FS.

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# NIELSEN'S HEURISTIC-BASED NEEDS ANALYSIS FOR THE DESIGN REQUIREMENT OF A VIRTUAL TOUR MOBILE APPLICATION

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***Abstract:*** *The implementation of virtual technologies in higher education has improved institutional communication, accessibility, and engagement This study focuses on identifying and prioritizing usability requirements for the design of a mobile virtual tour application for University Islam Selangor (UIS), based on Nielsen's Usability Heuristics. The objective is to establish a heuristic-based framework that informs user-entered design requirements for developing an intuitive and functional virtual tour system. In this research, a quantitative research design was used, and data were collected via an online questionnaire sent to prospective students and parents, who are the primary target users of the UIS Virtual Tour application. The questionnaire items were based on Nielsen's heuristic dimensions in relation to the respondents' expectations on the interface, usability, interactivity, and feedback systems. Out of the distributed questionnaires, 184 respondents were used for the analysis which included descriptive statistics (mean and standard deviation scores) in SPSS focusing on the usability elements most significant to users. The findings indicate the priority users assign to key system features, such as ease of navigation, feedback, error recovery, and other interface functionalities, as well as the overall system design. This indicates that users prefer designs that balance consistency with functional simplicity. Theoretical contributions of this study include demonstrating how heuristic evaluation can be utilized in the needs-analysis phase of design and practical contributions include offering tailored design specifications aimed at the creation of an engaging and user-friendly mobile application for virtual tours in higher education.*

***Keywords: Virtual Tour, Mobile Application, Nielsen's Usability Heuristics, User Experience (UX), Needs Analysis***

## 1.0 Introduction

Higher education institutions have integrated technology to improve institutional visibility, engagement, and accessibility, particularly to advance the goals of the new digital transformation. One of the most useful tools in these efforts is the virtual tour application, which facilitates an immersive mobile experience that enables prospective students and parents to explore a university's environment and facilities. Communication in the form of virtual tours is essential now, providing realistic representations of campus life and allowing potential students to make decisions about enrolment far in advance without traveling to the campus

(Wiryawan & Nuraisyah, 2023; Li, Zhang, & Zhao, 2022). Considering that most users access and consume information via mobile devices, the design and functionality of such applications, therefore, determine their usability and users' acceptance overall.

Addressing users' expectations, behaviours, and interaction must for the construction of user-centred virtual tours. Existing virtual tour systems, however, concentrate on visual usability at the expense of essential design dimensions of feedback, consistency, and control, which are necessary for meaningful user experience (UX) (Norman, 2013; Rodríguez, 2025). The first phase of design development must focus on a needs analysis, which, in turn, extends the scope of user-entered design considerably and alignment of the design goals with usability and contextual objectives.

Nielsen's Ten Usability Heuristics present a comprehensive framework for identifying and structuring critical usability requirements, particularly relevant for the development of user-centered mobile applications like virtual tours (Wook et al., 2018). These heuristics effectively capture the weaknesses of current virtual tour systems by emphasizing the importance of some, otherwise neglected, design dimensions like feedback, consistency and control. For example, this systematic assessment through the heuristics such as visibility of system status, match between system and real world, consistency and standards, and error prevention consistently provides an intuitive, predictable, fault-tolerant user interface. This incorporation of these established frameworks is to ensure that the needs analysis for proposed Virtual Tour University Islam Selangor mobile application is not only founded on a preliminary phase but it represents itself as being truly based on research-based and empirically-validated design principles recommendations, thus fostering a genuine, meaningful and effective user experience.

This paper aims to address this issue by performing a heuristic-based needs analysis in order to accurately identify the users' requirements and set usability levels in developing Virtual Tour UIS application. The user feedback extracted from this study, as interpreted by future students and their parents, will be a crucial part of building a mobile virtual tour that is truly designed with them in mind to help inform and empower their decision-making process.

## 2.0 Literature Review

This literature review outlines previous research and fundamental ideas on mobile virtual tours, user experience (UX), and heuristic evaluation, which form the basis of the understanding of the principles of usability that can inform the design of the proposed Virtual Tour UIS mobile application.

### *2.1 The Concept of Mobile Virtual Tours and the Adaptation of Heuristics to User Experience (UX) Design*

Interactivity and technological applications have advanced to the point where users access and interact with space in ways that have not previously been imaginable in virtual environments (Li et al., 2023). Mobile virtual tours, for example, have incorporated 360-degree panoramic technology and are able to replicate real-world spaces effectively. These applications allow users to delve into an environment over a smartphone or tablet, incorporating multimedia

elements and adding interactive features such as voiceovers, videos, and text overlays, as well as allowing users to manipulate the environment (Wiryawan, 2023). This is consistent with recent research finding that interactive avatar-audio/visual composite linking enhances user presence and immersion in a virtual environment, providing a responsive virtual experience.

In higher education, virtual tours represent a technological advancement that bolsters institutional communication and expands educational accessibility by offering a preliminary virtual experience of a campus and its facilities. The inherent convenience of this technologically mediated access has led to the widespread adoption of remote exploration for academic environments and facilities. (Samala et al., 2024) This digital shift necessitates a rigorous application of usability heuristics to ensure these virtual platforms effectively meet user needs and expectations, particularly for mobile interfaces (Wook et al., 2018).

The success of mobile virtual tours, from the design perspective, critically depends on User Experience (UX). Users' experience designates the users' feelings and attitudes as they interact with and manipulate an electronic system (Norman, 2013). In the case of virtual environments, the UX focuses on the design elements of kinaesthetic feedback, visual integration, and interactive systems that assist users in cognitive mapping and orientation (Rodríguez, 2025). This finding, which validate an emerging agreement among researchers that user-centred design principles are the key aspects of ensuring meaningful engagement and lasting educational benefit within virtual tour, shall be used as the basis for entertainment-centred virtual tour for learning.

### *2.2 The Adaptation of Heuristics to User Experience (UX) Design*

With the development of more advanced mobile and immersive interfaces, the scholarly focus on the evaluation and optimization of the user experience (UX) has led to the adoption of usability heuristics within a particular methodology. Of the heuristics available, Nielsen's ten usability heuristics remain the most prominent frameworks for evaluating and guiding the design of interfaces (Nielsen, 1994). Of the principles, the visibility of system status, system and the real world, the consistency and standards, and error prevention are the most generalized and practical across interfaces under different contexts. Mobile applications present unique challenges and limitations to interface design, including smaller screens, gesture-controlled user interfaces, and varying mobile connectivity (Othman, Sulaiman, & Aman, 2018). Adapting heuristic principles for mobile contexts allows evaluators to focus on issues more relevant to the horizontal responsiveness of the mobile interface, touch-target size, and the discernability of navigation and command interfaces.

The evaluation method using heuristics in augmented and virtual environments has highlighted numerous technical and perceptual usability challenges. For instance, in a study on a smartphone virtual museum application, Tehrani, Zainuddin, and Takavar (2014) applied Nielsen's heuristics and concluded that consistency, feedback, and navigation sign were fundamental determinants of user satisfaction. Likewise, Li et al. (2022) showed that usability gaps, particularly related to orientation, timing of feedback, and visual clutter in interfaces of virtual exhibitions, were effectively identified through evaluative heuristics.

These studies state the importance of heuristic principles in designing mobile virtual tour interfaces that are intuitive and contextually relevant, facilitating spatial exploration in a meaningful way, and engaging with the user on multiple levels (Wiryawan & Nuraisyah, 2023).

Incorporating heuristic evaluation into the needs analysis stage establishes a foundational way of aligning user expectations into design requirements. By examining user perceptions with heuristic principles, designers are equipped to determine which usability elements are prioritized by prospective users. These may include elements such as navigational awareness, information presentation, and feedback responsiveness. Ultimately, this method strengthens the predicted design's user-centred quality, producing a heuristic-derived mobile virtual tour application that delivers both functional efficacy and a seamless user experience.

## 3.0 Methodology

Quantitative methods, particularly survey scales, questionnaires, and rating scales, are widely used in fields like Human-Computer Interaction and User Experience research to measure user experiences, perceptions, and satisfaction (Perrig et al., 2024). The online research targeted prospective users specifically, future students and parents, who are the primary audience for the proposed Virtual Tour UIS mobile application. The study aimed to determine the usability and design characteristics needed for a mobile-based virtual reality (VR) application designed to portray the UIS campus, its surroundings, facilities, and the academic environment.

Data was obtained totally through an online questionnaire that was posted through institutional messaging systems, social media, and direct approaches to communities around school-leavers and parents. This strategy enhanced the study's reach, and it captured respondents who are likely to be more potential users of the application for prospective enrolment. Items on the questionnaires were generated according to Nielsen's usability heuristics to incorporate both the design and the technology aspects of the mobile application to be evaluated. Expectations and importance perceptions regarding usability features, such as clarity of navigation, visual and functional consistency, interactivity, and feedback, were rated on a five-point Likert scale and were assessed for importance. For the ethical provision of the data, all data were provided anonymously.

The data were analyzed using SPSS software. Most importantly, the mean and standard deviation were used to prioritize the most critical aspects of usability. This quantitative approach is consistent with the findings from other research conducted in Malaysia which has highlighted the use of survey-based usability testing for educational mobile applications (Nik Ahmad & Hussaini, 2021; Mohamed et al., 2024). These findings were crucial as they provided detailed user expectations and design inputs necessary for developing a UIS Virtual Tour application that is easy to use and centered around the user.

## 4.0 Analysis and Result

This study involved 184 respondents, comprising 53.8% females and 46.2% males. The majority were aged between 18–25 years (52.2%) and were students or prospective students (66.3%). In terms of ICT skills, most respondents identified themselves as moderately skilled (70.7%), while mobile phones were the most commonly owned device (58.7%). Regarding

purpose, 79.9% of respondents stated their interest in using a *virtual tour* application to explore the UIS campus virtually, demonstrating alignment with the target audience of the application.

**Table 1: Respondents' Demographic Profile (N=184)**

| Profile | No | Percentage (%) | Mean | Standard deviation |
|---|---|---|---|---|
| **Gender** | | | | |
| • Male | 85 | 46.2 | 1.54 | 0.500 |
| • Female | 99 | 53.8 | | |
| **Age** | | | | |
| • 18-25 years | 96 | 52.2 | | |
| • 26-35 years | 38 | 20.7 | 2.02 | 1.272 |
| • 36-40 years | 0 | 0.00 | | |
| • 41 years and above | 50 | 27.2 | | |
| **Profession** | | | | |
| • Student/prospective student | 122 | 66.3 | | |
| • Parent | 56 | 30.4 | 1.64 | 0.918 |
| • Public | 6 | 3.3 | | |
| **ICT skill level** | | | | |
| • No skilled | 28 | 15.2 | | |
| • Less skilled | 130 | 70.7 | 1.99 | 0.543 |
| • Skilled | 26 | 14.1 | | |
| • Very skilled | 0 | 0.00 | | |
| **Ownership of Mobile Technology Devices** | | | | |
| • Mobile Phone | 108 | 58.7 | | |
| • Laptop | 52 | 28.3 | 1.42 | 0.36 |
| • Tablet | 24 | 13.0 | | |
| **Purpose of Using the University Virtual Tour Application** | | | | |
| • Visiting the campus | 147 | 79.9 | | |
| • Making admission decisions | 10 | 5.4 | 1.35 | 0.723 |
| • Interest/tourism | 27 | 14.7 | | |

Table 1 indicates that the majority of respondents were young students with moderate ICT skills. Mobile phones were the most dominant device, highlighting the need for the application to be developed in a mobile-friendly format.

**Table 2: Awareness and Interest in Using the Application**

| Profile | No | Percentage (%) | Mean | Standard deviation |
|---|---|---|---|---|
| **Are you aware of Selangor Islamic University (UIS)?** | 184 | 100.0 | 1.00 | 0.000 |
| • Yes | | | | |

| | | | | |
|---|---|---|---|---|
| **What channels do you choose/use to obtain information about Selangor Islamic University (UIS)?** | | | | |
| • Official UIS electronic media (Email, Telephone, email) | 82 | 44.6 | 1.57 | 0.519 |
| • Social Media | 100 | 54.3 | | |
| • Print media (Brochures, Flyers, etc.) | 2 | 1.1 | | |
| **Have you ever used a Virtual Tour app?** | | | | |
| • Yes | 105 | 42.9 | 1.57 | 0.496 |
| • No | 79 | 57.1 | | |
| **Are you interested in using a mobile application that allows you to virtually tour the UIS campus (UIS Virtual Tour)?** | | | | |
| • Yes | 179 | 97.3 | 1.97 | 0.163 |
| • No | 5 | 2.7 | | |

Table 2 shows the awareness of UIS was universal (100%), with social media identified as the dominant source of information (54.3%). Although more than half of the respondents had never used a *virtual tour* application (57.1%), nearly all (97.3%) expressed strong interest in the UIS Virtual Tour. This confirms the significant potential of the application as a promotional medium and a tool for virtual campus exploration.

**Table 3: Descriptive Analysis of Respondents and Percentage for UIS Virtual Tour Mobile Application Design Requirements**

| Item | Number | Percentage |
|---|---|---|
| **System Feedback (Visibility of System Status)** | | |
| D1: I want the application to display notifications when there are updates or new information about places that can be visited virtually. | 127 | Strongly Agree (69.0%) |
| D2: I want the application to show my virtual tour progress in the form of a time indicator or interactive map. | 105 | Strongly Agree (57.1%) |
| **Match Between System and the Real World** | | |
| D3: I want this application to use icons and terms that are commonly used in other applications. | 112 | Strongly Agree (60.9%) |
| D4: I want this application to use the same location names as those used on the actual campus so that I do not get confused. | 138 | Strongly Agree (75.9%) |
| **User Control and Freedom** | | |
| D5: I want a clear 'Back' or 'Exit' button for easy navigation. | 130 | Strongly Agree (70.7%) |
| D6: I want to be able to end the virtual tour session easily at any time. | 128 | Strongly Agree (69.6%) |
| **Error Prevention** | | |

| | | |
|---|---|---|
| D9: I want the application to provide a warning before I accidentally close the virtual tour session. | 115 | Strongly Agree (62.5%) |
| D10: I want the application to remind me if I try to leave the tour before completing all main areas. | 128 | Strongly Agree (69.6%) |
| **Ease of Use (Recognition Rather Than Recall)** | | |
| D11: I want the application to have a main menu that is always visible for easy navigation. | 129 | Strongly Agree (70.1%) |
| D12: I want the application to display icons that allow users to recognize functions without memorizing them. | 130 | Strongly Agree (70.7%) |
| **Flexibility and Efficiency of Use** | | |
| D13: I want the application to allow me to choose different tour modes such as 'Quick Tour' or 'Detailed Tour'. | 122 | Strongly Agree (66.3%) |
| D14: I want a 'Quick Search' feature that allows me to find locations on campus without exploring one by one. | 129 | Strongly Agree (70.1%) |
| **Minimalist and Aesthetic Design** | | |
| D15: I prefer an application with a simple design and not overloaded with information on one page. | 136 | Strongly Agree (73.9%) |
| D16: I prefer if the icons in the application are designed in a minimalist style but still easy to understand. | 130 | Strongly Agree (70.7%) |
| **Error Resolution Support (Help Users Recognize, Diagnose, and Recover from Errors)** | | |
| D17: I want clear error messages if a technical problem occurs. | 121 | Strongly Agree (65.8%) |
| D18: I want the application to have a 'Reset' function that allows me to restart the tour if I experience a technical issue. | 129 | Strongly Agree (70.1%) |
| **Help and Documentation** | | |
| D19: I want the application to provide a guide or tutorial before I start using it. | 114 | Strongly Agree (62.0%) |
| D20: I want a FAQ section or customer support in the application in case I encounter problems. | 137 | Strongly Agree (74.5%) |

Table 3 presents the results of the descriptive analysis on the design requirements of the UIS Virtual Tour mobile application based on respondents' feedback regarding Nielsen's heuristic design principles. The findings indicate that the majority of respondents strongly agreed with the proposed design features, reflecting users' expectations for usability, functionality, and their overall experience while using the application. In terms of System Feedback (Visibility of System Status), 69.0% of respondents strongly agreed that they want the application to display notifications when new information about virtually visitable places becomes available. Additionally, 57.1% of respondents showed strong agreement on the need for the app to display tour progress, either through a time indicator or an interactive map.

For Match Between System and the Real World, 60.9% of respondents strongly agreed that the use of familiar icons and terms commonly found in other applications is important. Furthermore, 75.9% of respondents expressed very high agreement on the use of actual campus location names to avoid confusion during virtual tours. Regarding User Control and Freedom,

a majority of respondents (70.7%) stated that they wanted a clear "Back" or "Exit" button to simplify navigation. Additionally, 69.6% agreed that they should have the ability to end a tour session easily at any time. For Error Prevention, 62.5% of respondents indicated that they want the app to issue a warning if a tour session is accidentally closed. Moreover, 69.6% wanted the app to remind them if they attempt to exit the tour without completing all key areas.

In the Recognition Rather Than Recall category, 70.1% of respondents wanted the main menu to remain visible for easier navigation, and 70.7% agreed that the icons used should be easily recognizable without the need to memorize their functions. Concerning Flexibility and Efficiency of Use, 66.3% of respondents wanted the app to offer different tour modes such as "Quick Tour" or "Detailed Tour," while 70.1% expressed the need for a "Quick Search" feature to locate specific places without exploring the entire campus. For Aesthetic and Minimalist Design, 73.9% of respondents preferred a simple interface without excessive information on one screen. Additionally, 70.7% agreed that icons should be designed in a minimalist yet easily understandable way.

In terms of Error Recovery Support, 65.8% of respondents wanted clear error messages in the event of technical issues, while 70.1% desired a "Reset" function to restart the tour if any problem occurs. Lastly, for Help and Documentation, 62.0% of respondents wanted the app to provide guidance or a tutorial before use, and 74.5% emphasized the need for a FAQ section or customer support in case they encounter issues while using the app.

Overall, the findings from Table 3 clearly show that respondents have high expectations for usability, flexibility, and clarity of information in the UIS Virtual Tour application. This reflects the need to develop an intuitive, user-friendly app that fully supports an effective and seamless virtual tour experience.

## 5.0 Discussion

### *5.1 Design Requirements for the UIS Virtual Tour Application*

The findings indicate that respondents have high expectations for an application design that adheres to Nielsen's heuristic principles. Most users agreed on aspects such as minimalist design (73.9%), ease of navigation (70.1%), and flexibility of use (66.3%). This reflects users' desire for an application that not only functions effectively but is also easy to understand and visually appealing.

Nielsen's heuristic design principles, which include the visibility of system status, user control and freedom, and error prevention, are paramount for enhancing application usability (Wook et al., 2018). This finding is supported by Zhang and Adipat (2005), who emphasized that mobile applications designed based on these principles provide a more satisfying user experience. Wren and Reynolds (2004) also found that Minimalist design, which eliminates unnecessary elements and minimises visual clutter, is important for creating clarity in interfaces. Furthermore, Jylhä & Hamari (2020) discovered that an attractive user interface that adapts to user needs and preferences is highly important for facilitating interaction and enhancing the overall user experience.

Therefore, the development of the UIS Virtual Tour should emphasize visual aspects, intuitive navigation, and user support features such as tutorials and FAQs to ensure a more engaging,

interactive, and accessible virtual tour experience for all users. The analysis results show that users strongly agree with all the principles studied, indicating their awareness of the importance of usability, aesthetics, and user experience in virtual applications. This discussion critically examines eight key principles with support from previous research.

### *5.2 System Feedback (Visibility of System Status)*

A total of 69% of respondents agreed that the application should display notifications or real-time updates during the virtual tour. This shows that users appreciate a responsive system that provides real-time information to enhance interaction. Applications that fail to provide immediate feedback may cause confusion or negative perceptions of the system's functionality. This finding aligns with Nielsen (1994), who emphasized that system feedback is crucial to ensuring users always understand the current system state. Agarwal and Venkatesh (2002) found that systems providing real-time feedback enhance user trust and interaction effectiveness. Similarly, Liao et al. (2019) demonstrated that fast feedback in mobile applications increases user satisfaction and reduces abandonment rates. Critically, these findings highlight the need for the UIS Virtual Tour to include elements such as loading indicators, new tour notifications, and clear connection statuses to maintain user trust and engagement throughout the session.

### *5.3 Match Between System and the Real World*

A total of 75.9% of respondents agreed that the application should use actual UIS campus location names and familiar icons from other applications. This shows that users prefer a digital environment that mirrors real-world settings to avoid confusion during navigation. This finding supports Norman's (2013) concept of mental models, which suggests that users interact more easily when digital systems simulate the real world. Wismer (2021) also found that that a high level of immersion in VR leads to a greater sense of presence, which is the subjective feeling of being there in the virtual environment. In addition, Radianti et al. (2020) showed that applications using real-world objects and location names in virtual tourism strengthen users' understanding of real environments. Hence, the UIS Virtual Tour design should emphasize contextual terminology and icons to help users navigate intuitively and realistically, replicating actual campus tour experiences.

### *5.4 User Control and Freedom*

A total of 70.7% of respondents wanted clear "Back" or "Exit" buttons and the freedom to end the tour at any time. This indicates that users value flexibility and full control over their experience. Preece et al. (2015) stated that users feel more confident when they can control navigation and cancel actions without fear of losing data. Zhang and Adipat (2005) also found that clear user control in mobile applications reduces cognitive load and interaction errors. Additionally, Hussain et al. (2018) emphasized that giving users freedom to control app functions increases perceived usefulness and satisfaction. Therefore, the UIS Virtual Tour should provide bidirectional navigation controls and non-intrusive exit options to create an interactive, flexible, and user-friendly experience.

### *5.5 Error Prevention*

About 69.6% of respondents agreed that the application should provide warnings if users attempt to close the tour session prematurely. This reflects user awareness of the need for proactive systems that prevent user errors. Nielsen (1994) emphasized that systems designed to prevent errors are more effective than those that merely display error messages after the fact. Bastien and Scapin (2003) also noted that warning mechanisms before critical actions improve efficiency and reduce user frustration. Furthermore, Yen et al. (2018) found that applications with error prevention features such as confirmation pop-ups and autosave functions enhance user satisfaction in digital learning apps. Therefore, the UIS Virtual Tour should integrate smart warning functions before critical actions, such as ending a tour session, to prevent disruptions and ensure continuous user interaction.

### *5.6 Recognition Rather Than Recall*

A total of 70.7% of respondents agreed that the icons in the application should be easily recognizable without memorization. This shows the need for an intuitive application that does not demand complex memory recall. Nielsen (1994) stated that systems emphasizing recognition over recall help users navigate more efficiently. Shneiderman et al. (2016) explained that consistent, visually-based interfaces reduce users' cognitive load. Alsumait and Al-Osaimi (2010) also found that the use of universal icons and fixed menus enhances the usability of educational apps because users do not need to relearn functions each time they use them. Accordingly, the UIS Virtual Tour should ensure that elements such as icons, labels, and the main menu remain visible to allow users to navigate easily and consistently throughout the virtual experience.

### *5.7 Flexibility and Efficiency of Use*

A total of 70.1% of respondents wanted the app to offer different tour modes such as "Quick Tour" or "Detailed Tour," showing users' desire for experiences adaptable to individual needs. Zhang and Adipat (2005) found that flexibility in mobile apps provides users with various interaction paths suited to their skill levels. Li and Wang (2019) also discovered that users are more likely to continue using virtual tourism apps when given freedom to choose tour modes. Hassenzahl and Tractinsky (2006) further emphasized that flexibility enhances hedonic value and positive perceptions of digital experiences. Thus, the UIS Virtual Tour should offer multiple usage options such as guided tours, self-exploration, and quick search features to meet the diverse needs of users in terms of interests and available time.

### *5.8 Aesthetic and Minimalist Design*

A total of 73.9% of respondents preferred a simple design that is not overloaded with information. This preference highlights the importance of visual aesthetics in shaping user perception of technological sophistication and overall user experience in virtual environments (Jo & Park, 2023). This emphasis on minimalism directly correlates with Nielsen's heuristic of "aesthetic and minimalist design," which advocates for interfaces that avoid irrelevant or infrequently needed information (Alwafi et al., 2022).

This shows that users appreciate clean aesthetics focused on core content. According to Wren & Reynolds (2004), minimalist design, which focuses on removing unnecessary components, is crucial for improving clarity and reducing visual clutter in interfaces. This approach directly

aids users in focusing on key content, thereby enhancing their ability to interact efficiently with the application (Bakar et al., 2017). Furthermore, visually appealing interfaces significantly contribute to overall user satisfaction and initial engagement, influencing the perceived attractiveness and initial usage of the technology (Eichenberg, 2012). Hence, the UIS Virtual Tour design should adopt a minimalist visual approach with soft colours, consistent typography, and a clean layout to create a professional and distraction-free visual experience.

### *5.9 Help and Documentation*

A total of 74.5% of respondents strongly agreed that the application should provide tutorials or a FAQ section. This indicates that users value clear informational support to help them overcome technical barriers. Lazar et al. (2017) found that user-friendly documentation enhances users' ability to understand systems quickly. Preece et al. (2015) emphasized that contextual assistance, such as step-by-step guides, reduces user errors. Al-Gahtani (2016) also found that online help and interactive tutorials build user confidence in educational digital applications. Therefore, the UIS Virtual Tour should include text-based guides, video tutorials, and automated help systems (chatbot support) to improve usability and ensure a more effective and independent user experience.

### *5.10 Error Resolution Support*

The findings show high agreement regarding the need for clear error messages (65.8%) and a "Reset" function (70.1%) that allows users to restart the tour in case of technical issues. This demonstrates that users value an application's ability to help them identify and recover from errors without repeating the entire process. Nielsen (1994) emphasized that error messages should be written in simple language, describe the issue, and offer clear solutions for immediate action. Norman (2013) also explained the concept of forgiving design, which allows users to correct mistakes easily using functions such as undo, redo, or guided messages. Lazar et al. (2017) found that interactive assistance and step-by-step documentation accelerate error recovery and increase user confidence in the system. Therefore, the UIS Virtual Tour should provide action-oriented error messages that clearly explain the causes and solutions. Features such as "Continue Tour," "Try Again," and "Reset" should be carefully designed so users can quickly recover sessions without losing data. This approach not only improves user satisfaction but also ensures the system remains user-friendly and responsive to any technical disruptions.

## 6.0 Conclusion

This research explored how to assess and define the usability and design parameters for a mobile virtual tour application specifically for the University Islam Selangor (UIS), using a heuristic-based needs analysis approach with Nielsen's Ten Usability Heuristics. Considering prospective students and parents as the main respondents, this research determined the most important usability needs that should inform the design and development of the Virtual Tour UIS application. From the 184 valid responses received, the quantitative data indicated the most important user needs to be ease of navigation and feedback, error prevention, and

adjustable control. In addition, users requested high aesthetic simplicity, low cognitive effort, and adaptive progressive disclosure. These results highlight the need for a well-designed mobile application that balances visual and functional simplicity with usability.

The results demonstrate the value of applying heuristic evaluation during the needs analysis stage of user-centred design, instead of only post-design evaluation. The early-stage incorporation of heuristic principles will improve the chances of achieving design outcomes that satisfy user expectations and usability criteria. From a practical standpoint, this research will serve as a guide for educators and developers as they work to build intuitive, user-friendly, and responsive educational mobile applications. From a conceptual perspective, it will enhance the understanding of heuristic-based user experience design frameworks applicable to mobile and virtual spaces. Constructing the proposed design framework and validating it through prototype experimentation and user experience design focusing on live interactions in the virtual plane will advance this work. Such efforts would substantiate the relationship between heuristic-entered needs analysis and usability in practice, providing an avenue for the advancement of mobile virtual tour apps for use in higher education.

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# RISK MANAGEMENT IN WORKPLACE SAFETY: A BIBLIOMETRIC AND THEMATIC INTEGRATION OF GLOBAL RESEARCH

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***Abstract:*** *Workplace safety research has undergone substantial transformations because of evolving governance, technology, and sustainability perspectives. This study presents a bibliometric and thematic analysis of global research on risk management in workplace safety. It aims to trace its intellectual development and emerging directions. A total of 3,249 publications retrieved from Scopus and Web of Science (WoS) formed the dataset. ScientoPy was used to analyse performance indicators and temporal trends, while VOSviewer facilitated network mapping and thematic visualisation. The results reveal a significant expansion of research output after 2010 and a marked transition in recent years from compliance-driven to technology-oriented approaches. Four key themes were identified: (i) procedural and regulatory safety management, (ii) behavioural and cultural safety, (iii) technological and predictive systems, and (iv) crisis-responsive and resilient workplaces. Earlier research emphasised risk analysis, ergonomics, and safety culture, whereas recent studies increasingly apply artificial intelligence, machine learning, and deep learning to develop predictive safety frameworks. The field now demonstrates a paradigm shift towards intelligent, adaptive, and socio-technical systems that integrate human factors, digitalisation, and resilience under Environmental, Social, and Governance (ESG)-oriented frameworks. These findings underscore how the convergence of technology and behavioural insight is redefining the theoretical and practical foundations of workplace risk management for sustainable organisational performance.*

***Keywords:*** *Workplace Safety, Risk Management, ESG-oriented Governance*

## Introduction

Research on workplace safety has undergone a significant transformation in recent years. One might recall that it has been shaped by shifts in concepts of efficient governance, technology, and sustainability (Abdullah & Sofyan, 2023; Akano et al., 2024; Basiru et al., 2023). Apart from this, there is a growing recognition that effective risk management is a crucial predictor of success. From a practical standpoint, effective risk management impacts organisational resilience and long-term sustainability (Akano et al., 2024).

In the early 1900s, occupational safety research primarily focused on regulatory compliance and accident statistics, reflecting the era of the Industrial Revolution (Friedman & Ladinsky, 2021). Since then, the implementation of formal management systems, such as OHSAS 18001 and ISO 45001, marked a significant shift in safety management (Karanikas et al., 2022; Madsen et al., 2020). Through formal safety management, this element provides a systematic framework (Otitolaiye & Abd Aziz, 2024). This framework is valuable in identifying, assessing and reducing occupational hazards. However, the basis of this norm lies in more proactive and systematic action. Therefore, we should understand how to increase awareness of hazards at

the workplace. Equally important, creating a safety culture and implementing new technologies in prevention systems are also considered crucial (Jabłoński & Jabłoński, 2021).

In the 2020s, workplace safety has been discussed within the environmental, social, and governance (ESG) framework (Jain et al., 2024). This means that risk management is no longer just about procedural compliance. In tracing this evolution, it has developed by making environmental, social and governance aspects the main guide in workplace safety risk management (Martin & Massyn, 2023). Indirectly, this exposure can ensure that the strategic orientation and approach to workplace safety risk management align with the ESG imperative (Redinger, 2024). Indirectly, this trend reflects the nature of industrial systems that evolve with the times. In the meantime, long-term performance in managing occupational safety risks also depends on proactive methods (Bochkovskyi & Sapozhnikova, 2023).

Having established the theoretical basis, workplace safety risk management research has now focused across disciplines and methodologies. Bibliometric analysis, for instance, can identify potential research agendas that could be explored (Abdullah et al., 2023). Previously, bibliometric analysis pertinent to occupational safety risk management focused on construction safety (Ensslin et al., 2023) or behavioural compliance (Abdullah, 2022). Also, previous bibliometric analysis studies concerning workplace safety have primarily utilised a single database, particularly Scopus (e.g., Abd Aziz et al., 2021; Cruz-Ausejo et al., 2023; Otitolaiye & Abd Aziz, 2024). This limits their coverage and excludes the cross-disciplinary insights captured in the Web of Science (WoS) Core Collection. Recognising this methodological gap, a more integrative approach that draws on multiple databases can better illuminate the evolution of themes and research frontiers. Building on this premise, research ideas that drive further research on workplace safety risk management can be well-directed by analysing past studies that deemed the use of bibliometric analysis (Abdullah et al., 2023). It is best suited and aligned with the thematic evolution, synthesis, and interpretation of research trends.

To appreciate this dynamic, the combination of bibliometric and thematic analysis has been shown to provide researchers with a significant advantage in identifying potential studies that can be conducted (Casadei et al., 2023). As researchers, we need to draw on past works to gain insightful ideas and develop a field of knowledge. Seen in this way, there is a need for integrative studies that utilise various databases. Recent reflections on bibliometric scholarship (Mukherjee et al., 2022; Öztürk et al., 2024) emphasise that impactful bibliometric studies not only report data but also interpret the meaning behind the data and explain how research can shape new thinking ideas. In this regard, this study was conducted to explain how risk management research in workplace safety has evolved and experienced paradigm shifts.

Extending from this rationale, by integrating the interpretation of thematic analysis with bibliometric methods, it aims to trace the intellectual evolution and emerging directions that define the field. To achieve these objectives and ensure coherence between bibliometric mapping and thematic synthesis, the following research questions were formulated:

1. Research Question 1: What are the global publication patterns, the most prolific institutions and countries, and keyword frequency?
2. Research Question 2: What are the main conceptual structures and thematic linkages revealed through the co-occurrence of author keywords in workplace safety risk management research?

3. Research Question 3: How have research themes in workplace risk management evolved, and what emerging directions indicate future theoretical and practical developments?

## Methodology

### *Research Design*

This study employs a mixed-procedures design, incorporating both bibliometric and thematic analyses. This step is undertaken to assess the evolution and development of risk management measurement research in the context of workplace safety through a bibliometric analysis. At the same time, thematic methods are used to interpret the global research landscape of risk management in workplace safety. Bibliometric analysis involves objective and quantitative elements. These elements rely on publication statistics and mapping co-occurrence to ensure objectivity and accuracy (Hoang, 2025). Thematic synthesis, in turn, increases our understanding of the interpretation of research clusters that develop into conceptual narratives (Casadei et al., 2023). The current study utilises integration because the quantitative bibliometric elements alone report statistical data, which does not convey the underlying meaning that can be obtained through thematic analysis (Abdullah et al., 2023). Therefore, bibliometric analysis needs to evolve to reveal why or how research develops and evolves. Second, thematic interpretation ensures that bibliometric findings are relevant to theory and practice by linking numerical data with conceptual reasoning (Lim & Kumar, 2024).

### *Data Sources*

This study utilised two databases: Scopus and Web of Science (WoS). Both databases were accessed through the e-resource collection of the Sultanah Bahiyah Library, Universiti Utara Malaysia, in September 2025. The Scopus database was selected due to its more comprehensive journal coverage, including regional and multidisciplinary applied research. By contrast, the WoS database was selected because it prioritises impact-based and quality-based publications (Durrant et al., 2024; Lewandowska, 2024; Nora et al., 2025). Taken together, the use of both data sets increases reliability, reduces bias, and enables comparative research across disciplinary boundaries. Also, building on this reasoning, the dual-database strategy aligns with current recommendations in bibliometric methodology (Passas, 2024), which advocate for triangulated data collection to obtain a vibrant picture of scholarly communication.

### *Search Strategy, Data Retrieval and Data Cleaning*

In this study, search queries were conducted on the Title, Abstract and Keywords fields in Scopus, as well as the Topic field in WoS: (“risk management” OR “hazard management” OR “safety risk”) AND (“workplace safety” OR “occupational safety” OR “industrial safety”). The use of Boolean (“OR”/“AND”) was to maximise the accuracy and relevance of keywords to align with the current focus of this study. The search method, using the Title, Abstract, and Keywords fields in Scopus, as well as the Topic field in WoS, was employed to ensure that the retrieved datasets provided a comprehensive number of publications related to workplace safety risk management. Although the Title, Abstract and Keywords search may return peripheral entries, manual screening and keyword validation were performed to ensure the accuracy and robustness of the dataset. The publication time of the dataset was not fixed in advance; however, after data extraction and preprocessing using ScientoPy, the earliest record

identified was 1970, with coverage extending up to 2024. This made the period of publication analysis conducted involve 54 years of research.

This work seeks to include only journal articles, review papers, and conference proceedings, as selected to maintain uniformity, data integrity, and academic reliability. The datasets initially retrieved from Scopus and WoS were 4,058 documents. These datasets were then merged into a single dataset. A preprocessing technique, which followed the ScientoPy automated protocol, was performed to detect and remove duplicates (Ruiz-Rosero et al., 2019). This procedure removed 508 duplicate records (13.5%), resulting in 3,249 documents consisting of 648 (19.9%) from WoS and 2,601 (80.1%) from Scopus. The final dataset used in this analysis consisted of 3,249 documents. This final number of documents met the minimum threshold suggested by Donthu et al. (2021) for conducting a quality bibliometric assessment.

***Performance Analysis Using ScientoPy***

The first phase of analysis in this study sought to address Research Question 1. This analysis was conducted to explore global publication patterns, identify prolific contributors, and determine key terms in the field of workplace safety risk management. This assessment is regarded as a performance analysis. ScientoPy was used to conduct a performance analysis, providing an overview of research productivity and thematic growth over time (Ruiz-Rosero et al., 2019). ScientoPy successfully generated descriptive indicators. These elements included annual, institutional, and country publications, as well as the frequency and evolution of author keywords. Given this perspective, ScientoPy's temporal visualisation capabilities were proven to identify how scholarly attention and thematic priorities have changed (Abdullah & Sofyan, 2023). Indirectly, this analysis can provide insight into the evolution of workplace safety risk management research over a 54-year period (1970-2024).

***Network Analysis Using VOSviewer***

The second phase focused on addressing Research Question 2 and employed VOSviewer. VOSviewer is a software application designed to create and explore maps from bibliometric datasets (Arruda et al., 2022). In this study, VOSviewer was used to conduct a co-occurrence analysis of author keywords. This process was conducted to gather information about the conceptual structure of research in the domain of workplace risk management. To achieve this goal, this approach identifies the frequency with which keywords co-occur across publications. Accordingly, it can illustrate thematic relationships and areas of focus that emerge in this field. It should be noted that this study only analysed authors' keywords. This selection was implemented because it most accurately represents the conceptual framing intended by the authors in their study.

A minimum threshold of twenty keyword occurrences was applied to ensure that only relevant and substantively significant terms were visualised. VOSviewer's association strength normalisation and modularity-based clustering algorithms were used to generate colour-coded network maps that display groups of closely related keywords (McManus et al., 2025). Each cluster represents a distinct thematic focus, and the proximity and link strength between nodes indicate the degree of conceptual relatedness among topics. The resulting network visualisations enabled the identification of dominant and emerging themes in workplace safety risk management research.

### *Thematic Evolution, Synthesis, and Interpretation of Research Trends*

The final phase of this analysis was to answer Research Question 3. It was designed to explore how research themes in workplace safety risk management have evolved and to identify directions for theoretical and practical development related to workplace safety risk management. This study employed a combined approach, specifically ScientoPy temporal keyword analytics and VOSviewer co-occurrence visualisation.

To examine how the field has evolved, ScientoPy temporal trend data were cross-referenced with VOSviewer overlap maps. This alignment allowed us to identify when key topics emerged and how they were interconnected. The combination of frequency counts, co-occurrence mapping and chronological overlap visualisation allowed for a comprehensive assessment of the evolutionary path of workplace safety risk management research.

Finally, the keyword clusters generated by the VOSviewer software were compiled qualitatively. Keywords denoting each cluster were re-evaluated in relation to pertinent high-impact publications to validate their conceptual coherence. This step was taken to ensure that thematic interpretations were grounded in both quantitative significance and theoretical consistency. The integration of keyword frequency, network clustering, and chronological overlap analysis establishes a robust methodological framework for delineating developmental trajectories and emerging frontiers in workplace risk management research. This study is seen as a performance analysis. We utilised ScientoPy to do a performance study, which showed how research output and topic growth changed over time.

## Results

### *Research Question 1: Global Publication Patterns and Productivity Trends*

The global publication patterns analysis, conducted using ScientoPy, revealed a steady and sustained growth in research on workplace safety risk management from 1970 to 2024 (see Figure 1). The earliest record was published in 1970, with only one document indexed in Scopus and none in WoS. For nearly two decades, publication activity was irregular and modest, reflecting the early stages of research interest in formalised risk management in the workplace.

A distinct rising trend appeared in the mid-1990s, corresponding with increased industrial safety regulation and the institutionalisation of occupational health research (Boullier & Henry, 2022). Between 1995 and 2005, the number of publications increased modestly, averaging 20 to 40 papers per year. The rise accelerated after 2010, indicating that the discipline was rapidly maturing, where Scopus alone recorded more than 90 papers in 2011, rising to over 140 by 2019.

The most significant increase in the number of annual publications is observed from 2020 to 2024, with a combined Scopus and WoS record surpassing 200, peaking at 189 in 2024. This increase is consistent with the growing global interest in integrating emerging technologies, such as artificial intelligence (AI) and data analytics, into occupational safety research (Abdullah & Sofyan, 2023) and workplace resilience and pandemic-related safety management (Maddakandage et al., 2025).

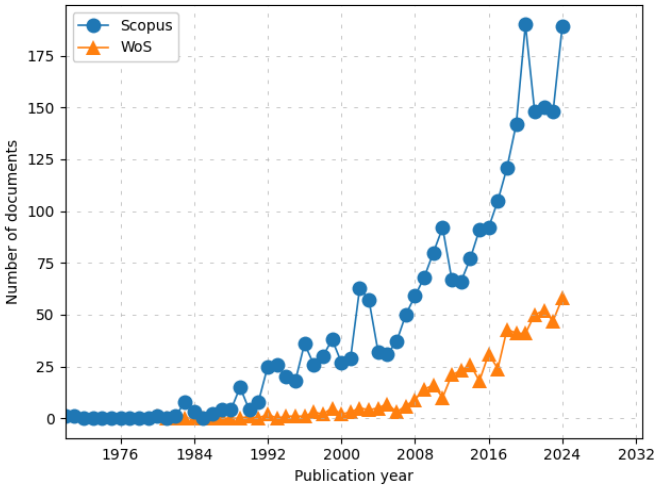



**Figure 1: Annual Publication**

The analysis of institutional contributions revealed a geographically wide distribution of research on workplace safety risk management (see Figure 2). The National Institute for Occupational Safety and Health (NIOSH), a United States institution, emerged as the most productive, with 13 publications, reflecting its long-standing research mandate in occupational risk prevention. The University of Nottingham, United Kingdom, ranked second with 10 publications, followed by the Delft University of Technology, Netherlands (9), and Monash University, Australia (8).

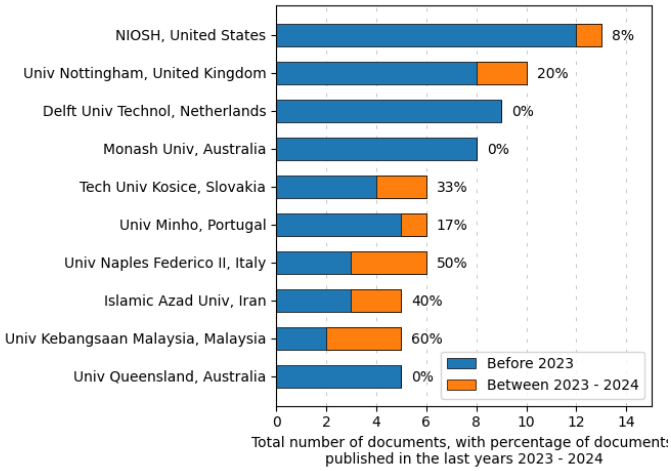



**Figure 2: Top Ten Prolific Institutions**

Recent productivity trends indicate a notable rise in contributions from European and Asian institutions. Among them, the University of Naples Federico II (Italy), Islamic Azad University (Iran), and Universiti Kebangsaan Malaysia (Malaysia) exhibited the strongest recent engagement, with 50%, 40%, and 60% of their outputs, respectively, published in 2023 and 2024. These figures suggest that research activity is increasingly shifting toward emerging and transitional economies that are integrating digitalisation, safety culture, and regulatory innovation into workplace risk management frameworks.

In contrast, older centres, such as Delft University of Technology and Monash University, exhibit relatively stable yet mature output patterns, focusing largely on established engineering and systems safety research domains. Collectively, the institutional analysis demonstrates both the historical leadership of high-income nations and the growing contribution of universities in Asia and southern Europe, reflecting a more globalised and interdisciplinary engagement with the field.

The country-level analysis (see Figure 3) reveals that research on workplace safety risk management is primarily driven by contributions from a small group of industrially advanced countries. However, recent years have witnessed broader international participation. The United States leads with 597 publications, reflecting its historical leadership in occupational safety and regulatory research. China ranks second with 294 documents, showing a consistent rise since 2015 and accounting for 26% of its total output in the most recent two years (2023-2024).

The Russian Federation (238), United Kingdom (221), and Australia (190) follow as key contributors, collectively shaping the field's scientific discourse through diverse institutional collaborations. Among European countries, Italy (179) and Germany (119) maintain stable contributions, each representing 7% to 15% of global publications. A significant trend is the recent emergence of India, which recorded 45% of its total publications in 2023 and 2024 alone, suggesting a growing academic focus on workplace safety in rapidly industrialising economies. Similarly, France (109) and the Netherlands (87) continue to contribute consistent yet moderate outputs, primarily in ergonomics, risk modelling, and construction safety research.

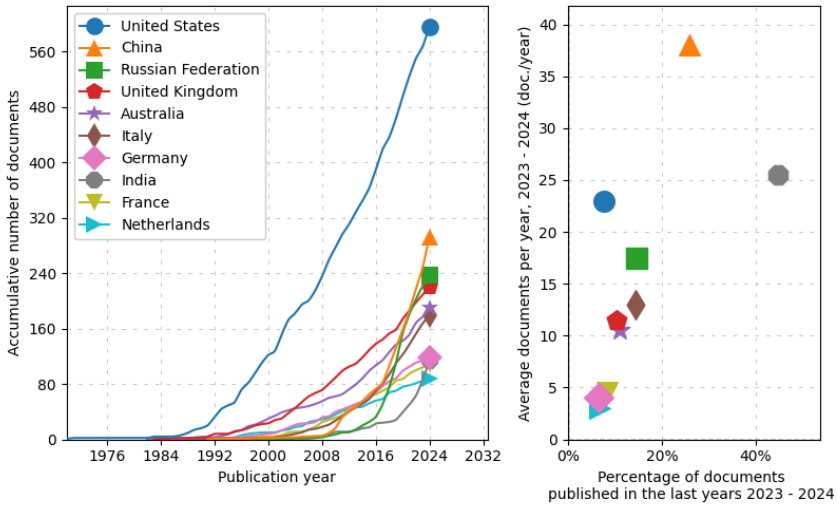



**Figure 3: Top Ten Productive Countries**

Keyword analysis offers valuable insights into the dominant themes and emerging directions in workplace safety risk management research (Figure 4). The ten most frequently used author keywords are construction (63 occurrences), accident (46 occurrences), risk analysis (43 occurrences), construction safety (41 occurrences), ergonomics (40 occurrences), safety culture (39 occurrences), COVID-19 (29 occurrences), machine learning (26 occurrences), deep learning (25 occurrences), and artificial intelligence (20 occurrences). Traditional topics such

as construction, accident, and risk analysis remain at the core of scholarly attention, reflecting the field's long-standing focus on hazard identification, control, and prevention, particularly in high-risk sectors like construction and manufacturing. Meanwhile, ergonomics and safety culture indicate continued interest in human factors and organisational safety behaviour, supporting the gradual shift from purely procedural to socio-technical perspectives.

Notably, the percentage of publications featuring machine learning (54%), deep learning (68%), and artificial intelligence (40%) in 2023 and 2024 reveals a marked technological transformation in the field. These keywords signal a growing application of computational intelligence and predictive modelling in risk detection, accident forecasting, and decision support. Similarly, the increased occurrence of COVID-19 (21%) highlights the post-pandemic shift in workplace safety research toward resilience, occupational health, and adaptive risk management under crisis conditions.

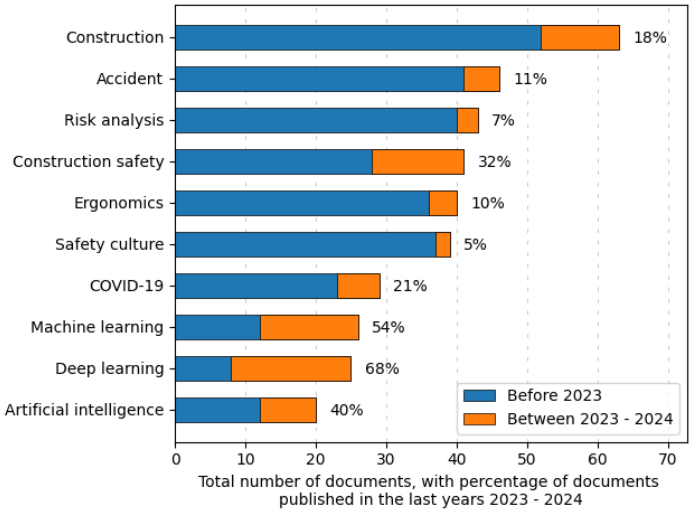



**Figure 4: Top Ten Authors' Keywords**

***Research Question 2: Conceptual Structures Based on Keyword Co-occurrence***

The network visualisation generated through VOSviewer (see Figure 5) illustrates the conceptual architecture of research in workplace safety risk management, derived from author keyword co-occurrence analysis.

Cluster 1 (Red) comprises risk assessment, safety culture, management, hazards, prevention, and accidents. This cluster represents the traditional procedural and managerial safety domain, centred on hazard identification, prevention frameworks, and safety leadership. The dense interconnections among these terms reveal that risk assessment and safety culture serve as bridging concepts, integrating managerial oversight with behavioural approaches to safety.

Cluster 2 (Blue) includes occupational safety, ergonomics, virtual reality, and construction. This cluster emphasises the human-centred and applied safety dimension, where ergonomics and immersive technologies, such as virtual reality, are increasingly adopted to enhance worker awareness, training, and hazard simulation in high-risk environments.

Cluster 3 (Green) focuses on artificial intelligence, machine learning, construction safety, and COVID-19. It embodies a technology-driven, predictive systems philosophy. One that incorporates computational intelligence and data analytics into the fabric of safety management. The strong relationship between machine learning and construction safety emphasises the growing use of algorithmic models to predict dangers and provide early warnings, indicating a dramatic shift toward proactive and data-driven safety procedures.

Cluster 4 (Yellow) integrates themes of industrial safety, workplace safety, and deep learning, reflecting an emerging focus on resilience and crisis management. It illustrates how the research community has adapted to global health emergencies, recognising that occupational safety now extends beyond conventional physical hazards to encompass psychosocial well-being, organisational flexibility, and data-informed workplace policies aimed at maintaining continuity amid disruption and uncertainty.

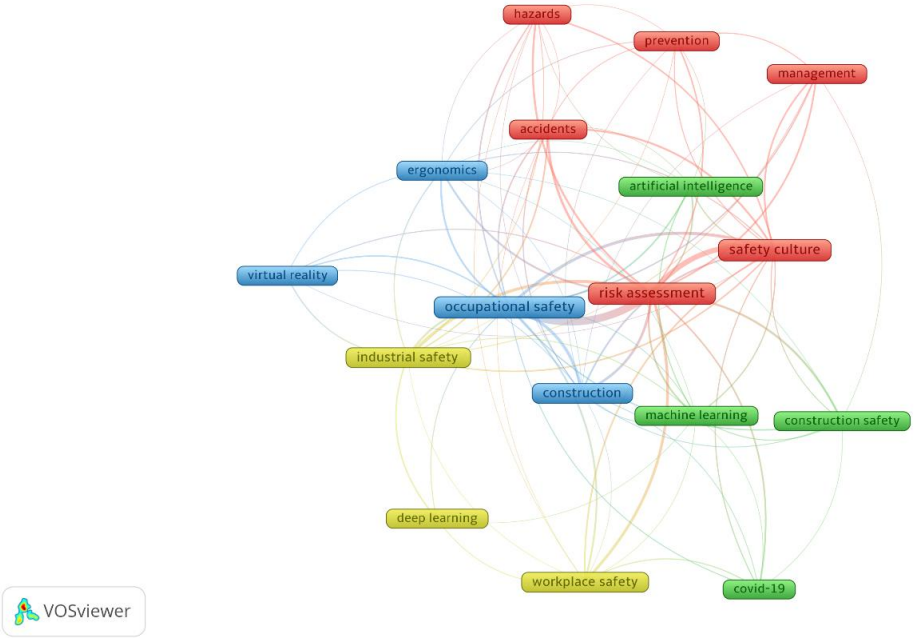



**Figure 5: Network Visualisation of Authors' Keyword Co-occurrence**

***Research Question 3: Thematic Evolution, Synthesis, and Emerging Directions***

In Figure 4, ScientoPy analysis revealed two distinct thematic phases: before 2023 and during 2023 and 2024. Different research priorities and conceptual orientations characterise these phases. The pre-2023 period was characterised by keywords such as construction (63 occurrences), accident (46 occurrences), risk analysis (43 occurrences), construction safety (41 occurrences), ergonomics (40 occurrences), and safety culture (39 occurrences). These terms reflect the field's traditional focus on procedural and behavioural safety management, particularly in construction and industrial settings. The prominence of risk analysis underscores the long-standing commitment to quantitative risk assessment and hazard control (Glevitzky et al., 2025). In contrast, safety culture and ergonomics represent the gradual inclusion of human and organisational dimensions into mainstream safety research (Bentley & Tappin, 2010).

The period from 2023 to 2024 publications demonstrates a significant thematic expansion towards technological and adaptive safety systems. Emerging keywords such as machine learning (54%), deep learning (68%), and artificial intelligence (40%) mark the incorporation of computational intelligence and predictive analytics into risk management frameworks. Concurrently, COVID-19 (21%) highlights the field's growing engagement with occupational health, resilience, and crisis preparedness, which are the areas that extend traditional safety concerns into public health and emergency contexts.

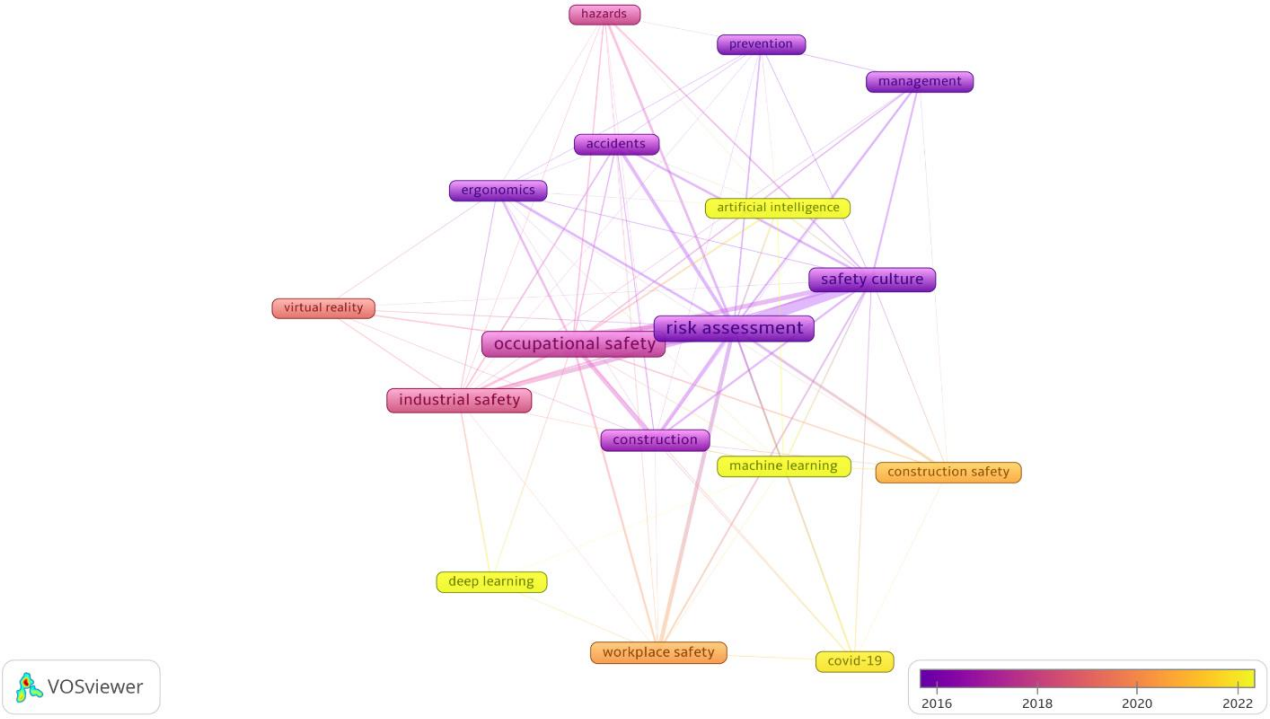



**Figure 6: Overlay Visualisation of Authors' Keyword Co-occurrence**

The VOSviewer overlay visualisation (Figure 6) provides a temporal map of keyword progression, where earlier research (depicted in blue) clusters around risk assessment, management, and accidents. At the same time, more recent studies (shown in yellow) are concentrated on artificial intelligence, machine learning, and deep learning. This colour gradient indicates a chronological shift from compliance-driven safety models to proactive, predictive, and technology-augmented systems. Moreover, the overlay map reveals that risk assessment and safety culture remain central bridging nodes, linking older procedural paradigms with emerging digital and resilience-based approaches. Thematic density and link strength among technological keywords confirm that digitalisation is now a dominant research trajectory in workplace safety risk management.

By integrating ScientoPy's temporal evidence with VOSviewer's structure mapping, four thematic categories delineate the evolution of the field, as presented in Table 1. These four themes were developed using ScientoPy's temporal keyword frequency trends (Figure 4) and VOSviewer's overlay visualisations (Figure 6). The synthesis reveals that the discipline has

evolved from procedural and behavioural foundations (pre-2023) to technologically advanced and resilience-oriented frameworks (2023 and 2024), indicating a shift toward intelligent, adaptive, and socio-technical models of workplace risk management.

**Table 1: Synthesis of Emerging Themes on Workplace Safety Risk Management**

| Thematic Category | Representative Keywords | Conceptual Orientation | Key Implications and Future Directions |
|---|---|---|---|
| (i) Procedural and Regulatory Safety Management | Risk Assessment, Accident, Prevention, Management, Hazards | Anchored in compliance, regulation, and systematic control of risks. Emphasises standardised procedures, auditing mechanisms, and preventive strategies. | Integration of procedural frameworks with digital monitoring and automation to enhance compliance and strengthen legislative and governance standards. |
| (ii) Behavioural and Cultural Safety | Ergonomics, Safety Culture | Centred on human factors, organisational learning, and participatory engagement. Highlights the psychological and social dimensions of risk. | Future studies should expand behaviour-based safety training, leadership engagement, and holistic safety cultures across diverse industrial contexts. |
| (ii) Technological and Predictive Systems | Machine Learning, Deep Learning, Artificial Intelligence, Virtual Reality, Construction, Construction Safety | Represents a paradigm shift toward data-driven and computationally assisted safety intelligence. Employs automation, predictive analytics, and AI-enhanced modelling for proactive hazard identification. | Future research should integrate digital twins, IoT, and real-time analytics to build predictive, adaptive, and self-learning risk management systems. |
| (iv) Crisis-Responsive and Resilient Workplaces | COVID-19, Occupational Safety, Industrial Safety, Workplace Safety | Broadens the concept of workplace safety to encompass health resilience, organisational adaptability, and crisis management. Integrates physical, psychosocial, and systemic risk perspectives within the sustainability and ESG agenda. | Encourages deeper inquiry into how the Social and Governance pillars of ESG can strengthen occupational resilience, enhance employee well-being, and institutionalise transparent crisis management frameworks in pandemic and post-crisis contexts. |

## *Discussion*

This study employed ScientoPy and VOSviewer to conduct an integrated bibliometric and thematic analysis, aiming to map the intellectual and thematic landscape of workplace safety risk management research. The rise in publication output from 1970 to 2024 reflects the progressive institutionalisation of workplace safety risk management as a scientific field. The sharp escalation after 2010, and particularly after 2020, signals a maturing discipline responding to new industrial challenges, such as automation (Egbumokei et al., 2025), digital transformation (Qiu & Li, 2022), and public health crises (Nguyen et al., 2022). These transitions demonstrate how workplace safety risk management research is evolving from compliance-based models to adaptive, technology-driven, and resilience-oriented paradigms that reflect the complexity of modern industry.

Institutions in the United States, the United Kingdom, China, and Australia dominate due to their developed research ecosystems, significant financing, and long-standing traditions of academic-industry partnerships in safety and risk management. Meanwhile, developments from Malaysia, Italy, and India demonstrate rising national investment in occupational safety research, increased international collaboration, and a growing global emphasis on sustainable and safe working practices.

The synthesis of emerging themes identified four conceptual clusters, namely, (i) procedural and regulatory safety management, (ii) behavioural and cultural safety, (iii) technological and predictive systems, and (iv) crisis-responsive and resilient workplaces. Historically, the dominance of procedural and regulatory safety management confirms the long-lasting effect of systems theory and risk control hierarchies (Schmid & Stanton, 2018), which prioritise organised hazard identification and mitigation (Salokolaei & Vali, 2019). However, the concurrent prominence of safety culture and ergonomics demonstrates the integration of human and organisational factors (Bentley & Tappin, 2010), which is consistent with socio-technical systems theory, which holds that safety performance is dependent on the interaction of people, technology, and the environment (Carayon, 2021).

This study also found that the conceptual network has undergone a paradigmatic shift towards data-driven safety intelligence, in line with the emergence of artificial intelligence, machine learning, and deep learning. This finding suggests that artificial intelligence, machine learning, and deep learning are emerging research areas that warrant exploration in the field of occupational safety and health management (Abdullah & Sofyan, 2023). This development is significant because the technology enables predictive and adaptive decision-making while enhancing conventional risk analysis models (Abdullah & Sofyan, 2023).

Interestingly, this advancement is also in line with the Industry 4.0 framework that is transforming safety practices through real-time analytics and intelligent monitoring systems driven by digitalisation and automation (Sharma, 2024). The use of immersive simulation tools to improve hazard identification and training effectiveness is also supported by recent findings regarding the integration of virtual reality with safety and ergonomic aspects in the construction sector (Rahman et al., 2023).

Thematic evolution analysis has revealed two temporal phases that distinguish the level of conceptual maturity in workplace safety risk management research. The first phase, prior to 2023, is characterised by a procedural and behavioural orientation, while the second phase, between 2023 and 2024, is marked by technological and adaptive transformations. The trajectories of these two phases illustrate a significant epistemological shift in safety research. In simple terms, it has evolved from a reactive paradigm to a more proactive approach.

In the early stages, research focus was more on compliance, risk analysis, and accident prevention, reflecting a mechanistic worldview in which safety is managed through rules and controls (Moradi & Yazdi, 2025). However, the post-2023 phase marks the emergence of an intelligent and adaptive safety paradigm, in which predictive analytics, artificial intelligence, and crisis resilience combine to address uncertainty in complex work systems (Abdullah & Sofyan, 2023).

The study also found that the use of the keyword "COVID-19" also showed an increase in research after 2023. This pattern reflects how the pandemic not only has a direct impact on occupational health but also serves as a catalyst for research on organisational resilience and psychological safety in the workplace. These findings align with the resilience engineering perspective, which emphasises the ability of systems to adapt, anticipate disruptions, and learn from uncertainty as critical components in complex and dynamic operational contexts (Vert et al., 2021).

Within this framework, the evolution of research indicates that workplace safety is now comprehended as a multidimensional construct that combines health protection, digital technology, and behavioural adaptation in response to changing social, organisational, and technical pressures. This emphasis underscores that the post-pandemic transition is not merely a temporary phenomenon, but rather a structural shift in occupational safety thinking. Accordingly, future research should explore the dynamics of post-pandemic safety in more depth, particularly how the integration of technology, psychological support, and resilience strategies can shape a more adaptive and holistic risk management approach in the modern work ecosystem.

***Theoretical and Practical Implications***

Theoretically, this study adds to our understanding of workplace safety risk management as a multidisciplinary and socio-technical topic. The convergence of procedural, behavioural, and digital safety paradigms suggests that future models must incorporate systems thinking, data science, and human aspects to understand risk phenomena comprehensively. It also contributes to the knowledge-action framework in safety research by demonstrating how digital technologies can bridge the traditional gap between risk detection and behavioural compliance through the provision of predictive insights.

Practically, these findings underscore the importance of technical literacy, cross-sector collaboration, and regulatory innovation in contemporary safety management. Organisations must augment traditional risk assessment methods with AI-powered predictive technologies, while maintaining behavioural safety programs and fostering a culture of resilience. Furthermore, the rise of developing economies in recent years has highlighted the need for context-specific policies that connect global safety standards with local workforce realities.

***Limitations and Future Research Directions***

This study has several limitations that require consideration. Bibliometric data is limited to Scopus and WoS databases, which may exclude regional publications and grey literature. The keywords used in the dataset search in this study, if increased or decreased, may yield different findings. Indirectly, this leads to inconsistencies in terminology that could potentially affect the formation of conceptually related themes. Furthermore, the use of ScientoPy and VOSviewer focuses primarily on structural and temporal mapping, which offers limited insight into contextual depth. Changes in results may occur if other software is used. Therefore, although these findings provide a comprehensive overview of research trends and thematic evolution, they should be interpreted within the methodological constraints, such as the use of databases, search keywords, and the software employed.

Future studies should employ an integrative approach that combines bibliometric mapping with qualitative content analysis. This can provide in-depth information for interpreting results obtained through bibliometric analysis. We do not simply report high or low data but rather explain the meaning behind the analytical results obtained, such as the evolution of publications and keywords. Future studies should also expand the datasets to include regional databases, policy documents, and industry reports, thereby enriching the understanding of how security practices evolve across different economic and regulatory contexts.

## Conclusion

This study demonstrates how workplace safety risk management has evolved from a procedure- and compliance-based discipline to a dynamic field of practice. Combining ScientoPy and VOSviewer analysis reveals clear changes. Previous research focused on risk assessment and safety culture. Meanwhile, more recent research is increasingly focused on artificial intelligence, machine learning and predictive systems. Accordingly, the evolution of research and publications related to workplace safety risk management reflects the increasing alignment of the field. Among the areas of recent focus is the innovative socio-technical paradigm, which combines technology, human factors, and organisational adaptation to manage complex workplace risks in the era of digitalisation and global volatility. Therefore, this area warrants further attention from future researchers to produce more comprehensive and impactful research findings in managing workplace safety risks.

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# EVALUATING THE EFFECTIVENESS OF AN EBOOK-BASED LEARNING APPROACH: A CASE STUDY ON INTRODUCTION TO NETWORK

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***Abstract:*** *This paper presents a comprehensive study on the published eBook titled "Introduction to Network" at Polytechnic Kuching. With the increasing reliance on digital education, this study aims to evaluate the effectiveness of eBooks in improving student learning outcomes in technical subjects. A total of 23 students from classes 2A, 2B, and 2D participated in a structured assessment involving pre-tests and post-tests. The performance data were collected, analysed, and interpreted to identify knowledge gains. Results showed a significant improvement in student scores post-intervention, affirming the role of digital learning tools in enhancing comprehension. The paper also includes insights gathered from student feedback. The findings contribute to ongoing discussions about digital transformation in education, and suggest that eBooks, when well-designed, can serve as effective instructional tools in technical education settings.*

***Keywords:*** *eBook, Networking, Pre-Test, Post-Test, Learning Outcome*

## Introduction

Digital transformation in education has accelerated in recent years, particularly due to the COVID-19 pandemic and the shift to online learning platforms. The groundwork for electronically sharing literature and scholarly materials began in the early 1970s, but the widespread adoption of e-resources accelerated in the late 1990s and early 2000s with the emergence of online databases, digital libraries, and electronic journals (Sood et al., 2024) [12]. The use of eBooks has become widespread in institutions of higher education for reasons including accessibility, interactivity, and cost-effectiveness (Hodges et al., 2020) [1]. E-books are growing in popularity due to features like 24/7 remote access, searchability, copy-paste functionality, space efficiency, portability, and environmental benefits, all of which contribute to improved library usage through enhanced accessibility and availability. In the context of technical and vocational education, eBooks offer a dynamic way to deliver foundational knowledge in fields like networking, allowing learners to study at their own pace and engage with embedded resources like quizzes and diagrams (Kukulska-Hulme, 2012) [2]. Digitizing books improves accessibility and convenience, allows for easy searching, offers free download options, and makes them simpler to carry, store, and share with others (Amirtharaj et al, 2023) [17].

Computer networking is a subject that presents conceptual and practical challenges for students. Traditional lecture-based instruction may not always be sufficient to help learners

grasp these complex ideas (Ally, 2009) [3]. Computer networking courses offered in educational institutions often involve abstract and highly technical theories that can be challenging to explain and grasp without practical examples or real-world application (Prvan & Ožegović, 2020) [14]. Delivering instruction on advanced topics such as troubleshooting, network management, and network security is considerably more complex and demanding (Andreatos, 2021) [15]. Computer-related courses or subjects require students to allocate time for mastering the practical aspects of computer networking, alongside their theoretical understanding (Woolcott & Bui,2023) [16]. The global rise in the use of e-books for teaching and learning has led educational institutions, educators, and organizations to develop strategic approaches for effectively integrating them into educational settings (Ghafar, 2024) [13]. This study aims to determine whether an eBook can serve as a standalone or supplementary teaching tool by evaluating student performance before and after using the Introduction to Network eBook.

Furthermore, using pre-test and post-test assessments provides a standardized method to gauge student learning gains (Fraenkel et al., 2012) [4]. These assessments offer measurable outcomes, allowing educators to draw conclusions about the effectiveness of new learning materials such as eBooks. In Malaysia, efforts to modernize technical education include the use of digital learning tools under the Malaysia Education Blueprint 2015–2025 (Higher Education) [5]. This study contributes to that initiative by providing data on student learning outcomes using a localized, purpose-built eBook.

## Literature Review

The integration of digital resources into teaching has transformed the landscape of education, particularly in technical fields such as networking. According to Gikas and Grant (2013) [6], mobile learning platforms, including eBooks, enhance accessibility and support self-paced learning, making them an ideal supplement or alternative to traditional classroom resources. In the realm of networking education, foundational concepts such as IP addressing, subnetting, and protocol layers require repeated engagement and practical examples. eBooks provide a platform where text, interactive diagrams, and embedded quizzes can coexist, enriching the learning experience (Kukulska-Hulme, 2012) [2].

Previous studies have shown a positive correlation between the use of digital texts and learning outcomes. A comparative study by Rockinson-Szapkiw et al. (2013) [7] found that students using e-textbooks performed significantly better in assessments than those using printed materials. Moreover, the shift towards digital learning is in line with the 21st-century learning model that emphasizes digital literacy, self-directed learning, and technological fluency (Saavedra & Opfer, 2012) [8].

According to Dahlan (2024) [18], a detailed analysis highlights how interactive eBooks improve learning outcomes and student engagement by seamlessly integrating multimedia, interactive tasks, and personalized features. These eBooks are particularly effective in capturing students' attention, creating an immersive learning environment that supports deeper understanding and promotes active involvement. Additionally, the study emphasizes the broader role of interactive eBooks in advancing education, noting their potential to connect traditional methods with digital learning. Their use in various educational settings offers a significant opportunity for meaningful transformation in modern education.

In the context of networking education specifically, Jasek et al. (2021) [9] emphasized the importance of interactive tools in teaching complex IT concepts. They concluded that integrating quizzes and self-assessment modules within eBooks increased student engagement and improved retention rates.

Lastly, studies such as those by Zhang and Pérez-Paredes (2022) [10] highlight the role of personalized learning pathways within digital environments, noting that the ability to revisit materials and self-assess contributes to higher academic performance, particularly in technical domains like computer networking.

The design and development research (DDR) approach is a structured method that offers organized processes for conducting developmental studies (Hasbullah et al, 2022) [20]. It is a form of research that aims to test theories and empirically validate practices. Moreover, it serves as a means to develop new procedures, techniques, and tools grounded in the methodologies of specific studies. DDR research encompasses a broad range of activities and areas of interest. It achieves its objectives through two types of research projects: Type 1, which focuses on product and tool development, and Type 2, which centers on model development (Govindasamy et al, 2023) [21]. The second type of design and development research involves the development, validation, and application of a model, focusing on the models and processes themselves rather than their demonstration. Model research can also be conducted alongside the development of a product or program, often aiming to identify and describe the conditions that contribute to successful design and development.

## Methodology

This study adopted the Design and Development Research (DDR) methodology as its guiding framework. DDR is a systematic approach commonly used in educational technology research, particularly when the goal is to design, develop, and evaluate instructional products such as digital learning materials. The iterative and evaluative nature of Design-Based Research (DDR) enables the continuous refinement and enhancement of instructional interventions (Aris, Ibrahim & Halim, 2025) [19]. The process is typically divided into five main phases: Needs Analysis, Design, Development (or Implementation), Data Collection, and Evaluation. Each phase is interconnected and allows for continuous refinement based on feedback and findings, ensuring that the product meets the user needs. The rationale for choosing this methodology lies in its suitability for research involving product development. For this case, an instructional eBook and the evaluation of its effectiveness in a real educational setting. Figure 1 illustrates the phases involved in the DDR model as applied in this study (Richey & Klein, 2007) [11].

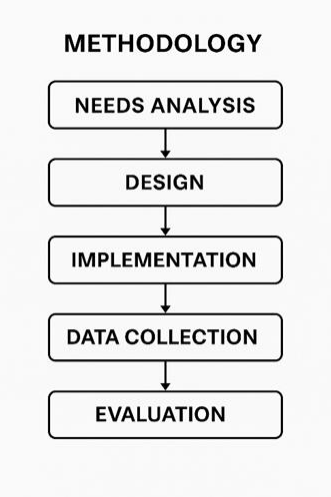



**Figure 1: Design and Development Research (DDR) methodology model**

A needs analysis constitutes a vital phase in product development, wherein information is gathered, either directly or indirectly from users, with the purpose to identify existing challenges and forecast potential future requirements (Aris, Ibrahim & Halim, 2025) [19]. The needs analysis phase was essential for establishing a baseline understanding of students' knowledge regarding computer networking. A 20-question multiple-choice test was developed by referencing core networking concepts: OSI model, IP addressing, binary conversion, subnetting, and network devices. The test was reviewed for content validity by two subject matter experts. This test was administered to 23 diploma-level students enrolled in Classes 2A, 2B, and 2D at Polytechnic Kuching Sarawak. Students completed the pre-test without any prior formal lessons or access to the eBook to ensure that their scores reflected genuine prior knowledge. The results were recorded and analyzed to identify common weaknesses. These results guided the structure and focus of the eBook content. The primary goal of the Needs Analysis was to obtain actionable data that could inform a targeted and effective instructional design.

In the Design phase, the Introduction to Network eBook was developed based on insights from the Needs Analysis. The eBook followed an instructional design model that included clear learning objectives at the beginning of each chapter, progressive content development, real-world examples, and embedded assessments. The material was organized into four main parts: foundational networking elements, communication protocols and technologies, quizzes and videos. The design was developed in Canva and exported as a high-resolution PDF to ensure compatibility across devices (PC, tablet, mobile). Additionally, the document included navigation aids like a clickable table of contents and chapter summaries to support self-paced learning.

The Implementation phase involved distributing the eBook to the 23 participating students for independent learning. The eBook was shared via a learning management system and made available for download to allow offline access. Students were instructed to study the eBook within a two-week period without any external lectures or intervention. This approach ensured that learning was solely attributed to the eBook itself. During this phase, students were encouraged to note down any unclear concepts and complete the practice questions embedded

in the book. Communication channels such as WhatsApp and Google Forms were opened for students to report errors, ask clarification questions, or submit feedback. However, the

Facilitator's role was passive and non-instructional to maintain the integrity of the study. The objective of this phase was to mimic a self-paced, autonomous learning environment where the effectiveness of the eBook could be evaluated in isolation. To ensure accountability, students were reminded midway through the implementation phase to confirm that they had completed the reading parts and attempted the practice questions. This stage reinforced digital literacy, independent study habits, and time management among students.

Upon completion of the two-week implementation period, the Data Collection phase began. Students were asked to retake the same 20-question test they had attempted in the pre-test. This served as the post-test to measure knowledge gained through the eBook. The tests were administered under the same controlled conditions to ensure reliability. Students completed the post-test via Google Forms, which enabled automatic collection of responses and score calculations. The pre- and post-test scores were then exported into Microsoft Excel for processing. Key data points included: raw scores, individual improvement rates, and group performance averages. The data showed that most students improved by 15 to 30 points. This phase produced robust, quantifiable evidence of learning outcomes attributable to the eBook intervention.

In the final Evaluation phase, a comprehensive analysis of the collected data was conducted. Descriptive statistics were used to compare pre-test and post-test results, including mean, median, standard deviation, and range. The overall average pre-test score was 41.3, while the post-test average rose to 66.7—indicating a 61.5% improvement. Based on these findings, the study concluded that the Introduction to Network eBook was not only effective but also well-received by its users. The evaluation outcomes support the use of eBooks in technical education and suggest that future iterations could benefit from the inclusion of embedded videos or interactive quizzes to further enrich the learning experience.

Figure 2 displays the cover page for the eBook "Introduction to Networks" is a bilingual eDictionary designed to help learners understand basic networking terms in both Bahasa Melayu and English. This resource is ideal for students and beginners in the field of computer networking, offering clear definitions and translations to support learning and comprehension.

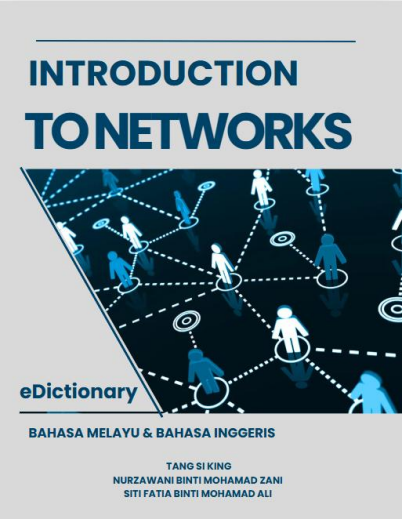



**Figure 2: The cover page for the eBook**

## Result and Discussion

The results obtained from the pre-test and post-test assessments demonstrate a substantial improvement in student performance following the use of the Introduction to Network eBook. As shown in Figure 3, a visual comparison highlights significant upward trends in individual scores across all 23 participating students.

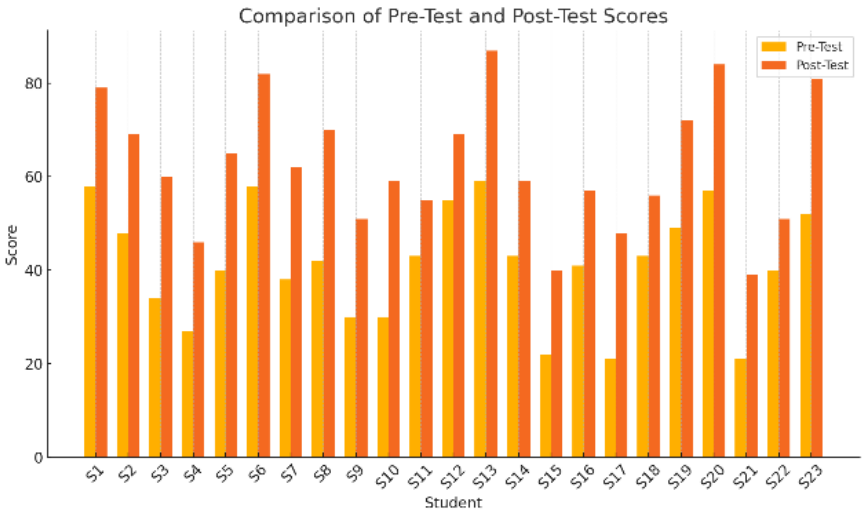



**Figure 3: Comparison of Pre-Test and Post-Test Scores**

Quantitative analysis reveals that the average pre-test score was 41.3, whereas the average post-test score rose to 66.7, marking an average improvement of 25.4 points. This reflects an overall percentage increase of approximately 61.5% in test performance, underscoring the eBook's effectiveness as an instructional tool. More notably, every student showed improvement, with the lowest recorded gain being 10 points and the highest reaching up to 34 points. Such consistency suggests that the eBook succeeded in addressing common knowledge gaps, especially in topics previously identified as challenging during the needs analysis phase.

The improvement pattern was particularly strong among students who initially scored below 40 on the pre-test. These students showed marked progress, achieving post-test scores between 60 and 75, indicating that the resource was especially helpful for lower-performing learners. This outcome aligns with previous studies (e.g., Rockinson-Szapkiw et al., 2013; Means et al., 2014) which reported that interactive, self-paced digital materials promote deeper understanding and higher retention.

Overall, the data supports the conclusion that digital instructional materials such as eBooks can serve as effective tools in technical education. The study also provides evidence that a well-structured eBook, combined with a self-paced approach and embedded formative assessments, can significantly enhance learning outcomes among diploma-level students.

## Conclusion

This study provides compelling evidence for the effectiveness of eBooks as instructional tools in technical and vocational education, particularly in the field of computer networking. The Introduction to Network eBook was shown to significantly enhance students' conceptual understanding and performance, as reflected in the consistent improvement of post-test scores across all participants. The eBook's structured content, visual explanations, and embedded self-assessment features enabled students to learn at their own pace, revisit complex concepts, and reinforce their understanding through active engagement.

Furthermore, the application of a pre-test/post-test methodology allowed for a quantifiable assessment of learning outcomes, revealing an average score improvement of over 60%. These findings affirm that well-designed digital resources can address the learning needs of diverse student populations, including those who may struggle with abstract or technical content in traditional classroom settings. In line with global educational trends and national digital learning strategies, this research supports the broader adoption of eBooks in higher education.

## Acknowledgment

We would like to extend heartfelt gratitude to everyone who contributed to the successful completion of this study. This project would not have been possible without the collective efforts of many individuals whose support, encouragement, and guidance have been invaluable throughout the research process. We also thankful to academic colleagues and peers who offered constructive feedback during the development and refinement of the eBook. Their professional insights helped ensure that the content was pedagogically sound and aligned with current academic standards. Finally, a special note of appreciation goes to the learners who participated in this project. Their engagement, honesty, and willingness to adapt to a new learning method played a critical role in demonstrating the value and potential of digital educational tools in technical education.

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# THE BOR-HAD APPLICATION: A CONCEPTUAL INNOVATION IN ISLAMIC EDUCATION WITH UMI PRINCIPLES

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***Abstract:*** *The escalating digital transformation in global education, dramatically intensified by the recent COVID-19 pandemic. It underscores an urgent need for innovative and value-driven technological solutions particularly within Islamic educational institutions. This article introduces and conceptually analyzes, Bor-Had, a proposed student attendance management system. Bor-Had is designed not only to significantly enhance efficiency, accuracy and communication in academic settings but also uniquely to integrate with Kelantan's foundational ethical framework: 'Ubudiyyah' (devotion to Allah SWT), 'Mas'uliyyah' (responsibility and accountability) and 'Itqan' (excellence and mastery). This paper employs a conceptual framework analysis by examining Bor-Had's proposed features and functionalities against these UMI principles to establish its rationality and significance as an innovation. Our analysis reveals that Bor-Had's envisioned automation and real-time analytics are meticulously designed to foster 'Ubudiyyah' by liberating valuable time for core pedagogical and spiritual pursuits. Furthermore, its planned robust transparency and accountability in record-keeping are argued to profoundly enhance 'Mas'uliyyah'. Concurrently, Bor-Had's emphasis on precision, error elimination and operational excellence is set to vigorously promote 'Itqan'. This conceptual innovation is positioned as a pivotal contribution to the digital transformation of Islamic education, offering a practical model for developing 'Sharia-Compliant by Design' technological solutions. These solutions inherently align with and actively strengthen Islamic ethical principles. The discussion illuminates Bor-Had's potential to significantly support resilient and adaptive Islamic education systems. Thereby, ensuring that administrative improvements directly serve higher spiritual and moral objectives. This study also identifies critical broader implications and future research avenues for the ethical and effective integration of values-driven technology.*

***Keywords:*** *Android Application, Digital Transformation, Islamic, UMI Principles*

## Introduction

The landscape of global education is undergoing a rapid digital transformation, a trend dramatically accelerated by the COVID-19 pandemic. This shift has necessitated the adoption of technology in virtually all aspects of educational administration and pedagogy (Zulfiati et al., 2021). Within Islamic educational institutions, this evolution presents a unique imperative: the development of innovative technological solutions that not only enhance efficiency but are

also intrinsically aligned with core Islamic ethical and moral values. While many contemporary digital tools prioritize mere utility, a critical gap remains in developing technologies that are intentionally 'Sharia-Compliant by Design', ensuring that administrative advancements contribute directly to higher spiritual and moral objectives.

Manual student attendance management systems are a prime candidate for technological intervention, as they are often prone to human error, inefficiency, data loss and hinder timely data recapitulation (Gustiar et al., 2022; Yuliadi et al., 2022). These shortcomings consume valuable time for both educators and administrators, diverting focus from core teaching and spiritual mentoring activities. To address these issues, this article introduces and conceptually analyzes Bor-Had (a short form for '*Borang Kehadiran'*), a proposed Student Attendance Management System (SAMS).

Bor-Had is envisioned as an innovative platform that couples administrative enhancement with a commitment to Islamic ethics. The system's design integrates directly with Kelantan's foundational ethical framework - '*Ubudiyyah'* (devotion to Allah SWT), '*Mas'uliyyah'* (responsibility and accountability) and '*Itqan'* (excellence and mastery) - often referred to as the UMI principles (Ahmad et al., 2013; Yaacob & Badlihisham, 2017). The purpose of this paper is to establish the conceptual rationality and significance of Bor-Had by examining how its proposed features and functionalities serve to reinforce these UMI principles.

The structure of this article follows a logical progression, beginning with a Literature Review that explores existing attendance technologies and the UMI principles. This leads into the Methodology, which outlines the conceptual use of the ADDIE model for the system's development roadmap. The core analysis is then presented in the Conceptualization of Bor-Had and UMI Principles, detailing the alignment of the system's technical design with the ethical framework. Finally, the Discussion and Recommendation sections evaluate the significance of Bor-Had and propose critical next steps for its empirical development and future research, followed by the Conclusion.

## Literature Review

This conceptual paper's literature review is organized into two distinct but related areas: the adoption and efficacy of digital student attendance systems and the application and understanding of the UMI ethical principles in institutional contexts. Reviewing the technological background first provides the necessary context for the administrative gap that the UMI-integrated application, Bor-Had, aims to fill.

### *Digital Student Attendance Systems*

The administrative challenges of manual attendance are widely documented, including time consumption, data inaccuracy and susceptibility to manipulation (LakshmiSudha et al., 2015; Sutabri et al., 2019). The push toward automation seeks to overcome these hurdles, especially given the increased use of digital platforms accelerated by the pandemic (Zulfiati et al., 2021). Consequently, contemporary solutions leverage various technologies, from web-based applications to advanced identification methods.

Web-based systems are common, utilizing platforms like PHP/MySQL for digital record-keeping, which addresses the issue of lost paper records and difficult data recapitulation (Gustiar et al., 2022; Yuliadi et al., 2022). These web-based systems often incorporate QR code technology for quick and secure student check-in, significantly enhancing process efficiency (Gulo et al., 2020; Liew & Tan, 2021; Masalha & Hirzallah, 2014; Rabu, 2019). The feasibility and strong user response to these web-based information systems are consistently validated across different educational levels (Panji, 2022; Firdaus et al., 2022).

Beyond QR codes, sophisticated identification technologies are employed to increase security and accuracy. These include biometrics like fingerprint-based systems, which can autonomously create attendance records and even notify parents via SMS (Abbas et al., 2024; Bakhri et al., 2020), as well as Radio Frequency Identification (RFID) systems for faster and more reliable identification in large halls (Rjeib et al., 2018; Shibghatullah et al., 2020). Face recognition, often utilizing deep learning algorithms like YOLOv5, represents the frontier of automation, offering high accuracy and speed to eliminate human error in the attendance process (Mohammad et al., 2018; Sunaryono et al., 2021; Susanti et al., 2023). Therefore, the literature confirms that these automated systems are crucial for improving efficiency, accuracy, and transparency in student monitoring (Nurfaizi & Hindarto, 2023).

### *UMI Ethical Principles in Islamic Governance*

The conceptual basis of the Bor-Had application is rooted in the UMI principles: *'Ubudiyyah'* (Devotion), *'Mas'uliyyah'* (Responsibility/Accountability) and *'Itqan'* (Excellence). These concepts serve as the philosophical pillar for socio-economic development in Kelantan, Malaysia and form the core of the state's Islamic governance philosophy, known as *'Membangun Bersama Islam'* (Developing with Islam) (Ahmad et al., 2013; Mohamad et al., 2016).

*'Ubudiyyah'* emphasizes that human action must be seen as an act of servitude and devotion to Allah SWT, where man is understood as the vicegerent of God on earth (Ahmad et al., 2013). In practical terms, this principle encourages dedicating time and resources to spiritual and purposeful acts, moving away from time-consuming administrative tasks that do not add pedagogical or spiritual value.

Ahmad et al. (2013) also refers to *'Mas'uliyyah'* as the sense of accountability, integrity, and responsibility. Any task or job undertaken must be fulfilled with integrity as a duty toward Allah SWT. This principle is directly relevant to administrative processes, mandating transparency and honesty in record-keeping and resource management (Kamaruzaman et al., 2022). Ultimately, the integration of this concept ensures that administrative actions are ethically grounded and verifiable.

Of equal importance, *'Itqan'* is centered on quality, excellence, and mastery in all undertakings. It demands precision, the elimination of errors, and the relentless pursuit of perfection in one's work (Ahmad et al., 2013). This principle directly mandates the development of systems that are highly accurate and reliable, ensuring that output, such as attendance records, is of the highest quality.

### *Instructional Design and the ADDIE Model*

Meanwhile, the successful development of technology for educational settings often relies on a systematic instructional design framework. The ADDIE model (Analysis, Design, Development, Implementation and Evaluation) is widely recognized as a generic, systematic, and highly effective model for developing learning materials, multimedia and technology-based systems (Cahyadi, 2019; Hidayat & Nizar, 2021; Safitri & Aziz, 2022; Spatioti et al., 2022). Its procedural and structured approach ensures that development is systematic, aligns with learning requirements and is subjected to rigorous validation (Weldami & Yogica, 2023). Its application is proven across diverse technology developments, including e-learning platforms (Zulfiati et al., 2021) and web-based systems (Adesfiana et al., 2022; Salas-Rueda et al., 2020). For Bor-Had, the ADDIE model provides the necessary structure to ensure that the development process meets the demands of UMI's *Itqan* principle by being systematic and validated.

## Methodology (Conceptual Framework Analysis and ADDIE Model)

This paper employs a Conceptual Framework Analysis as its core methodology, focusing on the foundational Analysis and Design stages of the widely accepted ADDIE (Analysis, Design, Development, Implementation, Evaluation) instructional design model. As the Bor-Had application is a proposed innovation, this conceptual phase is critical for establishing its theoretical and ethical viability prior to the commencement of any software engineering.

### *Research Design*

The research design is conceptual and qualitative, involving the following two principal components:

1. Literature Review: A comprehensive review of academic literature was conducted to establish the need for automated student attendance systems and to define the ethical context of the UMI principles. This systematic review provided evidence of existing attendance technology solutions (e.g., face recognition, QR code, RFID) and validated the use of the ADDIE model for developing such educational technologies.
2. Conceptual Framework Analysis: This involves the juxtaposition of the proposed technical features of the Bor-Had system against the defined components of the UMI ethical framework to establish clear alignment.

### *The ADDIE Model as a Roadmap*

The ADDIE Model is chosen due to its systematic and structured nature, making it ideal for the development of effective educational technology and inherently supporting the principle of *Itqan* (Cahyadi, 2019; Hidayat & Nizar, 2021). The Bor-Had project is currently situated within the first two phases:

#### *Analysis Phase*

This phase identified the problem: the inefficiency of manual attendance systems and the gap in existing technology that fails to explicitly integrate Islamic ethical values. This stage leveraged the literature to understand user needs (fast, accurate, transparent attendance recording) and established the primary design goal: to create a system that reinforces UMI principles (Gustiar et al., 2022).

***Design Phase***

In the Design Phase, the system's architecture is conceptually mapped. This involves defining the specific features of Bor-Had (e.g., real-time analytics, automated data capture) and explicitly linking each feature to a specific UMI principle (*'Ubudiyyah'*, *'Mas'uliyyah'* or *'Itqan'*). This conceptualization forms the core contribution of this paper.

***Future Research Phases***

The final three stages of the ADDIE Model constitute the subsequent empirical research phases necessary for the full realization of Bor-Had:

- Development: The actual construction of the application software (coding, database creation, user interface development).
- Implementation: Piloting the system within an Islamic educational institution in Kelantan and training end-users (teachers, students and administrators).
- Evaluation: Conducting validity, practicality and effectiveness testing (Gustiar et al., 2022; Panji, 2022). This final stage will be critical for empirically measuring not only the technical success but also the positive impact on the promotion of the UMI principles in the educational environment.

**Conceptualisation Bor-Had and UMI Principles**

The core innovation of the Bor-Had application lies in its intentional design to function as a technological instrument that actively promotes the UMI ethical framework. This section details the conceptual relationship by first defining each UMI principle and then linking it to the proposed features of the Bor-Had system. The interaction between the core technical attributes of Bor-Had and its intended ethical outcomes is illustrated in Figure 1 and the conceptual significance in promoting the UMI principles is further detailed in Table 1.

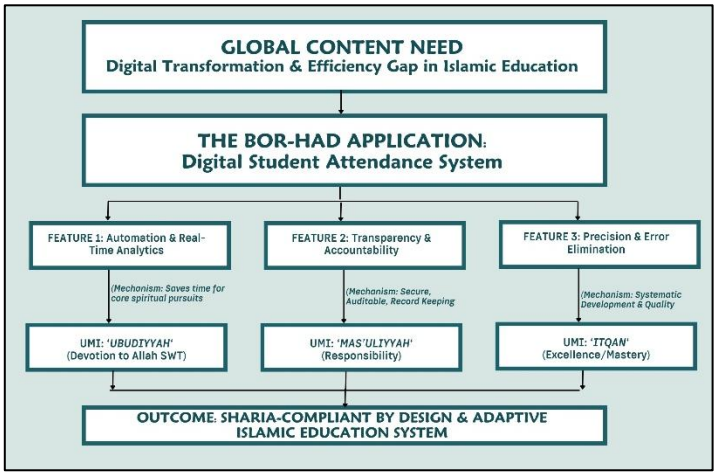


**Figure 1: Interaction between the Core Technical Attributes of Bor-Had & the Intended Ethical Outcomes**

Source: (Ahmad et al., 2016; Gustiar et al, 2022; Rabu, 2019; Nurfaizi & Hindarto, 2023; Sunaryono et al., 2021; Abbas et al., 2024; Juardi, 2019; Susanti et al., 2023; Firdaus et al., 2022; Panji, 2022; Kamaruzaman et al., 2022)

**Table 1: Significance of Bor-Had Student Attendance System (SAS) Feature that Interacts to UMI Principle**

| UMI Principle | Definition | Key Findings/ Focus |
|---|---|---|
| *Ubudiyyah* | Devotion to Allah SWT; the essence that man is the vicegerent of Allah in this world. | Liberation of Time for Spiritual/Core Duties:<br>• By automating the time-consuming and tedious manual attendance process, valuable time is redeemed for educators and student to focus on core pedagogical, intellectual and spiritual pursuits, thus fulfilling devotion. |
| *Mas'uliyyah* | Responsibility and accountability; a job is a responsibility and must be fulfilled as a duty toward Allah SWT. | Enhancing Accountability and Integrity:<br>• The system's use of real-time, tamper-proof digital records and high-security identification methods like biometrics or QR codes ensures robust transparency, eliminating fraud and strengthening the sense of responsibility. |
| *Itqan* | Excellence, mastery and quality in work | Achieving Operational Excellence and Precision:<br>• The design emphasis on automation, precision and error elimination ensures the administration process is executed with the highest quality.<br>• Using R&D models like ADDIE further guarantees the system's structural quality. |

Source: (Ahmad et al., 2016; Gustiar et al, 2022; Rabu, 2019; Nurfaizi & Hindarto, 2023; Sunaryono et al., 2021; Abbas et al., 2024; Juardi, 2019; Susanti et al., 2023; Firdaus et al., 2022; Panji, 2022)

### *UMI Principles Defined*

The UMI principles form the ethical compass for the governance and development in Kelantan (Ahmad et al., 2013).

1. '*Ubudiyyah'* (Devotion to Allah SWT): This principle asserts that all human efforts and time should ultimately be directed towards acts of servitude and spiritual significance. In an educational context, it requires minimizing time spent on non-core, time-consuming administration to maximize time for pedagogical and spiritual pursuits (Yaacob & Badlihisham, 2017).
2. '*Mas'uliyyah'* (Responsibility and Accountability): This principle emphasizes that every task is a trust (*amanah*) and must be fulfilled with integrity. It demands transparency, honesty, and verifiable record-keeping in ensuring all parties are accountable for their actions and commitments (Ahmad et al., 2013; Mohamad et al., 2016).

3. '*Itqan'* (Excellence and Mastery): This principle requires precision, high quality, and the pursuit of perfection in all work, including administrative processes. It is fundamentally about achieving operational excellence and eliminating errors (Kamaruzaman et al., 2022).

***Alignment of Bor-Had Features with UMI Principles***

***Bor-Had and 'Ubudiyyah' (Devotion)***

To foster '*Ubudiyyah'*, Bor-Had is conceptually designed to maximize the efficient use of time, thereby redirecting administrative effort towards core pedagogical and spiritual activities.

- Feature 1: Automated Data Capture (e.g., QR/Face Recognition): By utilizing high-speed identification technologies (Sunaryono et al., 2021; Sutabri et al., 2019), Bor-Had eliminates the minutes wasted in manual roll-calling or signature sheets. This saved time, aggregated across hundreds of classes, directly instantiates the objective of '*Ubudiyyah'* by allowing for more teaching, student monitoring, and other devotional pursuits.
- Feature 2: Real-Time Reporting and Recapitulation: The system's ability to instantly process and generate attendance reports prevents the time-consuming manual data entry and recapitulation activity commonly reported in traditional systems (Gustiar et al., 2022; Firdaus et al., 2022). This liberates administrative staff and educators for more value-added work, reinforcing the prioritization of the spiritual and academic mission.

***Bor-Had and 'Mas'uliyyah' (Repsonsibility)***

To enhance '*Mas'uliyyah'*, Bor-Had focuses on creating a robust and tamper-proof record of attendance, promoting integrity and accountability across the institution.

- Feature 3: Robust Security and Anti-Fraud Measures: Bor-Had employs features like biometric or time-and-location stamping (Liew & Tan, 2021) to eliminate proxy attendance (cheating), a common issue in manual and early digital systems (Rabu, 2019). By making attendance data verifiable and auditable, the system instills a culture where presence is tied to personal responsibility, thus reinforcing '*Mas'uliyyah'*.
- Feature 4: Multi-Stakeholder Transparency and Alerts: The system will provide real-time access to attendance records for parents, teachers and administrators (Bakhri et al., 2020). Features like automated SMS or application alerts regarding absenteeism ensure that responsibility is promptly communicated to parents (Abbas et al., 2024), fostering shared accountability for student attendance and welfare.

***Bor-Had and 'Itqan' (Excellence)***

To vigorously promote '*Itqan'*, Bor-Had prioritizes technical precision, systematic development and the highest quality of output.

- Feature 5: Systematic Development via ADDIE: The conceptual development of Bor-Had follows the systematic phases of the ADDIE Model (Analysis, Design, Development, Implementation, Evaluation) (Cahyadi, 2019). This structured, validated

approach is itself an act of '*Itqan'* that ensures the final product is reliable, effective and meets the highest standards of quality (Spatioti et al., 2022).

- Feature 6: High-Accuracy Digital Systems: By utilizing proven advanced identification methods (like Face Recognition at 97.29% accuracy, as demonstrated by Sunaryono et al., 2021), the system guarantees data integrity and eliminates the error-proneness of manual systems (Rjeib et al., 2018). The pursuit of absolute accuracy is the essence of '*Itqan'* applied to administrative tasks.

## Discussion and Recommendation

### *Discussion*

The conceptual analysis of the Bor-Had application confirms its profound relevance as a model for value-driven technological innovation within Islamic education. The escalating demand for digital efficiency in educational settings, accelerated by global events, mandates that technology not only solves administrative problems but also reinforces foundational ethical principles (Zulfiati et al., 2021). Bor-Had addresses the commonly identified issues of inaccuracy, administrative overhead and potential fraud inherent in manual attendance systems (Gustiar et al., 2022; Sutabri et al., 2019) by proposing an automated and real-time solution.

The primary significance of Bor-Had, however, lies in its deliberate integration of the Kelantan ethical framework: *'Ubudiyyah'*, *'Mas'uliyyah'*, and *'Itqan'* (UMI). This conceptual framework moves beyond simply using technology; it proposes a 'Sharia-Compliant by Design' model where technical features actively promote moral and spiritual objectives.

Firstly, the system's focus on Automation and Real-Time Analytics serves the principle of *'Ubudiyyah'*. By freeing up administrative time, Bor-Had allows educators and staff to allocate valuable resources toward core spiritual and pedagogical duties (Yaacob & Badlihisham, 2017). This aligns administrative improvements directly with the higher objective of devotion to Allah SWT, ensuring that technological progress supports, rather than distracts from, the religious mission of the institution.

Secondly, the emphasis on robust Transparency and Accountability reinforces *'Mas'uliyyah'*. Previous research shows that technology-based attendance systems, such as those employing biometric or SMS alerts, enhance monitoring and communication with stakeholders like parents (Abbas et al., 2024; Bakhri et al., 2020). Bor-Had's transparent record-keeping cultivates integrity by minimizing opportunities for fraud and ensuring that every stakeholder is fully accountable for their presence or absence, fostering the sense of duty prescribed by this principle.

Finally, the commitment to Precision and Error Elimination promotes *'Itqan'*. The use of systematic development models like ADDIE and high-accuracy identification methods (Sunaryono et al., 2021) ensures that the system operates with excellence, a fundamental requirement of *'Itqan'* (Kamaruzaman et al., 2022). By delivering reliable and accurate data, the system establishes a high standard of quality in institutional management, which in turn supports a resilient and trustworthy educational environment.

In essence, Bor-Had is conceptualized not merely as a student attendance system but as an ethical tool designed to make administrative tasks a direct manifestation of Islamic ethical

standards. It serves as a practical model demonstrating how technology development can be intentionally guided by Islamic philosophy.

***Recommendation***

Based on this conceptual analysis, the following recommendations are put forth to guide the future research and development of the Bor-Had application and the wider field of value-driven educational technology:

1. Full System Development and Validation: The conceptual framework must now be translated into a tangible product. It is recommended that the full cyclical stages of the ADDIE Model - specifically the Development, Implementation, and Evaluation phases - be immediately pursued. This must include rigorous technical testing, followed by user acceptance trials to measure the system's validity and practicality in a real-world setting (Panji, 2022; Gustiar et al., 2022).
2. Empirical Measurement of UMI Impact: Future empirical research should be designed to quantitatively and qualitatively measure the impact of Bor-Had's implementation on the UMI principles. This includes measuring the time saved by educators (linking to '*Ubudiyyah'*), the reduction in attendance manipulation ('*Mas'uliyyah'*), and user satisfaction with the system's reliability ('*Itqan'*).
3. Generalization of the UMI-by-Design Model: It is recommended that researchers investigate the generalization of this 'Sharia-Compliant by Design' framework. The UMI conceptual integration could be applied to other administrative or pedagogical technologies within Islamic educational institutions, such as grading management, curriculum development, or digital learning content (Spatioti et al., 2022), thereby broadening the scope of ethical technology integration in the sector.

**Conclusion**

The conceptual analysis presented in this article establishes the Bor-Had application as a pivotal and value-driven innovation for the digital transformation of Islamic education. Recognizing the dual pressures of global technological acceleration and the need to preserve core religious and ethical principles, Bor-Had offers a solution that transcends mere administrative efficiency. By systematically integrating the features of a modern student attendance management system - namely automation, real-time analytics and robust accountability - with Kelantan's foundational ethical pillars of *'Ubudiyyah'* (devotion), *'Mas'uliyyah'* (responsibility) and *'Itqan'* (excellence), Bor-Had is conceptualized as a genuinely 'Sharia-Compliant by Design' technology.

In conclusion, the Bor-Had conceptual innovation serves as a practical blueprint, offering a tangible model for developing resilient and adaptive Islamic education systems. Its significance lies in demonstrating that administrative improvements can and should be intentionally aligned to serve higher spiritual and moral objectives. It therefore sets a new precedent for the ethical and effective integration of technology within faith-based educational contexts.

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# THE ROLE OF SPIRITUAL EMPHASIS IN CONSTRUCTION BUSINESS SMES RESILIENCE: INSIGHT FROM MALAYSIAN OGSE SME LEADERS

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***Abstract:*** *This study examines the role of spirituality in strengthening resilience among SMEs in the Oil and Gas Services and Equipment (OGSE) sector, with insights applicable to construction SMEs. A qualitative case study approach was employed, using semi-structured interviews with seven SME leaders, each with over 10 years of industry experience and holding a PETRONAS license. Data were analyzed thematically, focusing on the influence of charity, religion, and honesty in business operations. Findings reveal that charity, expressed through CSR initiatives, enhances community ties and corporate reputation; religion fosters emotional resilience and unity among employees; and honesty promotes transparency, reduces conflict, and builds long-term trust with stakeholders. Together, these principles support leadership practices, workplace culture, and crisis management. The study underscores spirituality not only as a resilience-building mechanism but also as a framework for sustainable and ethical business practices, offering practical implications for SMEs and policymakers in high-risk industries.*

***Keywords:*** *Spirituality, Resilience, SMEs, Construction Industry*

## Introduction

Small and medium-sized enterprises (SMEs) enjoy a broad consensus as the heart of the economy, driving employment, novelty, and sustainable development (Saad et al., 2021; Erdiaw-Kwasie et al., 2023). In Malaysia, SMEs are critical to keeping industrialization on the track and providing for communities, notably concentrated in the Oil and Gas Services and Equipment (OGSE) construction industry (Ruslan et al., 2023). Despite their importance, SMEs are extremely vulnerable because of limited means, lean structures, and less formalized management practices (Roffia & Dabic, 2023).

Economic crises, technological failures, and the impact of the COVID-19 period on SMEs, which further uncovered the issues, showed the value of resilience definition as a survival and competitiveness mechanism (Kotsios, 2023; Ahmad et al., 2023). In specific terms, resilience is the ability of firms to deal with shocks, negotiate shocks, and gain from them, which is achieved through both internal capabilities and the use of external enablers. Among the internal aspects are innovation, ambidexterity, and strategic consistency (Iborra, Safón, & Dolz, 2020; Trieu et al., 2023), while externally having a network, access to finance, and social capital promote collaboration and resource mobilization in the face of a crisis (Ozanne et al., 2022;

Dias et al., 2022; Makmor et al., 2023). During the pandemic, many SMEs turned to digital transformation and creativity as mechanisms to continue operating (Khurana, Dutta, & Ghura, 2022; Zutshi et al., 2021).

Although the body of knowledge is growing, the literature on resilience in SMEs is by no means expansive. While certain pieces focus on such approaches to resilience as strategic and structural mechanisms, others emphasize behavior and the relational aspects, particularly leadership, culture, and community boundaries (Sullivan-Taylor & Branicki, 2011). Thus, resilience needs to be addressed contextually. In the case of construction SMEs in Malaysian OGSE, resilience is realized in both industrial and socio-cultural contexts (Rahman et al., 2022; Kamaruding & Bariono, 2025).

More recent scholars also stress the role of spirituality as a non-traditional yet compelling factor in resilience. Values-based leadership, ethical decision-making, and supportive workplace cultures provide for the ability to bend and act as one in the face of unpredictability (Ismail et al., 2024; Kamaruding, Mokthar & Rahman, 2022). In Malaysia, spirituality is closely intertwined with cultural and religious norms and is thus a relevant and comprehensive approach to maintaining performance, innovation, and capacity to maintain endurance (DiBella et al., 2022; Gonçalves et al., 2024).

This paper discusses how reinforcing spirituality enhances resilience in Malaysian OGSE construction SMEs in the context of leadership values. The paper finds that spirituality promotes prosocial goodwill, ethical climate, and crisis sensemaking, which contributes to the development of absorptive, adaptive, and transformative resilience.

## Literature Review

### *SME Resilience and Survival*

Economic development, job creation, and innovation among national and even global economies are all driven by SMEs (Saad et al., 2021; Erdiaw-Kwasie et al., 2023). SMEs in Malaysia stand as the leading drivers of industrialization, especially in the OGSE and building industries. Many small businesses still pose a risk given their scarce resources, slim organizational models, and even informal management approaches (Roffia & Dabic, 2023). The COVID-19 pandemic affected the SMEs, showing their vulnerabilities and proving the critical nature of resilience, the ability to absorb a shock, adjust, and recover from it (Kotsios, 2023; Ahmad et al., 2023).

### *Determinants of Organizational Resilience*

Researchers distinguish between internal and external resilience factors. Internally, companies reinforce their adaptability to change and resilience for long-term performance through innovation, ambidexterity, and strategic consistency (Iborra, Safón, & Dolz, 2020; Trieu et al., 2023). Externally, social networks, access to finance, and stakeholders contribute to the mobilization of resources in a crisis and, therefore, the ability to recover (Ozanne et al., 2022;

Dias et al., 2022; Makmor et al., 2023). Hence, SMEs' survival during the COVID-19 pandemic is studied in terms of digital transformation and business model innovation as essential resilience enablers (Khurana, Dutta, & Ghura, 2022; Zutshi et al., 2021). However,

those papers only consider a technical and structural approach, while moral, cultural, and spiritual dimensions help also sustain organizations.

### *Spirituality as a Source of Organizational Strength*

Growing studies hint that spirituality should be considered an important, yet neglected, source of resilience. The qualities that spirituality instills, such as moral behavior, compassion, and strength in unity, make it a capable tool for organizations dealing with ambivalence and subsequent recovery (DiBella et al., 2022; Gonçalves et al., 2024). In the Malaysian setting, the phenomenon of spirituality is bound by culture and religion, as Islam leads with the qualities of justice, devotion, and empathy (Ismail et al., 2024; Kamaruding, Mokthar, & Rahman, 2022). Prayer, contemplation, and zakat (charitable acts) are spiritual processes in the workplace, forming emotional security, brotherhood, and mutual faith (Li & Hu, 2025; Dorais & Gutierrez, 2021).

### *Integrating Spirituality into SME Management*

Studies increasingly highlight how spirituality influences leadership, marketing, and decision-making. Values-based leadership enhances employee engagement and ethical decision-making (Kamaruding, Alias, Muis, & Mokthar, 2023), while ethical branding and socially responsible marketing foster trust and loyalty among stakeholders (Pinto et al., 2024). In construction SMEs, where project risks and uncertainty are prevalent, spirituality provides moral grounding and strengthens collaboration, helping firms remain resilient and competitive in the long term (Kamaruding, Mokthar, & Rahman, 2022).

## Methodology

This research is done using the qualitative case study approach in order to understand the role of spirituality in enhancing OGSE SMEs' resilience in order to utilize the same in construction SMEs. The research involved semi-structured interviews with seven SME leaders who satisfied the following selection criteria: a minimum of 10 years of business establishment, active operation in the OGSE sector, and holding a PETRONAS license, which is an indication of industry standing (Table 1). The interviews were designed to allow for a mix of structured direction and open lines to explore concepts that emerged, focusing on the contribution that spiritual values of charity, religion, and honesty make in influencing leadership, organizational culture, and crisis management. The data were transcribed and then run through thematic analysis to highlight themes and patterns, which were then cross-checked with triangulation.

**Table 1: Profile of Informants**

| Informant | Position/Role | Years of Experience | SME Focus Area |
|---|---|---|---|
| 01 | Chairman (Upstream services) | 15+ years | Oil & Gas upstream services |
| 02 | Director (Midstream SME) | 10+ years | Community engagement focus |
| 03 | Leader (Downstream SME) | 12 years | Downstream operations |

| Informant | Position/Role | Years of Experience | SME Focus Area |
|---|---|---|---|
| 04 | General Manager (Multidisciplinary SME) | 15+ years | Multidisciplinary OGSE services |
| 05 | Founder (Technical support SME) | 10+ years | Technical support services |
| 06 | Entrepreneur (Supplier SME) | 12+ years | Supplier & distribution |
| 07 | Executive (Senior leadership role in SME) | 20+ years | OGSE operations |

## Findings and Discussion

This study's findings demonstrate that investing in spiritual emphasis contributes significantly to the resilience of OGSE SMEs and provides lessons for construction business SMEs that can be applied directly and through adjustment. Based on the feedback of SME leaders, the best way to understand spiritual emphasis is through charity, religion, and honesty, which, together, dictate leadership actions, the environment of the workplace, product and service marketing, and crisis handling. The results constantly show that resilience is not just the ability to work in the technical area or earn; it is also a moral and cultural resource rooted in the life of the institution (Saad et al., 2021; DiBella et al., 2022).

### Charity as a Strategic and Moral Driver

Resilience is supported in part by charity, given that informants identified zakat giving and fundraising for donations as a key component of their businesses and spiritual commitments. Informant 04 explains that "more donations will help the business gain stability" and Informant 02 comments that returning is a demonstration of social responsibility aside from religious duty. Charity not only brings barakah and social capital, but also strengthens the links between corporations and local communities whose networks are integral to SME operations. CSR or community participation builds confidence in stakeholders and supports corporate legitimacy (Ozanne et al., 2022), especially in times of resilience. In the case of construction SMEs, projects are closely connected to their strong ties to local communities. Philanthropy can lead to the integration of organizational agendas and create goodwill or reputation, as well as enabling resilience to external shocks. Charity thus fulfills not only spiritual and moral needs, but also leads to localized and tangible business benefits.

### Religion as the Foundation of Resilience

Religion was seen as the foundation of spiritual focus and as a guide for responsible choices, behaviors in the workplace, and unity in difficult situations. According to Informants, Islam is believed to guide the business field with the rules and regulations of responsible behavior, and Informant 02 expressed, "Observing what our religion demands, we will have a spiritual dimension in our business. You will be doing your job what has been accepted well and will take care of the business's survival." Prayer and reading the Quran, the daily activities, were suggested to be the most important factor in keeping a team united and emotionally stable and focused.

The findings are aligned with the literature that suggests being religious helps with resilience through psychological conditions, belonging, and meaning in the workplace (Ismail et al., 2024; Kamaruding et al., 2022; Kamaruding et al., 2023; Li & Hu, 2025). A religious element is enabling both collective discipline and emotional relief for demanding professions such as construction, where collaboration and stress are part of the daily job. Thus, for SMEs in the targeted business area, introducing spiritual practices as part of the routine could result in increased morale and unity, resulting in better adaptive capacity.

**Honesty as the Basis of Trust and Sustainability**

The informants stressed over and over that honesty is the irreducible minimum in resilience. In their words, “We do not compromise on honesty. It impacts every aspect of our life and ensures mutual respect and cooperation," as Informant 03 explained, or that open and transparent communication with clients in times of uncertainty creates trust and underlying support for stable relationships, as Informant 01 said.

Thus, the resilience literature recognizes Trustworthiness as a pillar for stakeholders’ networks and means to manage risk (Sullivan-Taylor & Branicki, 2011; Kamaruding et al., 2023). In construction SMEs, where dispersion and escalation into disputes are prevalent and complicated contracts are the norm, honesty in dealing with clients, suppliers, and regulators is not only ethically appealing but good for business. By minimizing friction and buttressing credibility, honesty underwrites long-term sustainability and elevates the organization’s ability to bounce back from adversity.

**Integration of Spirituality and Entrepreneurial Marketing**

Another significant point refers to the conjunction of spiritual emphasis with the existing EM practices. Advertisers expressed the idea of marketing being not transactional but value-oriented and relationship-centered, relating circumstances of commerce to the mutual spiritual concerns of the individuals involved in the act. Informant 04 said: “Marketing is more than just selling a product. It is about proving to clients and partners that we are aligned with the same values.”

This correspondence confirms the research on marketing, which is based on values, and it shows that companies that consider ethical and spiritual issues as relevant elements of the relationship between a company and its clients can improve the credibility of the company and its recognition among the industry players (Kamaruding et al., 2022; Kamaruding et al., 2023; Pinto et al., 2024). In this context, construction SMEs operating under relationship-driven markets could even use spiritual values in marketing campaigns as a competitive edge, enhancing customer confidence and sparking long-lasting personal and commercial relations.

**Spirituality and Crisis Management**

Ultimately, spirituality ended up being instrumental in crisis management by giving leaders emotional steadiness and perspective when faced with ambiguity. Informants remarked that faith-based practices, including istighfar (seeking forgiveness) and trust in the divine, helped shape the way they made decisions and motivated others within the team. For instance, Informant 03 mentioned, “70% of success comes from skills and knowledge, while the

remaining 30% is driven by spiritual strength," while another leader explained that when things go wrong, he must always trust in Allah.

It is in accordance with past research that spirituality can exists as a form of stress relief that allows leaders to be calm and adapt when it is time to make pressured decisions (Dorais & Gutierrez, 2021). For construction sector SMEs, where the crises of project delays, budget overruns, and resource scarcities, among many others, only need appear, spirituality can be interwoven into their crisis management strategies for faster adaptation, less leader burnout, and the collective will to work through uncertainty.

## Implications and Conclusion

This article emphasizes how charity, religion, and honesty contribute to resilience. It demonstrates the relevance of their application in the construction industry and other sectors with similar risk profiles. Through this approach, it is possible to suggest solutions to many problems that affect construction SMEs due to the interdependence of these values in leadership, organizational culture, and stakeholder relations.

The methods through which resilience may be achieved are CSR, which generates goodwill and trust among communities and various other stakeholders; religion, which offers the exceedingly strong emotion needed to build emotional resilience for certain purposes; honesty, which serves as a medium through which trust is established by holding the appropriate frame of mind to treat every stakeholder with the respect that each of them Deserves. Finally, good character, which is displayed in leadership, organizational culture, and the manner in which an entity engages with its stakeholders, provides pragmatic and operative measures to help overcome obstacles.

In the end, spirituality is revealed not only as a mechanism to conquer hardships but also as a channel of incorporating and using vital principles such as stewardship, social justice, and sustainability in operations. When an organization operates with a spiritual mindset, it can be rest assured of being able to flow through hard times smoothly and with minimum struggles while pushing for the welfare of its surroundings. Future studies should examine how these concepts can be applied in other sectors besides the ones already covered in this article and to operations in different cultural environments.

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# MOBILE-PHONE CONVERSATIONS AND DRIVER DISTRACTION: EVIDENCE FROM A DRIVING SIMULATOR

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***Abstract:*** *Nowadays, mobile phone is a very useful instrument to human beings whereby it can do lots more than make and receive telephone calls. Unfortunately, it has the potential to distract drivers in many ways. The main objective of the study is to measure the driver distraction of mobile phone usage in simulated traffic environment using Detection Response Task (DRT) method. In this study, 54 participants completed a number of secondary tasks (i.e. conversation task) while concurrently performing the DRT in a driving simulated environment. For driving scenarios comparison, three scenarios were used; free flow (40 km/h) with medium traffic volume, free flow (40 km/h) without traffic and traffic jam. For different conversation task, the contents of conversation were in emotional and factual conditions with hands- free and hand-held mobile phone. Overall, the results of this research showed that participants responded to lesser stimuli when dealing with more difficult conversation task. On another note, we also found that drivers were more distracted when dealing with more demanding tasks of using mobile phone (i.e. conversation tasks) as compared to baseline. In addition, participants attended the worst in term of stimuli and higher response time in traffic jam scenario as compared to other scenarios. In term of gender, male drivers were generally faster in term of response time as compared to female drivers with no significant differences. Besides, the study discovered that novice drivers' group was identified to respond significantly faster rate than the experience drivers' group.*

***Keywords:*** *Distracted driving; driving simulator; mobile phone; conversation tasks; road safety*

## Introduction

In 2023, there were 6,473 fatalities attributed to road accidents [1]. This alarming figure results in an average of 17 fatalities per day. Road traffic injuries are the eighth most common cause of mortality worldwide, and over one million individuals are murdered annually as a result of road accidents [2]. Human errors are the primary contributing factor to approximately 90% of road traffic accidents [3]. Driver distraction is a grievous and increasing hazard to road safety. Driver distraction is the act of performing any task that diverts the driver's attention from their primary task, which is driving [4]. Driver distraction can impede driver performance by preventing drivers from dedicating sufficient attention to the primary task in hazardous situations, as they are preoccupied with additional tasks that may impede their ability to operate a vehicle safely [5]. Driver preoccupation is acknowledged as a contributing factor in at least 25% of vehicle accidents in numerous publications [6,7,8]. This number may rise in the future

as a result of the widespread use of mobile phones while operating a vehicle, which has the potential to distract drivers.

The risk of accident involvement is increased by driving distraction, including the use of mobile phones while driving, as demonstrated by extensive research conducted worldwide [9,10,11]. Other studies have demonstrated that a driver's accident risk is increased by 400–900% by as little as 1 hour of cell phone use while driving per month [12,13,14]. Cell phone use while operating a vehicle has been documented to be more disruptive than alcohol intoxication [15]. Drivers' performance was adversely affected by the use of mobile phones while operating a vehicle, according to certain investigations. These studies also concluded that the performance of hands-free and hand-held mobile phones is comparable to that of normal driving, which does not involve the use of mobile phones [16,17].

One of the prominent empirical approaches to study human-related issues specifically for driver distraction performance is a driving simulator. Driving simulator is an instrument, which able to simulate a virtual driving environment and resemble real driving condition [18]. There are some advantages of using driving simulator as compared to other method such as on road driving research, which are the controlled and repeatable environment, safety purposes and cost reduction [19].

Driving simulator enables researchers to isolate experimental variables from other factor that might influence driving performance, therefore improving the accuracy of the recorded measures. Furthermore, simulator can study the hazardous driving situation that could not be replicated by on road study without exposing subject to unacceptable risks. Simulator study could reduce the research operation cost since the simulation environment and other factors can be controlled. Hence, there are no costs for fuel, toll fare, on road vehicle maintenance [20]. Driving simulator experiment is also an alternative to traditional methods such as self-reports which was widely argued to have limitations in studying driving behaviours. Among the limitations were the quality, type and the infrequency of occurrence of the pre-crash data and the integrity and reliability of self-reports [21].

Detection Response Task (DRT) is one of the methods for measuring driver distraction [22]. As stated by Engström, Larsson & Larsson (2013), DRT is employed for measuring the consequence of the driving as the main task and doing secondary tasks on driver attention [23]. The DRT method is a task in which participants respond to repeated stimuli presented within specific duration. Detection performance measured in terms of response time represents the degree to which selective attention is affected by the tasks under evaluation. Tactile Detection Response Task (TDRT) will be utilised in this study. It requires drivers to respond to the vibration they feel, by pressing a small switch attached to their finger. It involves tactile stimuli that are presented by means of small vibrators attached to the skin [24]. According to Engstrom, Aberg, Johansson and Hammarback (2005), the original study attached the vibrators on both participants' wrists, and stimulus presentation was varied randomly between them [25]. Merat, Johansson, Engstrom, Chin, Nathan and Victor (2006) and Merat and Jamson (2008) amended the method by attaching a vibrator to participants' necks [26, 27]. This amended method of TDRT minimises the use of wires or cables that can interfere with the driving activity. TDRTs are more reliable and sensitive in the field [28] and do not affect drivers' visual behaviour [29], compared to classical DRT.

The amount of research conducted on the topic of driver distraction, specifically in relation to mobile phone usage in Malaysia, remains insufficient. MIROS conducted a very limited experimental study using a driving simulator to measure the response time of several secondary tasks, including texting usage while driving, without specifying the character numbers. The study concluded that the texting response time significantly differed from the baseline task by 97% [30]. Additionally, a self-reported survey regarding mobile phone utilisation while driving in the Klang Valley discovered that 43.4% of drivers in the region utilised their mobile phones while operating their vehicles, 61.9% while at a red light, and 53.6% during traffic congestion [31]. In Malaysia, no specific accident data was reported in relation to the type of defect associated with driver preoccupation. Careless driving, dangerous driving, dangerous turning, dangerous overtaking, driving too close, careless at entrance or exit, and negligent signalling are all nearly related but disputable, with a combined percentage of 74.81% [32]. In 2015, Malaysia had an estimated 176.5 million mobile phone subscribers, with a ratio of 5.8 mobile phones per Malaysian. Furthermore, in the same year, an estimated 25,856 million Short Message Services (SMS) were transmitted [33]. It is anticipated that the utilisation of mobile phones while driving in the Malaysian context will be impacted by the aforementioned figures and the advancement of smartphones. MIROS conducted the study and published the paper that elucidates the methodology, data analysis, and research findings, recognising the critical issues of mobile phone utilisation as a source of distraction. The objective of the study was to measure the distraction in terms of the response time of participants in various driving scenarios and mobile phone conversation tasks.

## Materials and Methods

The study was designed using mixed method experiment in which we manipulated within-subject variables (conversation task, tactile task and driving scenarios) and between-subject variables (gender and age group). Convenience stratified sampling method was used to recruit the participants for this study. Fifty-four participants, with twenty-seven males and twenty-seven female participants, took part in the study. All participants are right-handed drivers and have no specific knowledge or expertise about the study. Participants' ages range between 18 and 57 years old, with a mean of 31.47 years old. Participants took part in the study voluntarily, having read and signed a consent form that informed the purpose and procedures of the study. All participants are licensed drivers with an average driving distance of 20,478.27 km a year and an average driving experience of 10.42 years. Participants were selected among the staff at MIROS and the general public. Participants must be able to drive using automatic transmission and were given RM 75.00 for their participation. Two groups of participants were involved in the study which are novice and experience drivers. Novice drivers are drivers who have the experience of driving less than 4 years and age between 18-24 years (SWOV, 2009). While, experience drivers considered as more than 10 years driving experience and age between 30-59 years [34].

The MIROS Driving Simulator Cabin (CabinDS) was used in this study. The platform for the simulator is a second generation Perodua Myvi 1.3L. The main components of the integrated system of CabinDS are steering wheel, pedals, transmission, full car cabin, LCD projector and screen, computer, simulation software, video camera and sound system. Figure 1 illustrates the CabinDS system.

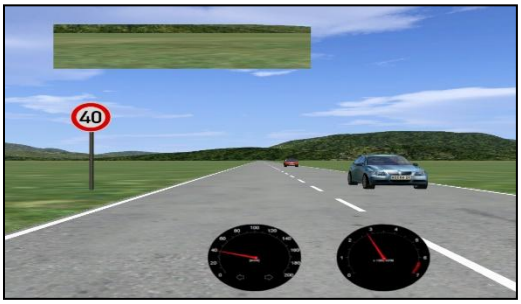



**Figure 1: The Integrated CabinDS System**

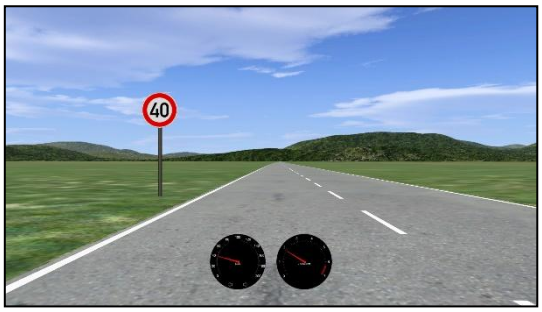
SILAB Version 5.0 was used as the simulation software in the development of the driving scenarios. It is a comprehensive driving simulation software package that consists of several programs that interact each other such as simulation preparation, test configuration, simulation realization and evaluation. Three different driving scenarios were designed in this study, which were free flow (40 km/h) with medium traffic volume, free flow (40 km/h) without traffic and traffic jam. Figure 2 presents an illustration of the designated driving scenarios.



(a) Traffic jam




(b) Free flow (40 km/h) with medium traffic volume




(c) Free flow (40 km/h) without traffic

**Figure 2: Illustration of The Simulation Scenarios**

Driving was performed in a simulated traffic condition and the Detection Response Task (DRT) was used in a dynamic setting. Participants performed the driving task and the secondary tasks concurrently according to road conditions. Stimulus presentations for the DRT were controlled

by the DRT software. Tactile Detection Response Task (TDRT) was used in the study. The stimulus was presented at temporal intervals randomly, uniformly distributed between three and five seconds. The stimulus stayed on for a maximum time of one second. If the participant responded while a stimulus was on, that stimulus would be extinguished at the moment of response. TDRT consists of a 3.68 $cm^2$ vibrotactile pad (tactor) that provided the stimulus. Participants responded by pressing a microswitch attached to the right index finger. Participants responded by pressing the switch to the steering wheel. The microswitch provided mechanical feedback indicating that a response has been made.

Mobile phone usages with conversation and tactile tasks were applied in the study as secondary tasks. For different conversation task, the contents of conversation were in emotional and non-emotional (i.e. factual) conditions with hands-free and hand-held mobile phone. There was an emotion induction procedure to induce emotional moods while converse using mobile phone. Participants were asked to read a short passage and watch short videos designed to make them angry, and then write for 12 minutes about a past experience that make them angry [35,36]. Then, the conversation revolved around the past experience to preserve their anger. For the factual condition, questions and answers methods were involved in the conversation that related to the histories and facts. Every conversation took about 2 minutes to be completed. Figure 3 shows the conversation task that using hand-held mobile phone.



**Figure 3: Conversation Task Using Hand-Held Mobile Phone as A Secondary Task**

Figure 4 illustrates the procedure of this study. Each participant required approximately one and a half hours to perform the procedures. Participants were given some guidelines and instructions before training and executing the procedures of the experiment. Prior to detailed briefing, participants were given an overview of the experiment, its expected duration and the procedures. Researchers emphasised that the intention of the experiment was not to test participants' skills and explained the secondary task, also the general principles behind the study. Participants were instructed to focus on the primary task (driving) and do their best to perform the DRT and the secondary tasks under evaluation. Participants were reminded that continuously pressing the button regardless of stimulus presentation would not yield better performance results. Participants were also asked to fill out the informed consent and personal detail forms.

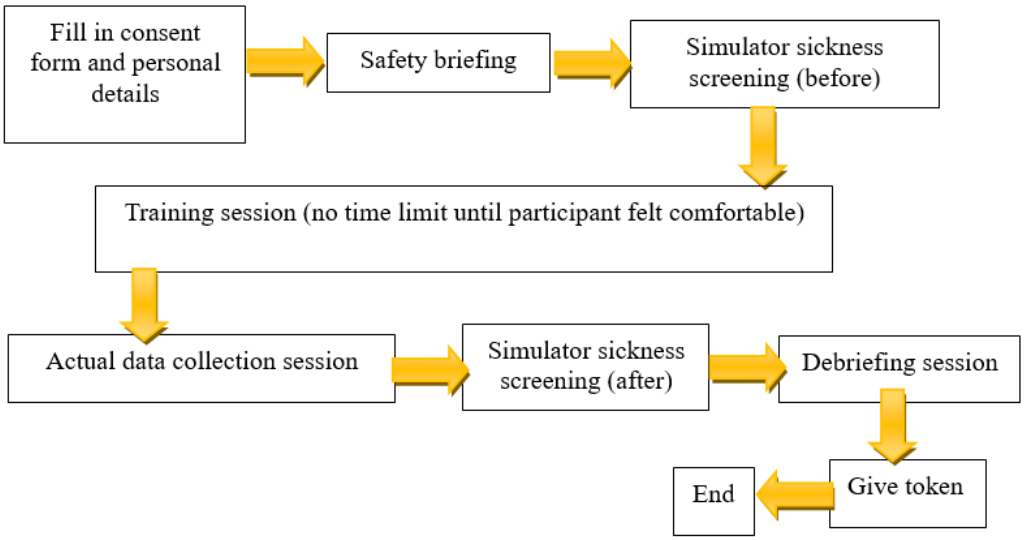



**Figure 4: Procedure of The Study**

Safety briefing was given to participants before the data collection was conducted. The important safety elements include the importance of driving safely and adhering to the speed limit. The prohibition of using mobile phones while driving, emergency response measures and provision of accident compensation were emphasised to the participants. In addition, participants also completed the informed consent and personal details form. Participants were subjected to simulator sickness screening prior to the experiment. The purpose of the screening was to ensure participants were well, fit and capable to drive the driving simulator. Participants were asked some questions related to their wellness such as conditions of general discomfort, fatigue, headache, eyestrain, focus difficulty, salivation increase, vertigo, sweating, nausea, concentration difficulty, head fullness, blurry vision, and dizziness when repeatedly opening and shutting their eyes.

As depicted in Figure 4, after participants were tested for simulator sickness screening, they were subjected to a training session. During this session, participants performed the secondary task (i.e. conversation tasks) without driving, get themselves accustomed to the simulator and the DRT device. Participants were not given time limit during this training session but the session was stopped when participants felt comfortable performing the tasks. Participants can stop the training session without coercion. During the actual data collection session, participants needed to complete all tasks and allowed to stop the experiment without coercion.

Participants were also subjected to post simulator sickness screening after they have completed the actual data collection. Participants were asked some questions related to their wellness. The purpose of the post simulator sickness screening was to ensure that participants were feeling well after the experiment and the same procedures applied for the pre-sickness screening. Upon completion of all experiment tasks, participants were interviewed about their driving experience. Participants were thanked and rewarded for their participation.

## Results and Discussion

Figure 5 shows the percentage of stimuli participants responded to when doing the secondary tasks for three respective driving scenarios. Participants responded most to the stimuli presented in the baseline condition – 96.9% in the 40 km/h situation with relative medium traffic volume, marginally 0.5% lower in the 40km/h situation without traffic, and slightly lower in the traffic jam scenario. The percentage of stimuli responded were lower than the baseline in the other four conversation related conditions. Inspection of Figure 5 suggests that, within each traffic situation, participants responded to the least stimuli during the emotional conversation without holding the phone, followed by emotional conversation while holding the phone. Participants responded relatively equal frequent to the other conditions involving factual conversations.

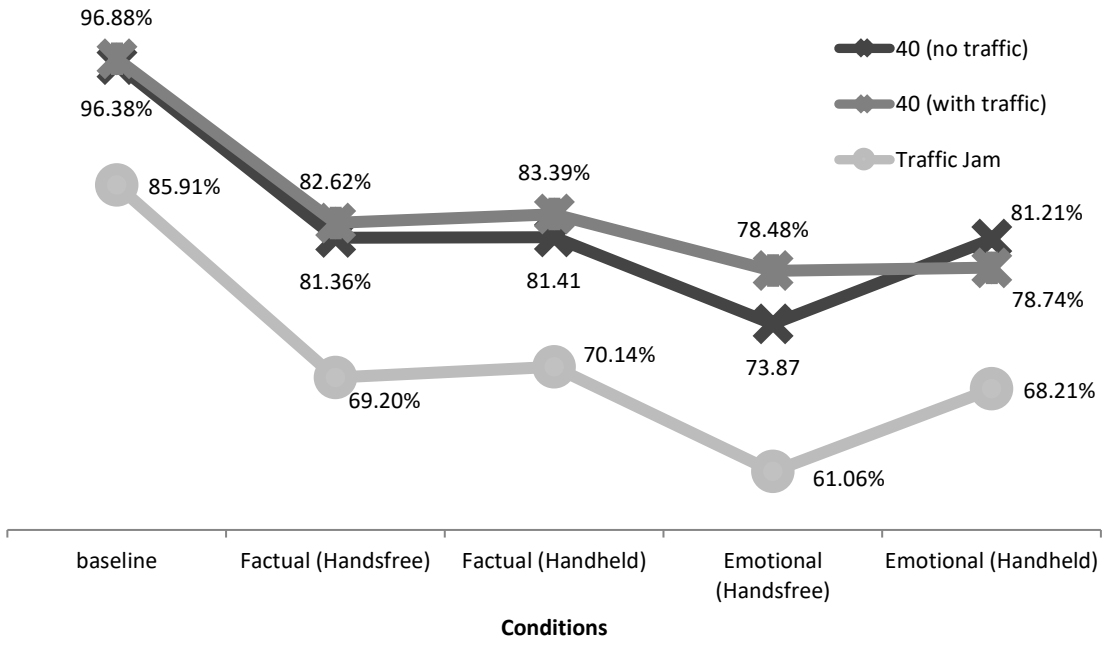



**Figure 5: Percentage of Stimuli Responded for Each Conversation Related Condition Based on Driving Scenarios**

To proceed with the analysis, the result of response time was subjected to mixed factorial repeated-measures ANOVA procedure to study for mean differences of response time with respect to various conversations, and driving scenarios, and any potential interaction.

As Mauchly's test indicated a violation to the assumption of sphericity for the main effect of conversation conditions, $X^2(9) = 24.84$, $p = .001$; the associated degree of freedom in the ANOVA was corrected using Greenhouse-Geisser estimates of sphericity. The results of the test revealed a significant main effect of conditions on response time, $F(3.21, 170.08) = 41.80$, $p < .001$. Further, simple contrasts revealed that response time for all conversation conditions are significantly higher than the baseline, $F_{baseline\ vs.\ factual\ (handsfree)}(1, 53) = 115.31$; $F_{baseline\ vs.}$

*factual (handheld)*(1, 53) = 93.27; $F_{baseline\ vs.\ emotional\ (handsfree)}$(1, 53) = 89.13; $F_{baseline\ vs.\ emotional\ (handheld)}$(1, 53) = 82.89; all pairs had $p < .001$.

Main effect of driving scenarios on response time was also significant, F(1.70, 90.28) = 89.86, p < .001; with significant contrasts between traffic jam and both 40 km/h scenarios, F(1, 53) = 120.51, p < .001; and F(1, 53) = 102.04, p < .001; respectively. There was also a significant interaction effect between conversation conditions and driving scenarios, F(5.79, 306.64) = 2.60, p = .02 (Greehouse-Geisser corrected). Figure 6 depicts these results. Response time for traffic jam scenario were longer than both 40 km/h driving scenarios across all conversation conditions.

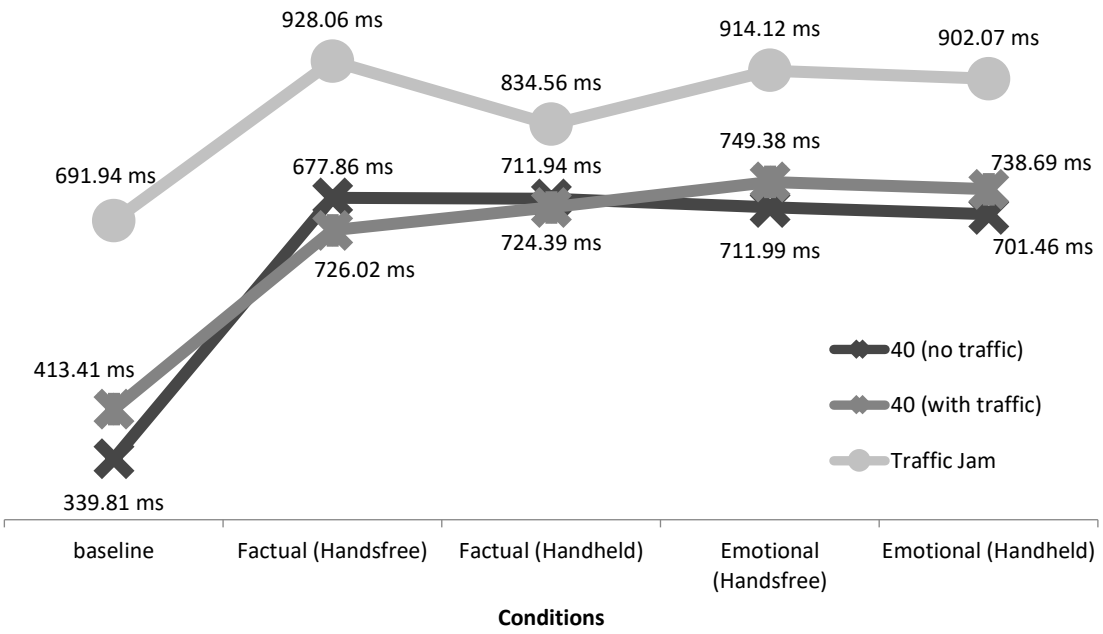



**Figure 6: Response Time (Milliseconds) For Each Conversation Related Condition Based on Driving Scenarios**

The analysis continued with investigation involving between-subject variables – gender and age group. The age group was defined as novice (less than 4 years driving experience and age between 18-24 years) and experience (more than 10 years driving experience and age between 30-59 years).

The main effects of gender and age group on response time during conversation conditions were both non-significant: $F(1, 52) = 2.20$, $p = .14$ for gender; and $F(1, 52) = 3.87$, $p = .06$ for age group. The only interaction effect involving response time during conversation was only between age group and conversation conditions $F(3.11, 161.90) = 3.51$, $p = .02$. The remaining pairs had no significant interactions: between gender and traffic situations $F(1.71, 89.12) = 2.38$, $p = .11$; between gender and conversation condition $F(3.20, 166.24) = .36$, $p = .80$; and between age group and traffic situations $F(1.71, 88.74) = .34$, $p = .68$. Mean and standard deviations for each condition pair are in Table 1.

**Table 1: Summary of Response Time Means Based on Gender and Age Group for Conversation Related Conditions.**

| Scenario | Character Number | Response Time, *M* (*SD*) milliseconds | | | |
|---|---|---|---|---|---|
| | | Male (*N* = 27) | Female (*N* = 27) | Novice (*N* = 28) | Experience (*N* = 26) |
| 40 km/h (no traffic) | Baseline | 320.86 (141.62) | 362.90 (138.99) | 334.31 (154.52) | 350.03 (126.43) |
| | Factual (HF) | 707.97 (387.94) | 755.15 (289.49) | 611.35 (304.53) | 861.01 (333.32) |
| | Factual (HH) | 667.49 (290.75) | 787.72 (228.65) | 644.35 (255.28) | 817.27 (252.17) |
| | Emotional (HF) | 632.58 (281.92) | 787.59 (370.45) | 684.30 (364.35) | 737.85 (305.68) |
| | Emotional (HH) | 668.33 (306.9) | 727.05 (347.12) | 649.50 (278.63) | 749.59 (368.61) |
| 40 km/h ( with traffic) | Baseline | 412.21 (202.78) | 416.83 (187.57) | 388.57 (193.22) | 442.46 (193.59) |
| | Factual (HF) | 672.15 (283.11) | 688.61 (211.69) | 617.31 (250.46) | 748.30 (230.46) |
| | Factual (HH) | 668.74 (307.87) | 758.40 (314.05) | 598.59 (268.96) | 837.40 (310.82) |
| | Emotional (HF) | 725.75 (447.16) | 766.80 (336.84) | 669.49 (321.81) | 828.97 (448.66) |
| | Emotional (HH) | 683.88 (294.92) | 784.21 (303.98) | 706.60 (278.11) | 763.60 (326.65) |
| Traffic Jam | Baseline | 628.37 (286.57) | 755.80 (338.06) | 691.91 (312.26) | 692.27 (328.21) |
| | Factual (HF) | 834.22 (389.94) | 1029.33 (400.22) | 899.45 (425.03) | 966.60 (384.37) |
| | Factual (HH) | 775.65 (293.07) | 926.73 (371.32) | 729.37 (295.84) | 982.38 (340.59) |
| | Emotional (HF) | 866.85 (255.96) | 981.35 (351.06) | 871.41 (298.58) | 980.84 (317.25) |
| | Emotional (HH) | 876.56 (332.02) | 932.38 (303.51) | 874.23 (355.29) | 937.04 (271.44) |

Note: HF and HH refer to hands-free and hand-held, respectively

Drivers can get distracted by using mobile phone in several ways while driving. This study used DRT to measure the effects of driving demand and engagement in secondary tasks on driver attention. The secondary task involved conversation task in which emotional and factual conditions were induced during the dialog session between researcher and participants. This task was using hands- free and hand-held mobile phone. The current experimental setup was found to have successfully captured the response time and measured the driving distraction among the participants. A vital finding is that all conversation conditions (i.e. emotion and factual conversation using hands-free and hand-held) are significantly higher than the baseline (i.e. without doing secondary tasks). However, there were no significant difference between hands- free and hand-held mobile phone, also between emotion and factual conversation. This result is aligned with the existing studies conducted by Elvik (2011); Stelling and Hagenzieker (2012), in which indicate that the use of hands-free and hand-held phones yield similar impairment in driving performance as compared to normal driving [37, 38]. In addition, the finding from the study seem to support the results by Beede and Kass (2006) that revealed mobile phone conversation diverts drivers' attention away from components of the driving task that require explicit attentional processing, resulting in longer response times [39]. Strayer and Johnston (2001) also support our finding, in which any mobile phone conversation regardless of emotional conditions negatively affects driving performance [40]. This finding, however, is

contrary to Briggs, Hole and Land (2011) who found the emotional aspects of a conversation increased the level of cognitive workload that may contribute to decrease vehicle control as compared to non-emotional conversation [41]. This opposing result may be due to different distraction measurement used in the study.

Another important finding was that drivers' engagement in the secondary tasks while driving in a challenging driving scenario increased their reaction time to stimuli, which indicate higher level of distraction. Drivers were found to be distracted the most when driving in a traffic jam, compared to a free-flowing traffic scenario. In other words, the level of distraction due to mobile phone usage is worsen by a demanding driving scenario. Although a previous study by Foss and Goodwin (2014) reported no relationship between the frequency of distracted driver behaviours and amount of traffic, our result could indicate potentially higher risk of distracted driving in certain traffic conditions [42]. This risk can be even higher when the secondary tasks are more complex in nature as indicated by the significant interaction effects on participants' response time.

This study has been unable to demonstrate the effect of gender on the level of distraction among drivers, across all variables. Although male drivers were generally faster at responding to the stimuli than their female counterparts, no significant differences were observed in their response time. This outcome is contrary to Irwin, Chekaluk and Geaghan (2011) who found the effect of gender on the level of distraction, measured by driving performances and errors [43]. They found that female drivers were more distracted when conversing on a mobile phone compared to male drivers. Female drivers were also found to make more lateral or lane position errors when distracted. This rather contradictory result may be because of different measure of distraction used in this study.

In the current study, comparing the response time between experience and novice drivers revealed an interesting finding. The novice group was found to respond to the stimuli at significantly quicker rate than the more experience group. This finding was unexpected mainly because being more experienced was established by previous research as a factor that is associated with a greater degree of adaptation to increasingly complex driving environments [44]. A possible explanation for this might be that the effect of experience is not necessarily the same on driving performances, as compared to the level of distraction. In other words, being quicker in responding to stimuli might not guarantee a better driving performance among the novice group, vice versa. Interestingly, Knapper et al. (2015) conclude that experience is not a factor that can solve the safety issues related to distracted driving caused by dual tasking, mainly due to the complexity of the primary task at hand (e.g., driving a moving vehicle) [45].

It is recommended that high-end driving simulator with advanced motion platform and realistic simulation scenarios could be utilised for future study to avoid and reduce the existence of simulator sickness and capable to simulate variety of actual mobile phone usage. For improving the safety of driving, indeed, mobile phones usages while driving should be avoided. Undeniable that the device may be helpful but as good drivers, their safety should not be compromised since it can distract drivers and increase the risk of crash occurrence.

## Conclusion

In a nutshell, the objectives of the study were fulfilled whereby to measure the distraction in term of participants' response time for different conversation task and driving scenarios using a driving simulator. The findings of this research indicate that participants responded to lesser stimuli when dealing with more difficult conversation task. In addition, drivers were more distracted with the more demanding tasks of using mobile phone (i.e. conversation tasks) as compared to baseline. Among three driving scenarios, participants attended the worst in term of stimuli and higher response time in traffic jam scenario. Besides, novice group was identified to respond significantly faster rate than the experience group. This study shows that using mobile phone whilst driving is considered as distracted activity that possibly raises the risk of crash.

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# SUSTAINABLE FORMULATION OF ANIMAL FEED SUPPLEMENT FROM VEGETABLE WASTE AND EXTRACTED OIL FROM CATFISH WASTE: A NUTRITIONAL AND PHYSICOCHEMICAL EVALUATION

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***Abstract:*** *The growing demand for livestock products has led to increased reliance on animal feed supplements, while simultaneously generating large amounts of organic waste from agro-industrial activities. Improper disposal of these by-products, particularly from fish and vegetables, contributes to environmental degradation. This study addresses the problem of food waste management by developing a sustainable animal feed supplement using extracted oil from catfish waste and vegetable residues. The methodology involved Soxhlet extraction of oil from catfish processing waste, which was then combined with powdered vegetable waste, eggshell powder, starch, soy lecithin, and distilled water. The supplement was formulated in powder form and evaluated for key physicochemical and nutritional parameters such as pH, moisture content, crude fat, protein, ash, crude fiber, and carbohydrates. Results showed that the formulated feed had comparable pH (6.10) and moisture content (7.35%) to commercial feed. It also contained higher crude fat (31.14%), ash (30.11%), and fiber (7.26%) values, indicating enhanced nutritional potential. Protein and carbohydrate content remained within acceptable ranges, though slightly lower than commercial alternatives. In conclusion, the formulated supplement is a viable, sustainable alternative to conventional animal feed, offering nutritional adequacy while supporting environmental sustainability through waste valorization.*

***Keywords:*** *Animal Feed, Fish Oil Waste, Vegetable Residues, Sustainability, Proximate Analysis*

## Introduction

The global increase in livestock production has generated a growing demand for high-quality animal feed. Simultaneously, agro-industrial and fishery sectors contribute significantly to organic waste, including vegetable residues and fish by-products. These waste streams, if not properly managed, result in environmental challenges such as methane emissions, water contamination, and increased landfill use (Rajeh et al., 2021). The disposal of organic waste without recovery not only wastes valuable nutrients but also contributes to climate change.

Catfish processing generates substantial amounts of oil-rich waste that is typically discarded despite containing essential fatty acids such as omega-3s, known to benefit animal growth and immunity (Jansen et al., 2021). Likewise, vegetable residues from agricultural and retail sectors are nutrient-dense, containing vitamins, minerals, and fiber that could enhance livestock nutrition (Kumar et al., 2023). Transforming these waste materials into value-added animal feed supplements aligns with sustainable development goals and supports circular economy practices in agriculture (Gasco et al., 2020).

Organic waste from aquaculture and vegetable processing remains underutilized in many developing regions, despite its nutritional potential. Current animal feed formulations often rely on costly imported ingredients, which increases production costs and environmental burdens. Moreover, the lack of sustainable alternatives limits innovation in the feed industry. There is a critical need to develop local, affordable, and eco-friendly animal feed supplements that reduce environmental impact while maintaining or improving nutritional quality. This study explores the integration of catfish waste oil and vegetable residues into animal feed to address these challenges.

The main objective of this study is to formulate an animal feed supplement utilizing vegetable waste and extracted oil derived from catfish waste. This study aims to evaluate the nutritional composition, such as protein, fat, and moisture content, and assess the physicochemical properties of the developed feed. In addition, this study aims to compare the nutritional quality and physicochemical characteristics of the formulated supplement with commercial animal feed products.

## Literature Review

In recent years, the valorization of food and agricultural waste has garnered significant attention due to its dual potential for environmental sustainability and cost-effective animal nutrition. The global increase in organic waste generation, especially from agro-industrial processes, has led researchers to explore its recovery as a feed resource (Rajeh et al., 2021). These waste materials, often rich in bioactive compounds, can serve as functional ingredients in livestock diets while reducing reliance on conventional, imported feed sources.

Vegetable waste including peels, leaves, stems, and unsellable produce has been recognized for its nutrient density and bioavailability. According to Kumar et al. (2023), vegetable residues are a viable source of fiber, antioxidants, vitamins, and essential minerals. Their incorporation into feed not only provides nutritional benefits but also promotes waste reduction in line with sustainable agricultural practices.

Fish waste, particularly from catfish and other aquaculture species, is rich in essential fatty acids such as EPA and DHA. Jansen et al. (2021) found that omega-3-rich fish oil contributes to improved immune function, fertility, and growth performance in livestock. This supports the potential of catfish oil waste as a valuable input for feed formulation, especially in developing regions with growing aquaculture output.

Eggshell waste, typically discarded in household and industrial kitchens, is a cost-effective source of calcium and trace minerals. Marone and Varese (2022) emphasized the importance of eggshell powder in improving bone health in animals due to its high bioavailable calcium content. This aligns with the need for natural mineral supplementation in feed formulations.

From a circular economy perspective, the combination of these waste materials aligns with the broader goals of reducing food loss and promoting resource efficiency. Gasco et al. (2020) stressed that integrated feed solutions using organic waste can significantly reduce greenhouse gas emissions associated with conventional feed production while enhancing feed security in low-resource settings.

Furthermore, Faridi and Arabhosseini (2021) highlighted that the formulation of animal feed from combined waste sources contributes to economic savings and ecological resilience, particularly in areas lacking access to high-cost commercial feed.

## Methodology

This study was conducted in several phases, including sample preparation, feed formulation, and analytical testing. Vegetable waste (kale, cabbage, carrot), catfish waste, eggshells, soy lecithin, starch, and distilled water were used. Vegetable waste and eggshells were collected from local markets and dried before processing. Oil was extracted from catfish waste using the Soxhlet extraction method with petroleum ether as the solvent. The process was conducted at 60°C for 6 hours. Extracted oil was stored in airtight containers at 4°C until further use. Then, the dried vegetable waste was ground into powder using a mechanical grinder. Eggshells were cleaned, oven-dried at 60°C for 2 hours, and ground into fine powder. Dry ingredients were mixed first, followed by the addition of fish oil and soy lecithin. Distilled water was gradually added to bind the ingredients. The mixture was homogenized and air-dried to produce a powder supplement. The feed supplement was formulated according to the following ratio:

**Table 1: Formulation of Animal Feed Supplement**

| Ingredients | Formulation |
|---|---|
| Vegetable Waste Powder | 57% |
| Egg Shell Powder | 10% |
| Fish Oil | 7% |
| Starch | 15% |
| Soy Lecithin | 5% |
| Distilled Water | 6% |
| Vegetable Waste Powder | 57% |
| **TOTAL** | **100%** |

The formulated animal feed supplement produced was shown in Figure 1. The psychochemical properties such as moisture content and pH Measurement and the nutritional content of the formulated animal feed supplement was analysed. All analyses were conducted in triplicate, and data were statistically analysed using SPSS to determine significant differences at $p<0.05$.



**Figure 1: The formulated animal feed supplement**

## Results and discussion

### *Moisture Content*

Moisture content is a critical factor in evaluating the quality and shelf stability of animal feed products. Table 2 shows the sample animal feed supplements through moisture content analysis by using a moisture content analyzer to measure the level of moisture in the animal feed supplement. The analysis in Table 2 shows that the formulated animal feed supplement recorded a moisture content of 7.35%, while the commercial supplement had a similar value of 7.34%. These values are well below the maximum threshold of 11.5% recommended for cattle feed, ensuring microbial stability and prolonged shelf life (Kumar et al., 2023). Low moisture content is beneficial as it reduces the risk of spoilage, microbial growth, and nutrient degradation during storage (Gasco et al., 2020). However, moisture can still be introduced during processing, packaging, or due to environmental humidity, necessitating consistent quality control throughout production. Maintaining optimal moisture levels is also essential for ease of mixing and palatability of feed (Faridi & Arabhosseini, 2021).

**Table 2: Moisture Content (%)**

| Animal Feed Supplement | Moisture Content (%) |
|---|---|
| Formulated Animal Feed Supplement | 7.35± 0.74 [a] |
| Commercial Animal Feed Supplement | 7.34± 1.16 [a] |

The significant differences ($p<0.05$) between means represented by different letters within column

### *pH Value*

The pH analysis was performed to determine the pH value of animal feed supplements. Table 3 shows that there was a significantly difference between the pH value of formulated animal feed supplement and commercial animal feed supplement with the formulated animal feed supplement. As shown in Table 3, the pH value of the formulated feed (6.10) was slightly higher than that of the commercial product (5.58), yet still within the acceptable range of 6.0

to 7.0. This range supports the stability of the supplement and aligns with the optimal pH for most phytase activity in animal digestion (Jansen et al., 2021). A stable pH in animal feed enhances nutrient absorption and helps maintain gut health in livestock, which is especially important in poultry production.

**Table 3: Mean pH Analysis Test**

| Animal Feed Supplement | pH |
|---|---|
| Formulated Animal Feed Supplement | $6.10 \pm 0.01^{a}$ |
| Commercial Animal Feed Supplement | $5.58 \pm 0.02^{b}$ |

The significant differences ($p<0.05$) between means represented by difference letter within column

***Proximate Analysis***

Proximate composition analysis provides a foundational understanding of the nutritional value and quality of animal feed products. It involves the determination of key macronutrients and components such as moisture, crude fat, crude protein, ash (mineral content), crude fiber, and carbohydrates. These components not only influence the metabolic performance and health of livestock but also determine the feed's energy content, digestibility, and storage stability. According to Faridi and Arabhosseini (2021), accurate proximate profiling is crucial for ensuring that formulated feed supplements meet the nutritional requirements for targeted animal species. In this study, both the formulated and commercial animal feed supplements were analyzed and compared using standardized methods to evaluate their nutritional equivalency and potential as a sustainable alternative. The result for proximate composition analysis obtained was shown in Table 4.

**Table 4: Proximate Composition Analysis Test**

| Sample | Formulated Animal Feed Supplement | Commercial Animal Feed Supplement |
|---|---|---|
| Crude Fat | $31.14 \pm 1.41^{a}$ | $29.70 \pm 2.01^{a}$ |
| Protein | $2.48 \pm 0.94^{a}$ | $2.96 \pm 2.87^{a}$ |
| Total Ash (Mineral) | $30.11 \pm 1.55^{a}$ | $23.90 \pm 2.67^{b}$ |
| Crude Fiber | $7.26 \pm 0.82^{a}$ | $2.41 \pm 0.01^{a}$ |
| Carbohydrate | $21.57 \pm 0.95^{a}$ | $33.69 \pm 1.31^{b}$ |

The significant differences ($p<0.05$) between means represented by difference letter within column

***Crude Fat***

Crude fat is an essential energy source in animal feed, contributing significantly to the metabolic needs and growth performance of livestock. In this study, the formulated animal feed supplement exhibited a higher crude fat content (31.14%) compared to the commercial supplement (29.70%). This increase is primarily attributed to the inclusion of catfish oil, a lipid-rich by-product known for its high levels of omega-3 fatty acids such as EPA and DHA (Alfio et al., 2021). These fatty acids play a vital role in enhancing immune response, reproductive health, and the overall growth rate in animals (Jansen et al., 2021).

***Crude Protein***

Protein is a fundamental component for the development of animal tissues and metabolic regulation. The protein content of the formulated feed (2.48%) was slightly lower than that of

the commercial feed (2.96%). Despite the lower percentage, the difference was not statistically significant and still falls within the acceptable range for supplemental feeding. According to Gasco et al. (2020), plant-based waste materials such as vegetable residues may offer limited protein, necessitating potential enrichment with additional protein sources for optimal growth performance. Future formulations could benefit from combining protein-rich organic materials, such as legumes or insect protein, to balance nutritional content.

### *Ash Content*

Ash content represents the total mineral matter present in feed, which includes essential elements like calcium, potassium, and magnesium. The formulated animal supplement demonstrated a significantly higher ash content (30.11%) compared to the commercial anima; feed (23.90%). This increase is likely due to the inclusion of eggshell powder and mineral-rich vegetable waste, both of which enhance the mineral profile of the feed. Marone and Varese (2022) confirmed that eggshell waste is a valuable and bioavailable source of calcium that supports bone development and metabolic health in livestock. A high mineral profile is especially beneficial for poultry and ruminants during growth and reproduction phases.

### *Crude Fiber*

Crude fiber plays an important role in maintaining digestive health and intestinal motility in animals. The formulated feed recorded a crude fiber content of 7.26%, significantly higher than the 2.41% observed in the commercial feed. This can be attributed to the high fiber content of the vegetable residues used in the formulation, such as kale, cabbage, and radish leaves. According to Kumar et al. (2023), dietary fiber enhances gut health, nutrient absorption, and reduces the incidence of gastrointestinal disorders in livestock. A fiber-enriched feed is particularly beneficial for ruminants and monogastric animals under stress or poor digestive conditions.

### *Carbohydrates*

Carbohydrates are the primary source of energy in most animal diets. The formulated feed contained 21.57% carbohydrates, which is lower than the 33.69% recorded in the commercial product. Although lower, the carbohydrate content in the formulated supplement is balanced by higher levels of fat and fiber, which can also serve as energy sources. According to Faridi and Arabhosseini (2021), a feed with diverse macronutrient sources can enhance energy efficiency and reduce the risk of metabolic imbalance. Future enhancements could consider starch-rich additives to improve the energy density of the formulation.

## Conclusion

This study successfully formulated and evaluated a sustainable animal feed supplement using vegetable waste and extracted oil from catfish waste. The formulation process involved the integration of agro-industrial by-products including fish oil, vegetable powder, eggshell powder, and starch into a powdered supplement that was analyzed for key nutritional and physicochemical properties. The results demonstrated that the formulated feed supplement demonstrated comparable pH and moisture content to commercial feed products, ensuring its stability and suitability for storage. Importantly, the feed showed higher levels of

crude fat, total ash (mineral content), and crude fiber, indicating improved nutritional potential and added functional benefits. Although the protein and carbohydrate contents were slightly lower than the commercial benchmark, it remained within acceptable limits for livestock consumption. These findings highlight the feasibility of using vegetable waste and aquaculture waste into a cost-effective, nutrient-enriched feed supplement that supports animal growth and environmental sustainability.

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# PERSUASIVE COMMUNICATION IN MULTILINGUAL CUSTOMER SERVICE: SOCIOCULTURAL INFLUENCES IN SABAH'S TOURISM HUB

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***Abstract:*** *Persuasive communication is a vital component of customer service interactions, especially in multilingual and culturally diverse environments. This empirical study examines how sociocultural factors influence persuasive strategies employed by customer service professionals in Kota Kinabalu, Sabah, a major Malaysian tourism hub. While research on intercultural communication and workplace discourse has expanded, limited empirical work addresses persuasion within frontline service encounters in East Malaysia. To bridge this gap, the study adopts a mixed-methods approach, combining surveys and semi-structured interviews with frontline employees from hospitality and tourism sectors. Findings reveal that persuasive strategies are frequently used and widely regarded as essential for achieving service outcomes. However, sociocultural differences such as linguistic variation, cultural norms of politeness, and differing perceptions of value, often lead to communication challenges and misunderstandings. These difficulties were most pronounced with customers from China, Korea, and Europe, reflecting the city's international visitor profile. Participants unanimously emphasized the need for structured training in intercultural communication, conflict resolution, and complaint management to enhance persuasive effectiveness. This study contributes to applied linguistics and workplace communication scholarships by demonstrating how persuasive discourse is mediated by sociocultural conditions in multilingual service settings. Practical implications include integrating sociocultural competence into English for Specific Purposes (ESP) curricula and professional development programs for customer-facing industries. The findings underscore the importance of equipping service professionals with strategies that combine linguistic proficiency and cultural awareness to improve persuasive communication in Sabah and similar multilingual tourism destinations.*

***Keywords:*** *Persuasive Communication; Sociocultural Competence; Multilingual Customer Service; Intercultural Communication; Tourism and Hospitality Industry*

## Introduction

Customer service interactions in multilingual tourism destinations rely heavily on persuasive communication, as frontline employees must not only provide information but also influence customer decisions, manage expectations, and resolve problems in real time. In Kota Kinabalu, Sabah, a major tourism hub in East Malaysia, persuasion is embedded within everyday service encounters across hospitality, and tourism sectors. These interactions occur in a linguistically rich environment where English, Malay, Mandarin, and local languages such as Kadazan-Dusun, Bajau, and Suluk coexist alongside the languages of international visitors. While

multilingualism is often regarded as an asset, it introduces sociocultural complexity that shapes how persuasive messages are constructed, interpreted, and negotiated.

In applied linguistics, persuasive communication is understood not merely as a strategy for influencing attitudes or behaviors but as a socially situated practice shaped by cultural norms, interactional expectations, and interpersonal goals. Recent studies have expanded the concept of persuasion beyond classical rhetoric, emphasising its pragmatic and relational dimensions (Ishihara & Cohen, 2021; McConachy & Liddicoat, 2022). In service settings, persuasion involves presenting options, reframing concerns, managing objections, building rapport, and maintaining a positive face for both parties. These actions depend on the speaker's ability to interpret sociocultural cues and adapt communication strategies accordingly.

In Southeast Asia, culturally grounded communication styles such as indirectness, relational politeness, and high-context meaning-making strongly influence persuasive discourse (Haugh, 2010; McConachy & Liddicoat, 2022). However, customer service employees in Kota Kinabalu frequently interact with customers whose expectations of politeness, assertiveness, and value differ markedly from local norms. This creates a dynamic communicative environment where persuasion is not simply a linguistic task but a continuous process of negotiating meaning across diverse cultural frames.

Despite extensive research on tourism communication and intercultural service encounters globally, empirical studies focused on East Malaysia remain scarce. Most Malaysian studies concentrate on Peninsular Malaysia, leaving a significant gap regarding Sabah's unique sociolinguistic landscape. This gap is noteworthy because Sabah's tourism profile differs substantially: it attracts high volumes of visitors from China, Korea, Europe, Australia, and domestic tourists from Peninsular Malaysia, each bringing distinct communicative expectations and interactional preferences.

Against this backdrop, the present study examines how sociocultural factors influence persuasive communication among customer service professionals in Kota Kinabalu. Specifically, it investigates employees' perceptions of persuasive communication, the challenges they encounter, and the training they consider necessary to enhance persuasive effectiveness. By integrating insights from sociocultural theory, intercultural pragmatics, and workplace communication research, this study contributes to a deeper understanding of persuasion as a context-sensitive communicative practice in multilingual service environments.

The objective of this study is to identify how sociocultural factors influence the persuasive communication practices of customer service employees in Kota Kinabalu, Sabah. This focus aligns with ongoing shifts in applied linguistics that foreground the role of sociocultural knowledge, pragmatic adaptability, and intercultural competence in workplace communication. The findings also hold practical relevance for English for Specific Purposes (ESP), vocational training, and customer service education, providing empirically grounded insights into the communicative demands of Sabah's tourism and hospitality industries.

## Literature Review

### *Persuasive Communication in Multilingual Service Encounters*

Persuasive communication is central to service-oriented industries, where employees must influence customer decisions, frame options, and negotiate expectations. In multilingual contexts, persuasion becomes more complex due to linguistic diversity and differences in communicative styles (Fan et al., 2021). Contemporary research views persuasion not merely as a transactional act but as an interpersonal process tied to rapport-building, face management, and alignment with customer values (Haugh, 2010; Ishihara & Cohen, 2021). Vásquez (2011) emphasizes that persuasive service communication increasingly involves digital and hybrid interactions, requiring greater pragmatic flexibility. Recent studies also highlight the growing importance of digital strategies in service encounters (Lee & Oh, 2024).

### *Sociocultural Theory and Pragmatic Adaptation*

Sociocultural theory provides a useful lens for understanding how language use is shaped by cultural norms, social practices, and interactional histories (Lantolf & Thorne, 2006). Within customer service settings, persuasive strategies are deeply embedded in culturally grounded expectations of politeness, assertiveness, and value negotiation (McConachy & Liddicoat, 2022). Employees must draw on sociocultural resources to adapt their communication in ways that are perceived as appropriate and effective by customers from diverse backgrounds. Recent research highlights pragmatic adaptability as a critical component of successful persuasion in intercultural contexts (Ishihara & Cohen, 2021). Misinterpretations of sociocultural expectations such as norms surrounding directness, disagreement, or expressions of appreciation, often lead to persuasion failures, resulting in customer dissatisfaction and service breakdowns. Emerging research on persuasion systems identifies key variables and techniques for designing effective communication strategies (Braca & Dondio, 2022). These theoretical insights complement applied linguistics perspectives by emphasising the role of structured frameworks in shaping persuasive outcomes.

### *Persuasion and Intercultural Pragmatics: Emerging Evidence*

Recent studies have begun to explore the intercultural pragmatics of persuasion in tourism and hospitality contexts. For instance, Zhang et al. (2025) found that Chinese tourists respond more positively to persuasive messages framed within collectivist values, such as group benefit, relational harmony, and respect for hierarchy. Similarly, research on Korean consumer interactions suggests that clarity and efficiency are prioritized over indirectness, creating challenges for Southeast Asian service workers accustomed to high-context communication styles (Kim & Park, 2022). Vásquez (2023) further notes that persuasive communication increasingly occurs through digital and hybrid platforms, requiring even greater pragmatic flexibility from service professionals. These findings collectively highlight the need for adaptive strategies that account for cultural variability in persuasive discourse.

### *Sabah's Tourism Communication Landscape*

Although research on tourism communication in Malaysia has grown, studies focusing on Sabah remain limited. Existing work indicates that Sabah's tourism workforce interacts daily with Chinese, Korean, and Western tourists, each bringing distinct interactional norms and expectations. English often serves as a lingua franca in these encounters; however, pragmatic challenges persist, particularly in tasks involving persuasion and negotiation. Despite the region's linguistic diversity and its status as a major tourism hub, no empirical study to date

has examined persuasive communication specifically within Sabah's customer service sector. This gap underscores the originality and relevance of the present research, which seeks to address an underexplored dimension of workplace discourse in East Malaysia.

### *Conceptual Framework*

The conceptual framework for this study is grounded in Sociocultural Theory (Lantolf & Thorne, 2006) and Intercultural Pragmatics (McConachy & Liddicoat, 2022; Ishihara & Cohen, 2021), which collectively emphasize that language use and communicative effectiveness are shaped by cultural norms, social practices, and interactional expectations. Persuasive communication in multilingual service encounters is not a static skill but a dynamic process that requires employees to navigate linguistic diversity and sociocultural variability while maintaining service goals.

This framework conceptualizes persuasive communication as operating within three interrelated dimensions. The first dimension, linguistic resources, refers to employees' ability to draw on multilingual proficiency and code-switching strategies to accommodate diverse customer needs. The second dimension, sociocultural competence, involves awareness of cultural norms, politeness strategies, and value orientations that influence how persuasive messages are interpreted. The third dimension, pragmatic adaptability, reflects the capacity to adjust speech acts and persuasive tactics in response to differing expectations of directness, assertiveness, and relational harmony.

These dimensions interact within the broader tourism service context, which includes hospitality, retail, and tourism sectors in Kota Kinabalu. Sociocultural factors such as linguistic diversity and cultural norms mediate the effectiveness of persuasive strategies, while communicative outcomes feed back into employees' adaptation processes. This cyclical relationship underscores the need for training programs that integrate linguistic proficiency with sociocultural and pragmatic awareness to enhance persuasive effectiveness in multilingual environments.

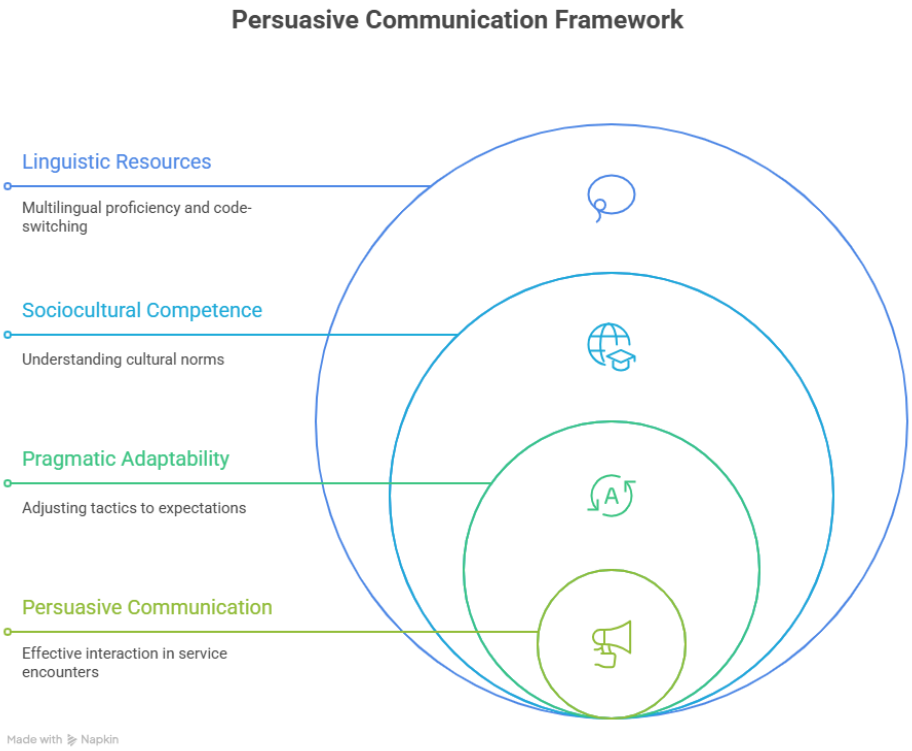



**Figure 1: Persuasive Communication Framework**

## Methodology

### *Research Design*

This study adopted a qualitative-dominant mixed-method design that combined survey data with semi-structured interviews. This approach was chosen to capture both the breadth of patterns in persuasive communication and the depth of sociocultural influences shaping these practices. The mixed-method design aligns with the study's objective of examining how sociocultural factors mediate persuasive strategies in multilingual customer service interactions. While surveys provided quantitative insights into attitudes, frequency of strategy use, and perceived challenges, interviews offered rich qualitative data on real-life experiences and pragmatic adaptations in service encounters.

### *Participants*

Participants comprised frontline employees from three key sectors: hospitality (hotel staff), tourism services (tour operators, travel counters, and attraction personnel), and retail and sales. All participants were based in Kota Kinabalu, Sabah, a major tourism hub characterised by high linguistic diversity and frequent intercultural interactions. The sample size of 20 was determined to ensure representation across sectors while maintaining feasibility for in-depth qualitative analysis. Participants were selected using purposive sampling to include individuals with direct customer-facing roles, as these positions require frequent use of persuasive communication.

### *Instruments*

Two instruments were employed: a structured survey and semi-structured interviews. The survey was designed to elicit participants' attitudes toward persuasive communication, the frequency with which they employ persuasive strategies, perceived sociocultural challenges, and training needs. This instrument provided a quantitative overview of patterns across the sample.

The interviews explored participants' lived experiences in greater detail, focusing on real-life examples of persuasive interactions, cultural misunderstandings, differences in communication expectations, and strategies used with diverse customer groups. Interview questions were informed by themes identified in the literature review, such as politeness norms, pragmatic adaptability, and intercultural negotiation.

### *Data Analysis*

Survey data were analyzed using descriptive statistics to identify trends in attitudes, frequency of strategy use, and perceived challenges. Qualitative data from interviews were transcribed and coded inductively following thematic analysis principles. Coding focused on identifying recurring sociocultural themes, such as linguistic accommodation, cultural expectations of politeness, and strategies for managing misunderstandings. This dual approach allowed for triangulation of findings, enhancing the validity and depth of interpretation.

## Findings

This section presents the results of the study, integrating quantitative survey data with qualitative insights from semi-structured interviews. The findings are organized around four core dimensions: the perceived importance and frequency of persuasion in customer service roles, sociocultural factors that facilitate or hinder persuasive communication, sources and consequences of communicative breakdowns, and training needs identified by participants. Quantitative data provide a macro-level view of employee perceptions, while qualitative excerpts offer deeper insight into how persuasion is enacted and negotiated in multilingual service encounters.

### *Importance and Frequency of Persuasive Communication*

Survey results revealed a strong consensus regarding the centrality of persuasion in customer-facing roles. Approximately 80% of respondents strongly agreed that persuasion is both important and frequently used in daily interactions, while the remaining participants reported agreement or neutrality. Notably, no respondents disagreed with this statement, indicating a uniformly positive orientation toward persuasion as a communicative skill.

Interview data confirmed these findings. Frontline employees consistently described persuasion as a "daily necessity," particularly in tasks such as handling complaints, recommending products or services, offering upgrades, and managing dissatisfaction. One participant from the hospitality sector explained:

> *"Every shift requires persuasion... from convincing guests to accept alternative room arrangements to calming them when something goes wrong. It's not optional; it's part of the job."*

These accounts reinforce the argument advanced in the literature that persuasion constitutes a key element of service work, where employees function not only as information providers but also as relationship builders and problem solvers.

### *Sociocultural Factors Shaping Persuasive Success*

#### *Language Differences*

A prominent theme emerging from both data sets concerns the role of linguistic differences in shaping persuasive effectiveness. Respondents consistently indicated that language proficiency gaps, particularly when interacting with customers from non-English-speaking countries, frequently impeded successful persuasion. Participants noted that customers from China and Korea often had limited English proficiency, necessitating simplified explanations, repetition, and reliance on nonverbal strategies.

The multilingual ecology of Sabah, where English, Malay, Sabah Malay, Mandarin, and indigenous languages circulate simultaneously, was also highlighted. While multilingualism can serve as a communicative resource, employees reported that mismatches in language choice sometimes triggered misunderstanding. One tourism staff member observed:

> *"When customers don't understand my English explanation, they assume I'm trying to trick them. I'm not—it's just the language barrier. But it affects trust."*

This finding resonates with intercultural pragmatics research emphasizing that persuasion is closely tied to perceived clarity, trustworthiness, and linguistic alignment.

#### *Cultural Interpretations of Value and Politeness*

Participants also described how cultural differences shaped expectations regarding politeness, assertiveness, and perceptions of value in service exchanges. European tourists were perceived as preferring direct, efficiency-focused communication, whereas East Asian tourists (e.g., Korean, Chinese, Japanese) were said to value relational warmth and indirectness before accepting persuasive offers.

Respondents reported that upselling attempts were sometimes perceived as "pushy," while polite hesitation or indirectness was viewed as a lack of confidence. These discrepancies often en place frontline staff in challenging positions, requiring real-time adjustments to persuasive strategies. A manager summarized:

> *"Different cultures expect different styles. Sometimes being polite can look weak. Sometimes being direct can look rude. Finding the right tone is the hardest part."*

### *Sources and Consequences of Communication Breakdown*

Both surveys and interviews revealed that communication breakdowns typically arose from three interrelated causes: language gaps, differences in cultural expectations, and misalignment in persuasive framing. Participants shared examples where customers misunderstood promotions, perceived staff behavior as rude or unhelpful, or rejected recommendations due to unclear explanations. These breakdowns sometimes led to negative emotional responses, refusal to cooperate, or escalated complaints to supervisors.

Employees emphasized that breakdowns were rarely due to lack of effort but more often to sociocultural misinterpretations. One hotel front desk officer noted:

> *"When guests get upset because they misunderstand us, we feel frustrated and helpless. We are trying our best, but culture affects everything—tone, timing, even how we solve problems."*

This supports findings in pragmatics and service communication literature indicating that misaligned expectations about politeness and interactional norms often contribute to conflict in cross-cultural service encounters.

### *Training Needs: Intercultural Interaction and Persuasion Skills*

Survey results showed unanimous agreement that structured communication training is necessary to enhance persuasive effectiveness. Three primary areas emerged from the data. First, respondents expressed strong interest in cultural competence training focused on understanding the communication norms of customers from West Malaysia, China, Korea, and Europe. The respondents felt that clearer knowledge of these groups' expectations would significantly improve persuasion outcomes, particularly in high-pressure situations such as complaint handling.

Second, respondents emphasized the need for conflict resolution and complaint management training. Persuasive communication becomes most challenging during conflict, where emotional management, tone, and empathy play vital roles. Many respondents (95%) stated that they lacked knowledge for navigating escalated interactions or recovering from breakdowns.

Finally, all respondents highlighted the importance of general customer service communication skills, including strategic language use, paraphrasing, tone adjustment, rapport-building, and service recovery phrasing. They also viewed persuasion not as a stand-alone skill but as an extension of broader communicative competence that integrates affective management, strategic framing, and relational work.

### *Summary of Key Findings*

Overall, the findings indicate that persuasion is viewed as essential and performed daily across customer service roles. Sociocultural factors, particularly language differences and cultural expectations regarding politeness and value, significantly shape persuasive success. Communication breakdowns frequently stem from mismatched expectations rather than

interpersonal conflict, and participants expressed a strong desire for structured, culturally informed communication training. As mentioned by Ahmad et.all 2024, "Language is a critical factor that helps tourists to communicate and understand local cultures and communities." p. 2456). These results provide the empirical foundation for subsequent discussion and reinforce the relevance of being socioculturally informed about persuasive communication models in multilingual service environments.

**Discussion**

The findings of this study underscore the centrality of persuasive communication as a core resource in multilingual customer service environments in Kota Kinabalu. The strong consensus among respondents that persuasion is both important and frequently used validates previous studies that positions persuasion as integral to service discourse (Vásquez, 2011; Haugh, 2010). Importantly, employees did not conceptualize persuasion merely as a transactional mechanism for promoting products or services; rather, they framed it as an interpersonal strategy essential for building rapport, clarifying expectations, and managing misunderstandings. This interpretation reflects the relational orientation of persuasive practices in Southeast Asian multilingual contexts, where communicative goals often extend beyond instrumental outcomes to include the maintenance of social harmony.

The study's results also reinforce recent developments in intercultural pragmatics, which conceptualize persuasion as a culturally embedded pragmatic act requiring sensitivity to interlocutors' sociocultural orientations and communicative norms (Ishihara & Cohen, 2021; McConachy & Liddicoat, 2022). Employees' accounts of persuasion-related challenges, particularly with customers from China, Korea, and Europe, suggest that breakdowns are frequently rooted in mismatched pragmatic expectations rather than linguistic deficits alone. For instance, what staff perceive as polite indirectness may be interpreted by Western customers as evasiveness, while direct promotional strategies may appear overly assertive to East Asian customers. These discrepancies mirror well-documented cross-cultural differences in politeness orientation, face management, and persuasive framing, as highlighted in prior research (Haugh, 2010).

The multilingual ecology of Kota Kinabalu further complicates these dynamics. While employees navigate English, Malay, Mandarin, and local Sabahan varieties fluidly, linguistic accommodation alone does not guarantee persuasive success. Participants emphasized that cultural interpretations of value and politeness often mediate persuasive outcomes, illustrating that persuasion is fundamentally shaped by culturally grounded perceptions of what constitutes "respect," "value," or "appropriate service." This finding aligns with applied linguistics research demonstrating that persuasive effectiveness depends on congruence between communicative strategies and interlocutor value systems (Holtgraves & Lasky, 1999).

Crucially, the challenges identified were not framed as interpersonal conflicts but as systemic sociocultural and pragmatic gaps, reinforcing the need for workplace training that goes beyond general English proficiency. Participants' recommendations for training, covering cultural norms, conflict resolution, complaint management, and customer-service pragmatics, echo global best practices for enhancing multilingual service quality in tourism and hospitality sectors (Goh & Baum, 2022; Li & Song, 2024). This convergence validates the study's practical contribution: it provides empirical evidence for communication challenges that are

widely acknowledged in industry practice but underrepresented in Malaysian scholarly literature.

The findings also extend the theoretical frameworks underpinning this research. First, they affirm the relevance of sociocultural theory by illustrating how persuasive competence develops through socially situated interactions that require continuous adaptation to linguistic and cultural variability. Second, they support intercultural pragmatics perspectives by demonstrating how employees negotiate meaning and co-construct interactional norms across divergent cultural frames. Finally, they contribute to English for Specific Purposes (ESP) studies by showing that occupational persuasive communication is a multidimensional construct requiring linguistic resources, cultural knowledge, and pragmatic flexibility.

In summary, this study advances empirical understanding of persuasion within Sabah's unique sociolinguistic landscape. It demonstrates that persuasive communication in multilingual service encounters is not a discrete skill but a complex, context-sensitive practice shaped by language, culture, values, and interactional expectations. Addressing these dimensions holistically in training and curriculum design is essential for improving communicative competence and service quality in tourism-driven economies.

## Conclusion

This study examined how sociocultural factors influence persuasive communication among frontline customer service employees in Kota Kinabalu, revealing that persuasion is deeply embedded in the cultural and linguistic dynamics of service encounters. Respondents overwhelmingly recognised persuasion as a critical element of their daily work and reported frequent reliance on persuasive strategies to address customer inquiries, promote services, and manage misunderstandings. Challenges were most commonly attributed to differences in pragmatic norms, communicative expectations, and culturally shaped interpretations of value, politeness, and assertiveness. These findings reinforce international scholarship indicating that persuasion in multilingual settings cannot be understood solely as a linguistic skill but must be situated within broader sociocultural frameworks.

Empirically, this study fills a significant gap in Malaysian research by providing data from East Malaysia, a region whose multilingual ecology differs substantially from the more widely studied context of Peninsular Malaysia. Theoretically, it demonstrates that persuasive competence in customer service requires a hybrid of linguistic, pragmatic, and intercultural knowledge. Methodologically, it offers a locally grounded model that future studies can adapt when examining pragmatic challenges in multilingual service sectors.

The findings carry important implications for workplace training, curriculum design, and policy development. There is an urgent need for targeted professional development programs that address intercultural communication and value systems, particularly for tourists from China, Korea, Europe, and Peninsular Malaysia. Training should emphasize pragmatic competence, including politeness strategies, persuasive framing, rapport-building, and culturally sensitive conflict resolution. Workplace-specific English for persuasion such as presenting options, managing objections, and reframing refusals, should be integrated into these programs. Experiential learning approaches, including role-play and authentic scenario-based activities, are recommended to enhance pragmatic adaptability.

Beyond workplace training, the results support the integration of socioculturally informed persuasive communication into English for Specific Purposes (ESP) curricula, tourism and hospitality courses, and vocational programs. Instructional design should incorporate pragmatic routines and culturally situated discourse patterns commonly encountered in Sabah's service sectors. At the policy level, stakeholders such as the Sabah Tourism Board and industry associations can leverage these findings to enhance frontline communication standards, develop regional training guidelines, and improve service quality ratings. Promoting Sabah as a culturally competent tourism destination aligns with global trends emphasizing intercultural communication as a benchmark of service excellence.

Finally, the study opens several avenues for future research. Comparative studies across Malaysian regions could illuminate variations in persuasive strategies, while investigations from the customer's perspective would provide a more holistic understanding of interactional dynamics. Analyses of real interactional data, including recorded service encounters, could deepen insights into pragmatic negotiation in authentic contexts. Further research might also explore the role of local languages such as Kadazan-Dusun and Bajau in shaping persuasive practices and evaluating the effectiveness of persuasion training interventions using instructed language pragmatics models. Such studies would advance understanding of persuasion as a socioculturally embedded communicative practice in multilingual Southeast Asian contexts.

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# AN ALUMNI-BASED EVALUATION OF PROGRAMME EDUCATIONAL OBJECTIVE ATTAINMENT FOR THE DIPLOMA IN INFORMATION TECHNOLOGY (TECHNOLOGY DIGITAL) AT POLITEKNIK KUCHING SARAWAK

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***Abstract:*** *This paper reports on an alumni-based evaluation of the attainment of the Programme Educational Objectives (PEOs) for the Diploma in Information Technology (Digital Technology) at Politeknik Kuching Sarawak. The study's purpose was to assess the perceived attainment of the five PEOs, identify program strengths and gaps as experienced by alumni, and recommend improvements for continuous curriculum enhancement. A quantitative survey design was employed, collecting data from 47 alumni (Networking and Software & Application Development tracks) from the December 2018 intake, fulfilling the three-to-five-year post-graduation assessment requirement. Alumni perceptions were measured using a five-point Likert scale, with mean values analyzed descriptively. The key results indicate that alumni perceive all five PEOs as highly achieved (mean scores consistently more than 3.66). Alumni reported the strongest attainment in workplace communication, reflected by the highest mean score of 4.34 under PEO 3. This was followed by PEO 1, with a mean score of 4.32 for the ability to perform daily work tasks, demonstrating strong preparedness for routine job responsibilities. The lowest, although still high, mean score of 3.96 was recorded under PEO 2, indicating that the application of current computing techniques in daily tasks is an area that could be further strengthened. Overall, the results confirm that graduates possess solid technical capabilities, communication skills, teamwork and ethical awareness, and a strong orientation toward lifelong learning, while also highlighting opportunities to enhance practical exposure to contemporary computing technologies.*

***Keywords:*** *Information Technology, Programme Educational Objectives, Politeknik Kuching Sarawak*

## Introduction

Politeknik Kuching Sarawak (PKS) plays a critical role within Malaysia's technical and vocational education system, providing diploma-level education that is aligned with labor-market needs. One of its core offerings is the Diploma in Information Technology (Digital Technology), crafted to give students both theoretical foundations and applied digital competencies. As digital transformation accelerates globally, the importance of producing well-prepared IT graduates through such diploma programs becomes ever more significant,

making PKS's efforts highly relevant. Therefore, closing the gap between graduates' expectations and actual professional experience is crucial, as many face challenges when transitioning from academic life to the workplace (Abd Halim *et al.*, 2025)

Outcome-based education (OBE) is a structured instructional approach where every component of the learning process is intentionally designed to support the achievement of specific student learning outcomes (Samadhi *et al.*, 2025; Sugumaran and Senthilkumar, 2025; Abidin *et al.*, 2024; Suhaimi *et al.*, 2022). Outcome-based education evaluates student performance by measuring the attainment of program outcomes, program educational objectives, and mission goals using both direct assessments such as courses and projects, and indirect measures like surveys (Rajak *et al.*, 2025). In line with outcome-based education (OBE) principles, Program Educational Objectives (PEOs) for the Diploma in Information Technology (Digital Technology) have been defined. These PEOs typically articulate the career- and professional-level achievements expected of graduates three to five years after graduation, such as applying ICT knowledge, solving real-world problems, working effectively in teams, and engaging in lifelong learning. These objectives are vital for evaluating how effectively educational programs address industry needs, where continual alignment between academic outcomes and real-world practice is required (Suud *et al.*, 2025; Zin *et al.*, 2023). The Curriculum Division (BK) of the Department of Polytechnic and Community College Education (JPPKK) has developed guidelines for conducting PEO achievement studies. These guidelines assist all polytechnics and community colleges in Malaysia to evaluate alumni outcomes related to PEOs, facilitating curriculum enhancement and meeting accreditation requirements (Jabatan Pendidikan Politeknik dan Kolej Komuniti, Bahagian Kurikulum, 2021).

Measuring PEO achievement is often done through alumni surveys, since alumni are uniquely positioned to reflect on how well their education has translated into real-world outcomes. Research has shown that alumni perceptions serve as a valuable indirect assessment method of PEO attainment, giving institutions insights into how graduates apply their skills, the relevance of their training, and areas needing improvement (Abd Hadi *et al.*, 2025). In Malaysian polytechnics and community colleges, such evaluations are vital to maintain alignment with quality assurance frameworks and to guide continuous curriculum enhancement. Quality assurance and continuous improvement processes are essential for evaluating whether established educational objectives meet the expected standards of quality in education (Thangaraj *et al.*, 2025).

Despite their importance, there is relatively limited literature focused on alumni-based PEO evaluation for Diploma IT programs in Malaysian polytechnics and community colleges. Existing studies have been carried out in other technical disciplines: for example, Politeknik Kuching Sarawak conducted an alumni survey to evaluate PEO attainment in its Diploma in Electronic Engineering (Communication), finding that strengthening the curriculum with entrepreneurial skills, leadership development, and advanced technology integration would better prepare graduates for industry demands. Input from the Industry Advisory Panel also underscores the need for ongoing curriculum updates to keep pace with changing industry expectations (Suud *et al.*, 2025). Similarly, in a Diploma in Electronics (Instrumentation) program at Kolej Komuniti Seberang Jaya, the results demonstrate that all PEO targets agreed upon by the institution and stakeholders have been successfully met (Abd Hadi *et al.*, 2025).

Therefore, the present study reports on an alumni survey conducted among graduates of the Diploma in Information Technology (Digital Technology) at PKS. Its aims are to assess the perceived attainment of PEOs, identify strengths and gaps in the program as experienced by alumni, and recommend improvements to enhance future graduates' readiness. Five PEOs are assessed: possess relevant knowledge, skills and aptitude to meet job specifications, organisational dan system needs (PEO 1), can utilise current computing tools and techniques by applying knowledge and interpreting information to solve problems, can execute and be resposible for routine tasks (PEO 2), have effective communication skills to convey information, problems and solutions (ICT) (PEO 3), have teamwork and interpersonal skills, entrepreneurial awareness and are aware of their social and ethical responsibilities (PEO 4) and possess skills for life-long learning and career development (PEO 5). By doing so, this research not only supports institutional quality assurance at PKS but also contributes to the broader discourse on the effectiveness of OBE implementation in Malaysian TVET institutions.

## Literature Review

A recent five-year mixed-method study on a Malaysian public university's civil engineering program demonstrates a structured approach to managing and improving Program Educational Objectives (PEOs) (Kamal and Che Ibrahim, 2025). Using surveys and document reviews across a six-phase PEO cycle, the researchers found that most PEOs were achieved, although aspects such as leadership and professional recognition require further enhancement. The study also identified seven essential factors that support successful PEO attainment, including collaboration, leadership, communication, lifelong learning, designation, professional status and the ability to manage complex projects. Overall, the work contributes a comprehensive framework for formulating, evaluating and refining PEOs in alignment with accreditation requirements, offering valuable guidance for institutions seeking to strengthen curriculum quality and graduate readiness.

Rahman *et al.* (2024) outlines how Malaysian polytechnics establish Programme Educational Objectives (PEOs) aligned with industry needs, focusing on graduates' expected knowledge, skills, and attitudes, and evaluates these objectives through a survey of 283 Electrical Engineering graduates three to five years after completing their studies. Using online questionnaires and descriptive analysis, the researchers reported achievement levels of 74% for PEO 1, 95% for PEO 2, 70% for PEO 3, and 95% for PEO 4, offering insights that support curriculum improvement and help ensure graduates are well-prepared for workforce demand.

Abd Rahman *et al.* (2016) study how Malaysian research universities formulate their Programme Educational Objectives (PEOs), highlighting variations in approach, traits and institutional priorities despite adhering to common accreditation requirements. By analysing 24 PEOs from five universities using a Venn diagram approach, the researchers identified shared, generic and unique attributes that reflect each institution's academic focus and stakeholder needs. The findings show that PEO selection is a dynamic process shaped by curriculum maturity, market expectations and evolving graduate competencies. The study underscores the importance of continuously refining PEOs to align with Engineering Accreditation Council (EAC) standards and to better support graduates' future career pathways.

Hairi *et al.* (2019) review how Malaysian community colleges evaluate Programme Educational Objectives (PEOs) within the Outcome-Based Education (OBE) framework required by the Malaysian Qualifications Agency. Using a triangulation approach involving semi-structured interviews with JPPKK officials and document analysis, the researchers compared community college PEO practices with those of eight local universities. The review revealed four major issues in community colleges' evaluation instruments: absence of clear PEO measurements, inappropriate data collection timelines, respondent fatigue due to lengthy questionnaires and limited stakeholder input. The findings highlight the need for a more suitable and systematic instrument to assess PEO achievement, with further research recommended to develop an effective evaluation framework for community colleges.

Robinos *et al.* (2025) examined the effectiveness of the Bachelor of Elementary Education (BEED) and Bachelor of Secondary Education (BSED) programs at the University of Perpetual Help System DALTA–Molino Campus by assessing graduate employability, licensure performance and the perceived achievement of PEOs and PLOs. Survey responses from all 2022 graduates showed excellent results in the Licensure Examination for Teachers and rapid employment, with most securing teaching positions within a month. Graduates also reported strong competencies in teaching, professionalism and community involvement, indicating high attainment of program objectives and outcomes. Although overall program effectiveness was affirmed, the study noted low alumni participation in action research, suggesting a need to foster stronger research engagement. The findings highlight the importance of improved alumni tracking, enhanced support for lifelong learning and initiatives that encourage evidence-based teaching and research practices.

## Methodology

This study employed a quantitative survey design involving alumni from two programme tracks under the Diploma in Information Technology (Digital Technology) at Politeknik Kuching Sarawak: the Networking System Track and the Software and Application Development (SAD) Track. The research focused on graduates from the December 2018 intake, as they fulfil the requirement of being three to five years post-graduation, the recommended time frame for Programme Educational Objective (PEO) assessment. For the Networking track, data were collected from 20 alumni. While for the SAD track, 27 alumni participated.

A structured questionnaire was used. The instrument contained items aligned with the five Programme Educational Objectives (PEOs) of the Diploma in Information Technology (Digital Technology). The items measured perceptions of PEO importance and PEO achievement, using a five-point Likert scale from 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). The interpretation of mean score values followed the following standard: 1.00–2.33 (Low), 2.34–3.66 (Medium), and 3.67–5.00 (High).

Demographic information was also collected, including employment status, salary range, work sector, and highest educational qualification. These data provided additional context for interpreting alumni readiness and career progression. Responses were analysed descriptively to compute mean values for each PEO indicator. Visual representations, such as tables, were referenced to support the interpretation of alumni perceptions across both programme tracks.

## Result and Discussion

### *Demographic Findings*

Table 1 presents the demographic distribution of 47 alumni based on their employment status, salary range, working sector, and highest education qualification. Across both tracks, the majority of alumni were employed (54.55% Networking; 64.29% SAD), while a smaller portion pursued further studies (27.27% Networking; 21.43% SAD). Only a minority were unemployed (18.18% Networking; 14.29% SAD). Salary ranges indicated that most graduates were in entry-level positions, earning RM1001–RM2000. Employment was dominated by the private sector, with more than 68.75% of SAD alumni and 77.77% of Networking alumni working in private companies. Most alumni hold a Diploma as their highest qualification (78.7%), with only 21.3% progressing to a Bachelor's degree and none yet pursuing postgraduate studies. These trends collectively demonstrate reasonable graduate employability and the alignment of programme outcomes with industry expectations.

**Table 1: Alumni Demographic Distribution**

| Item | Number | Percentage (%) |
|---|---|---|
| **Programme Track** | | |
| **Networking System** | 20 | 42.6 |
| **Software Application and Design** | 27 | 57.4 |
| **Working Status** | | |
| **Working** | 27 | 57.4 |
| **Further Studying** | 17 | 36.2 |
| **Not Working** | 3 | 6.4 |
| **Salary** | | |
| **RM1000 and below** | 18 | 38.3 |
| **RM1001 - RM2000** | 21 | 44.7 |
| **RM2001 - RM3000** | 6 | 12.8 |
| **RM3001 - RM4000** | 2 | 4.3 |
| **RM4001 - RM5000** | 0 | 0 |
| **RM 5001 and above** | 0 | 0 |
| **Current Working Sector** | | |
| **Government** | 4 | 8.5 |
| **Government Link Company** | 16 | 34 |
| **Self-Employment** | 22 | 46.8 |
| **Private Company** | 5 | 10.6 |
| **Highest Education Qualification** | | |
| **Diploma** | 37 | 78.7 |
| **Bachelor Degree** | 10 | 21.3 |
| **Master Degree** | 0 | 0 |
| **PhD** | 0 | 0 |

### *Perceived Importance of PEOs*

The results in Table 2 indicate that alumni view all Programme Educational Objectives as highly important, with the strongest emphasis on lifelong learning and career development (4.45), followed by communication skills (4.38) and teamwork, interpersonal skills, and ethical responsibilities (4.38), showing that they prioritise soft skills and continuous growth; meanwhile, technical knowledge (4.30) and the use of computing tools and techniques (4.17) are also regarded as very important, suggesting that alumni value both technical competencies and broader professional abilities needed for workplace readiness.

**Table 2: Alumni Perceptions of PEO Importance**

| Item | Mean Value |
|---|---|
| **PEO 1: Possess relevant knowledge, skills and aptitude to meet job specifications, organisational and system needs.** | 4.30 |
| **PEO 2: Can utilise current computing tools and techniques by applying knowledge and interpreting information to solve problems, can execute and be responsible for routine tasks.** | 4.17 |
| **PEO 3: Have effective communication skills to convey information, problems and solutions.** | 4.38 |
| **PEO 4: Have teamwork and interpersonal skills, entrepreneurial awareness and are aware of their social and ethical responsibilities.** | 4.38 |
| **PEO 5: Possess skills for life-long learning and career development** | 4.45 |

***Achievement of PEOs***

***PEO 1: Possess Relevant Knowledge, Skills And Aptitude To Meet Job Specifications, Organisational And System Needs***

Based on Table 3, the alumni show a high level of agreement regarding the achievement of Program Educational Objective 1 (PEO 1), with all items demonstrating a strong positive perception as indicated by mean values above 3.66. The results suggest that graduates of Politeknik Kuching Sarawak effectively use the knowledge learnt in the workplace (mean=4.09) and are successful in applying the skills learnt (mean=4.02). Notably, the highest mean score (mean = 4.32) relates to the alumni's ability to perform their daily work, suggesting that the program is highly effective in preparing students for the practical demands of their professional roles. Overall, the consistently high mean values confirm that PEO 1, which focuses on graduates successfully utilizing their learning and competency in their careers, is being met satisfactorily from the perspective of the alumni.

**Table 3: Alumni Perceptions of PEO 1**

| Item | Mean Value |
|---|---|
| **Alumni uses the knowledge learnt from Politeknik Kuching Sarawak at the workplace.** | 4.09 |
| **Alumni applies the skills learnt from Politeknik Kuching Sarawak at the workplace.** | 4.02 |
| **Alumni has the ability to perform the daily work.** | 4.32 |

***PEO 2: Can Utilise Current Computing Tools And Techniques By Applying Knowledge And Interpreting Information To Solve Problems, Can Execute And Be Responsible For Routine Tasks***

Based on Table 4, the alumni generally show a high level of agreement regarding the achievement of Program Educational Objective 2 (PEO 2) as indicated by mean values above 3.66, which focuses on the ability to utilize current computing tools and techniques for problem-solving and task execution. The results indicate that graduates are competent in using current computing tools to perform daily tasks (mean=4.00) and to interpret information for problem solving (mean=4.00). While the use of current computing techniques to perform daily tasks had a slightly lower, though still high mean (mean=3.96), the highest perception score was for the use of current computing techniques to interpret information for problem solving (mean=4.06). All mean values cluster tightly around the 4.00 mark, suggesting that alumni perceive the program as effective in equipping them with the necessary skills to utilize contemporary computing resources for their professional responsibilities. The consistency in the mean values confirms that PEO 2 is being substantially achieved.

**Table 4: Alumni Perceptions of PEO 2**

| Item | Mean Value |
|---|---|
| **Alumni can utilise current computing tools to perform daily task.** | 4.00 |
| **Alumni can utilise current computing technique to perform daily task.** | 3.96 |
| **Alumni can utilise current computing tools to interpret information for problem solving.** | 4.00 |
| **Alumni can utilise current computing technique to interpret information for problem solving** | 4.06 |

***PEO 3: Have Effective Communication Skills To Convey Information, Problems And Solutions***

Based on Table 5, the results strongly indicate that Program Educational Objective 3 (PEO 3), which focuses on graduates having effective communication skills to convey information, problems, and solutions, has been highly achieved. All three items recorded mean values well above 3.66, demonstrating a very strong positive perception from the alumni. Specifically, the highest mean value was observed for the ability of alumni to communicate with their colleagues at the workplace (mean=4.34), suggesting exceptional peer-level communication skills. Furthermore, graduates are perceived as highly effective in their ability to convey information to their supervisor (mean= 4.19) and to provide solutions to solve problems at the workplace (mean=4.15). The consistently high mean scores across all communication facets confirm that the program is highly successful in producing graduates who possess the effective communication skills essential for professional success.

**Table 5: Alumni Perceptions of PEO 3**

| Item | Mean Value |
|---|---|
| **Alumni can communicate with his/her colleagues at the workplace.** | 4.34 |
| **Alumni can convey information to his/her supervisor.** | 4.19 |
| **Alumni can provide solutions to solve problems at the workplace.** | 4.15 |

***PEO 4: Have Teamwork And Interpersonal Skills, Entrepreneurial Awareness And Are Aware Of Their Social And Ethical Responsibilities***

Based on Table 6, the results indicate that Program Educational Objective 4 (PEO 4), which encompasses teamwork, interpersonal skills, entrepreneurial awareness, and ethical responsibilities, has been achieved with strong alumni satisfaction. All four measured items recorded high mean values above 3.66. The highest scores were attributed to the graduates' ability to work with team members in the organization (mean=4.28) and their effectiveness in sharing ideas with team members (mean=4.23), highlighting the program's success in developing strong interpersonal and teamwork skills. Furthermore, alumni were perceived as having high ethical standards, with a mean of 4.21 for behaving ethically throughout employment. The lowest, yet still high, mean score was for entrepreneurial awareness at the workplace (mean=4.09), confirming that while all components of PEO 4 are met, the greatest perceived strength lies in the graduates' collaborative and ethical professional conduct.

**Table 6: Alumni Perceptions of PEO 4**

| Item | Mean Value |
|---|---|
| **Alumni can work with team members in the organization** | 4.28 |
| **Alumni can share idea with team members effectively.** | 4.23 |
| **Alumni can behave ethically throughout employment in the organization.** | 4.21 |

| | |
|---|---|
| **Alumni has the entrepreneurial awareness at the workplace.** | 4.09 |

***PEO 5: Possess Skills For Life-Long Learning And Career Development***

Based on Table 7, the results highly support the achievement of Program Educational Objective 5 (PEO 5), which focuses on graduates possessing skills for life-long learning and career development. All items recorded high mean values above 3.66, indicating a substantial positive perception from the alumni. The highest mean scores were recorded for the alumni's proactive approach to continuous learning, specifically their tendency to regularly look for opportunities to learn new skills (mean= 4.28) and new knowledge (mean=4.23). Furthermore, graduates demonstrated a high level of proactivity, as evidenced by the strong mean value for having the initiative to improve knowledge and skills for career development (mean= 4.17). The ability of alumni to apply newly acquired skills and knowledge to improve job performance was also rated highly (mean=4.13). The consistency across all dimensions confirms that the program is highly effective in instilling a culture of continuous learning and development in its graduates.

**Table 7: Alumni Perceptions of PEO 5**

| Item | Mean Value |
|---|---|
| **Alumni regularly look for opportunities to learn new skills.** | 4.28 |
| **Alumni regularly look for opportunities to learn new knowledge.** | 4.23 |
| **Alumni can apply newly acquired skills and knowledge to improve job performance.** | 4.13 |
| **Alumni has initiative to improve knowledge and skills for career development.** | 4.17 |

## Conclusion

The results across both the Networking and SAD tracks confirm that the Programme Educational Objectives (PEOs) are effectively achieved. Graduates demonstrate strong technical skills, effective teamwork, ethical awareness, and a commitment to lifelong learning. The alumni perceptions were also positive, slight gaps emerged in areas such as entrepreneurial skills, and confidence in applying computing tools to real-world problems. To enhance future programme quality, several recommendations are proposed. First, embedding more entrepreneurial and innovation-based learning, such as industry-linked projects or digital entrepreneurship modules which could improve PEO4 outcomes. Second, more structured industry exposure, such as apprenticeships or micro-internships, may help increase alumni confidence in PEO1 and PEO2 areas. Finally, future research should consider expanding sample sizes and integrating qualitative methods such as interviews or focus groups to capture deeper insights beyond quantitative ratings. Overall, the PEO framework remains relevant and continues to guide the programme toward producing graduates who are competent, adaptable, and aligned with Malaysia’s digital economy needs.

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# ASSESSING THE ROLE OF SLOW MIXING SPEED ON THE COAGULATION EFFICIENCY OF BANANA PEEL-BASED NATURAL COAGULANT

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***Abstract:*** *The application of natural coagulants presents a promising route toward environmentally sustainable wastewater treatment. This study focuses on the influence of slow mixing intensity on the performance of a banana peel-based coagulant for the treatment of domestic wastewater. While rapid mixing is generally responsible for dispersing the coagulant, the slow mixing phase plays a vital role in encouraging the growth and stability of flocs prior to sedimentation. The banana peel coagulant was prepared by drying, grinding, and sieving peel waste into a fine powder. A fixed dosage of 0.01 g was used in each 500 mL sample, with constant conditions of rapid mixing at 180 rpm for 3 minutes and a settling period of 30 minutes. The slow mixing speed was varied across 10, 30, and 50 rpm to evaluate its impact on turbidity, total suspended solids (TSS), and total dissolved solids (TDS) removal. Results indicated that the most efficient turbidity reduction (80.82%) and highest TSS removal (95.48%) occurred at 50 rpm, suggesting that stronger slow agitation promotes effective contact between micro-flocs and enhances bridging. At lower speeds such as 10 rpm, the formation of large flocs appeared limited, resulting in reduced removal efficiencies. However, TDS removal exhibited inconsistent results, with minimal variation across different mixing intensities, reaffirming the limited role of coagulation in dissolved solid separation. Overall, the findings emphasize that slow mixing is a critical operational parameter in optimizing the use of banana peel coagulants. By enhancing floc growth without causing shear damage, appropriate slow mixing speeds can significantly improve the performance of natural coagulants in practical water treatment applications.*

***Keywords:*** *Slow mixing intensity, Natural coagulant, Floc formation, Domestic wastewater treatment*

## Introduction

Wastewater generated from domestic sources often contains a high concentration of suspended solids, turbidity that causing particles, and dissolved impurities. Conventional water treatment methods rely heavily on chemical coagulants such as alum and ferric salts to remove these contaminants. While effective, their long-term use raises environmental and health-related concerns, including the accumulation of non-biodegradable sludge, toxicity from residual chemicals, and escalating treatment costs (da Silva et al., 2025; Keeley et al., 2014). These drawbacks have sparked interest in developing natural coagulants that are safe, biodegradable, and cost-effective, particularly from agricultural waste materials.

Among the various plant-based options, banana peels have shown promising coagulation properties due to tabundance, ease of processing, and presence of functional compounds such as pectin and lignin (Nurhaliza et al., 2023). These natural compounds aid in destabilizing colloidal particles and promoting floc formation (Maurya et al., 2024). While the dosage and rapid mixing steps are often emphasized in coagulation studies, the slow mixing phase plays a critical role in enhancing floc aggregation, enabling small micro-flocs formed during rapid mixing to grow into larger, more settleable particles (Ayoub et al., 2014; Park et al., 2016). Despite this, the influence of slow mixing speed on coagulation performance has not been widely investigated, especially in the context of banana peel-based coagulants.

This study aims to assess the effect of different slow mixing speeds of 10, 30, and 50 rpm on the efficiency of banana peel powder in treating domestic wastewater. With fixed parameters for dosage, rapid mixing, and settling time, the experiment evaluates how varying slow mixing intensities influence the removal of turbidity, total suspended solids (TSS), and total dissolved solids (TDS). The findings provide insight into optimizing mixing protocols to enhance the practical application of natural coagulants in water treatment.

## Material and Methods

### *Preparation of Natural Coagulant*

Banana peels were used as the raw material for the natural coagulant in this study. The peels were sourced from local food vendors in Pagoh Jaya and thoroughly rinsed with clean tap water to remove dirt and surface contaminants. After rinsing, the peels were cut into small strips and dried in a conventional oven at 90°C for two hours to reduce moisture content. The dried material was then ground into a fine powder using a household blender and sieved to ensure particle uniformity. The resulting powder was stored in airtight containers until use.

### *Experimental Design*

Jar test experiments were conducted to evaluate the impact of slow mixing speed on coagulation efficiency. A fixed dosage of 0.01 g of banana peel powder was added to 500 mL of raw domestic wastewater in each test. The rapid mixing speed was maintained at 180 rpm for 3 minutes to allow thorough dispersion of the coagulant. After that, the slow mixing phase was varied at 10 rpm, 30 rpm, and 50 rpm for a duration of 20 minutes, followed by a settling time of 30 minutes. All other conditions remained constant to isolate the effect of slow mixing intensity.

### *Measurement of Water Quality Parameters*

The water quality was assessed after the settling period by measuring turbidity, total suspended solids (TSS), and total dissolved solids (TDS). Turbidity was determined using a digital turbidity meter, where treated water was placed in a clean sample container, inserted into the device, and the reading in NTU was recorded. For TSS, 100 mL of treated water was filtered through pre-weighed filter paper, dried at 105°C, and reweighed to determine the mass of retained solids. TDS was measured using a digital water quality meter, with the probe immersed in the sample and readings recorded in ppm.

***Data Evaluation***

All experiments were performed in triplicate, and average values were used for analysis. The removal efficiencies of turbidity, TSS, and TDS were calculated using the Equation (1):

$$\text{Removal (\%)} = [(\text{Initial} - \text{Final}) / \text{Initial}] \times 100 \qquad \text{Equation (1)}$$

The data were used to determine the effect of varying slow mixing intensities on the coagulation performance of banana peel powder.

**Result and Discussion**

***Turbidity Removal***

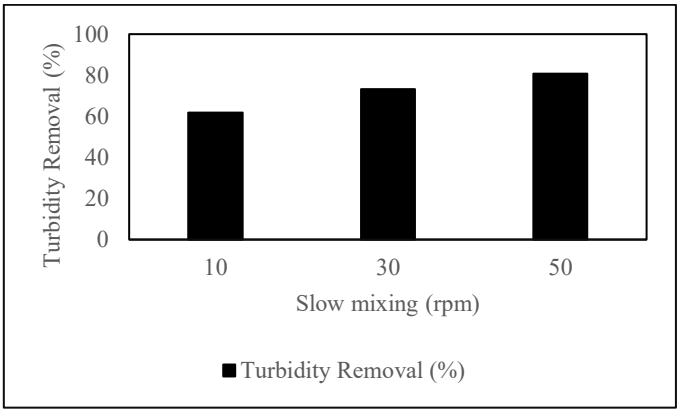



**Figure 1: Removal Performance of Turbidity**

The effect of slow mixing speed on turbidity removal efficiency was evaluated at 10, 30, and 50 rpm, with all other parameters held constant. The results as per Figure 1 indicated a clear upward trend in turbidity removal as the slow mixing speed increased. At 10 rpm, the removal efficiency was 61.69%, which improved significantly to 73.15% at 30 rpm and reached the highest value of 80.82% at 50 rpm. These findings suggest that higher slow mixing speeds facilitate more effective floc aggregation, allowing colloidal particles destabilized during the rapid mixing phase to collide and bind into larger, settleable flocs (Ayoub et al., 2014).

The role of slow mixing in coagulation is primarily to encourage gentle particle contact without causing floc breakage. At lower speeds such as 10 rpm, the contact rate between micro-flocs is limited, resulting in smaller, weaker flocs that do not settle efficiently. As the speed increases, the enhanced movement improves the probability of particle interaction and bridging, leading to stronger floc formation. The observed results are consistent with those reported by (Birima, 2021) who highlighted that optimal slow mixing conditions are critical in maximizing turbidity removal when using natural coagulants derived from plant waste.

Overall, the results affirm that slow mixing intensity is a key operational factor in the coagulation process. While banana peel-based coagulants possess intrinsic ability to reduce turbidity, their effectiveness is significantly enhanced under suitable mixing conditions (Esther Jebarani Rayer et al., 2024). In this study, 50 rpm provided the best results without signs of floc disruption, indicating that a moderately high slow mixing speed strikes the right balance between floc growth and structural stability.

***Total Suspended Solids (TSS) Removal***

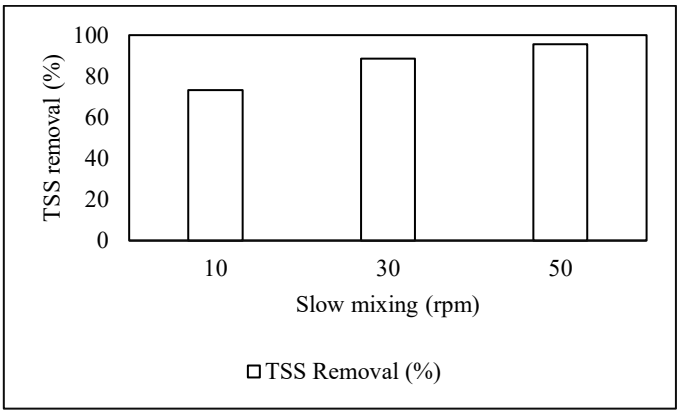



**Figure 2: Removal Performance of TSS**

The study demonstrated a significant improvement in total suspended solids (TSS) removal efficiency with increasing slow mixing speeds as presented in Figure 2. At 10 rpm, the TSS removal recorded was 73.17%, which increased to 88.51% at 30 rpm and peaked at 95.48% at 50 rpm. This trend suggests that higher slow mixing speeds enhance the formation and consolidation of flocs, which improves their ability to trap and remove suspended particles from the wastewater.

Slow mixing serves a crucial role in the flocculation process by allowing micro-flocs formed during rapid mixing to aggregate into larger, more stable flocs. At a very low speed such as 10 rpm, particle contact is minimal, leading to the formation of smaller and weaker flocs that are less likely to settle efficiently. In contrast, higher speeds like 50 rpm increase the frequency of floc interactions without introducing excessive shear that could break them apart. These findings are consistent with the work of Nan.et al (2016) who reported that optimal slow mixing intensities significantly improve the coagulation performance of plant-based materials by encouraging stronger floc growth.

The results of this study clearly indicate that slow mixing is a critical variable in maximizing the performance of banana peel-based natural coagulants for TSS removal. Among the tested speeds, 50 rpm provided the most favorable outcome, highlighting its suitability in practical water treatment systems. This finding reinforces the importance of not only selecting the appropriate coagulant but also optimizing mixing conditions to fully utilize its potential.

***Total Dissolved Solids (TDS) Removal***

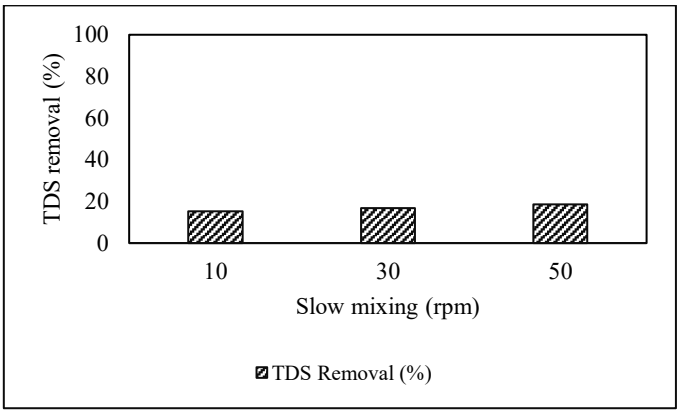



**Figure 3: Removal Performance of TDS**

The influence of slow mixing speed on total dissolved solids (TDS) removal showed only slight improvement across the tested range. At 10 rpm, the TDS removal efficiency was 15.23%, increasing to 16.87% at 30 rpm and reaching 18.64% at 50 rpm. Although the trend was generally upward, the changes were relatively small, indicating that TDS removal is less sensitive to variations in slow mixing speed compared to turbidity and TSS.

TDS consists mainly of dissolved ions and very fine particles that are not easily removed by coagulation and flocculation alone. The banana peel-based coagulant may facilitate some degree of TDS reduction through mechanisms like adsorption onto floc surfaces or entrapment during floc formation, but these effects are inherently limited (Lemma et al., 2024). The slightly higher removal at 50 rpm could be due to more stable and compact flocs that may have captured more fine particles during the slow mixing phase. However, the marginal differences suggest that slow mixing intensity has a minimal impact on dissolved solids removal.

Similar observations were made by other researchers using plant-based coagulants, such as Moringa oleifera and cactus mucilage, where TDS reduction was generally below 25% and considered supplementary rather than a primary treatment effect (Hassan et al., 2025; Verma et al., 2020). These results reinforce the understanding that natural coagulants like banana peel powder are primarily effective for turbidity and TSS, while TDS control may require additional treatment steps such as filtration or ion exchange.

Overall, while TDS removal showed minor enhancement with increased slow mixing speed, it remains a secondary benefit of the coagulation process rather than a primary treatment objective.

## Conclusion

This study investigated the impact of slow mixing intensity on the coagulation performance of a banana peel-based natural coagulant in treating domestic wastewater. With a fixed dosage of 0.01 g, consistent rapid mixing at 180 rpm, and a 30-minute settling period, the slow mixing speed was varied at 10, 30, and 50 rpm to evaluate its effect on turbidity, total suspended solids (TSS), and total dissolved solids (TDS) removal. The results revealed a significant improvement in both turbidity and TSS removal with increasing slow mixing speed, reaching maximum efficiencies of 80.82% and 95.48% respectively at 50 rpm. This highlights the

importance of sufficient floc interaction and aggregation during the slow mixing phase to produce settleable flocs.

In contrast, TDS removal showed only slight variation across the different mixing intensities, with the highest reduction being 18.64%. This outcome confirms that while banana peel coagulants may offer limited assistance in removing dissolved solids, their primary effectiveness lies in the separation of suspended particulates and turbidity-causing agents. The findings underscore the critical role of slow mixing in optimizing the coagulation process, especially when employing natural coagulants that rely heavily on gentle floc development rather than chemical precipitation.

Ultimately, the study concludes that optimizing slow mixing speed particularly around 50 rpm enhances the efficiency of banana peel powder as a sustainable and low-cost coagulant. These insights support the wider application of plant-based coagulants in decentralized or low-resource water treatment settings, where operational simplicity and environmental safety are key priorities.

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# ENHANCING EARLY COMMUNICATION SKILLS IN CHILDREN WITH AUTISM THROUGH A USER-CENTERED AUGMENTED REALITY OBJECT-RECOGNITION APPLICATION

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***Abstract:*** *Children with Autism spectrum disorder (ASD) often experience significant challenges in communication due to a limited understanding of objects and their functional meanings. This study introduces an augmented reality-based learning application designed with a user-centered framework to support early communication and cognitive development among children with autism. This framework integrates pedagogical design principles, sensory engagement, and iterative feedback from educators, parents, and domain experts. Using a quantitative approach, the prototype was tested with children aged 4 to 10 years at a Makmal Penyelidikan Autisme in UKM, with additional usability assessment provided by parents. Structured observations showed that the application supported attention, interaction, and basic communication behavior during object-recognition tasks. Parents' ratings further indicated high usability (M =4.42, SD=0.31) with strong scores for satisfaction, learnability, communication support, and sensory compatibility. The findings demonstrated that AR, when developed through user-centered design, can serve as an effective pedagogical tool for enhancing engagement and comprehension in the special education context. This work contributes to the growing field of educational technology for inclusive learning, offering practical insights for teachers, instructional designers, and researchers developing interactive learning environments for diverse learners.*

***Keywords:*** *Augmented Reality, Autism Spectrum Disorder, Educational Technology, User-Centered Design, Inclusive Learning*

## Introduction

Children with Autism Spectrum Disorder (ASD) commonly face difficulties in early communication, particularly in recognizing objects, linking them to functional meanings, and interpreting contextual cues (Delehanty et al, 2018). These challenges influence verbal development, daily learning routines, and the ability to generalize knowledge across environments. Conventional interventions such as Picture Exchange Communication System (PECS) provide important visual support but often lack interactivity or multimodal sensory engagement (Almusrashi et al., 2022)

Augmented Reality (AR) has emerged as a promising tool for special education, offering interactive visual overlays that enhance comprehension and maintain attention (Lorenzo et al, 2019). Studies have shown that AR can support children with ASD by strengthening symbolic understanding and reducing cognitive load (Scarcella et al. 2023). However, many AR applications are designed without considering sensory sensitivities, cognitive limits, or the learning behaviors of neurodiverse children.

To address these gaps, this study introduces a user-centered AR application designed to support early communication skills among ASD children. The present paper focuses on the quantitative usability evaluation of the prototype, examining how children interact with the application during guided tasks and how parents rate the application's usability and educational suitability. The UCD approach ensures that sensory, behavioral, and usability considerations are embedded throughout the design process, guided by continuous feedback from stakeholders (Khowaja & Salim, 2020).

This paper reported only structured observational metrics and quantitative parent ratings to provide a clear, measurable assessment of the application's usability. Findings from this evaluation contribute to the growing body of knowledge on technology-assisted communication tools for ASD learners and offer practical insights for designers and educators to develop accessible and engaging learning applications.

## Literature Review

### *Early Communication Challenges in Children with ASD*

Children with ASD commonly experience significant delays in early communication, particularly in establishing joint attention, understanding object-function relationships, and developing expressive and receptive vocabulary (Hyman et al, 2020). These challenges stem from neurological differences that affect social attention, imitation behaviors, and symbolic processing, which are essential foundations for early language acquisition (Jambaqué et al, 1998). For example, many children with ASD have difficulty shifting gaze between an object and a communication partner, limiting natural opportunities for learning through shared experiences. Such challenges reduce their ability to interpret everyday objects meaningfully, hindering functional communication and impeding readiness for structured classroom learning (Delehanty et al., 2018). As early communication is closely linked to later cognitive and social development, targeted interventions that strengthen object recognition, joint attention, and contextual understanding are crucial during the early years.

### *Technology-Assisted Learning Approaches for ASD*

Technology-assisted learning has gained increasing prominence in ASD intervention programs due to its ability to provide consistency, predictability, and individualized pacing, key factors that support neurodiverse learners (Khowaja & Salim, 2020). Tools such as mobile applications, interactive games, and digital visual schedules help reduce cognitive overload and support multisensory learning by integrating audio, visual, and tactile cues. Studies have shown that technology-mediated instruction can improve motivation, reduce anxiety during tasks, and encourage independent exploration by offering structured routines and instant feedback.

(Scarcella et al., 2023). Compared to traditional paper-based teaching materials, digital interventions offer higher engagement and adaptability. They also allow learners to revisit tasks repeatedly, which is beneficial for ASD children who require repetition to consolidate new concepts. Technology-assisted learning thus creates an environment in which communication skills can be nurtured through intentional design and adaptive learning experiences.

### *Augmented Reality Applications in Autism Intervention*

AR technologies enhance learning by overlaying digital elements such as animations, labels, or visual cues onto real-world objects, creating a blended learning environment that supports dual coding and contextual understanding (Childs et al., 2023). This multimodal approach is highly suitable for ASD learners, who often respond better to visual and concrete representations compared to abstract or purely verbal instruction. Research has demonstrated that AR can increase attention span, improve symbolic reasoning, and strengthen object recognition skills among children with ASD by providing engaging, real-time visual feedback (Lorenzo et al., 2019). For communication-focused tasks, AR is particularly advantageous because it allows children to interact with physical items while simultaneously receiving functional cues and audio labels, thereby reinforcing the association between an object and its use (Heun et al, 2013). AR-based interventions have also shown promise in improving task accuracy, imitation skills, and the generalization of learned concepts to real-life contexts. These strengths position AR as a valuable tool for early communication intervention.

### *User Centered Design Principles in Special Needs Education Technology*

UCD emphasizes developing technologies based on the needs, abilities, and sensory profiles of end users through iterative testing and stakeholder collaboration. For ASD-focused educational tools, UCD is essential because of the wide variability in sensory sensitivities, cognitive preferences, and communication abilities among learners (Khowaja & Salim, 2020). UCD encourages developers to work closely with parents, therapists, and special educators to ensure that prototypes are intuitive, accessible, and appropriate for neurodiverse users (Emma, 2024). Sensory-friendly design components, such as simplified visual layouts, moderate animation speeds, and low-clutter interfaces, are critical for reducing overstimulation and supporting focused engagement during tasks. Additionally, UCD supports predictable navigation structures to minimize cognitive load and allow children to interact with learning tools at their own pace. By incorporating iterative refinement cycles, UCD ensures that the resulting AR application is not only functionally effective but also meaningful and comfortable for ASD learners. This approach increases the likelihood of adoption and practical use in educational and therapeutic settings.

## Methodology

This study employed a UCD approach that integrated direct observational analysis of children with ASD and secondary usability evaluation from parents. While parents provided brief verbal feedback during the session, the present analysis focuses solely on quantitative data and does not report qualitative interview findings.

### *Participants*

The primary users in this study were five children with ASD (Respondent A-E), aged between four to ten years old, who were recruited from the Makmal Penyelidikan Autisme, Universiti Kebangsaan Malaysia. Selection was based on three criteria: a formal ASD diagnosis, the ability to participate in short, guided tasks, and the provision of informed parental consent. These children interacted directly with the AR prototype during structured individual sessions, allowing researchers to assess usability, interaction patterns, and communication behaviors within a naturalistic yet controlled setting. Five (5) parents served as secondary evaluators, where their role in this study was limited to observing the session and completing a quantitative usability questionnaire.

### *Materials*

The AR prototype evaluated in this study incorporated mobile camera-based object recognition to identify everyday items and overlay contextual digital content. Once an object was detected, the application displayed a corresponding 3D animation, audio, object label, and functional cue designed to reinforce object-function understanding. The interface adhered to sensory-friendly design principles, including minimal visual clutter, moderate animation pacing, neutral color tones, and predictable navigation flow. These design features were selected to suit the needs of neurodiverse learners and to minimize the risk of sensory overload, which is a common concern when designing technology for children with ASD.

### *Instruments*

Structured observations of the children's interaction with the prototype were conducted using an eight-dimensional rubric from the ISO 9241-11 usability framework. The rubric examined attention, instruction comprehension, interaction, assistance required, response time, emotional expression, communication attempts, and task completion. Each dimension was represented by a five-level performance descriptor (1-5) to standardize observations; however, these levels functioned as qualitative categories rather than numerical scores and were not treated as statistical variables. This approach ensured consistent interpretation across respondents without implying formal quantitative scoring. All sessions were video recorded to enable verification and to reduce observer bias through cross-check review.

For parents, usability feedback was gathered through a structured questionnaire employing a five-point Likert scale. The questionnaire assessed multiple aspects of the AR application, including perceived effectiveness, efficiency, satisfaction, learnability, sensory compatibility, communication support, and error handling. Verbal comments from parents were recorded informally to contextualize the quantitative scores, but were not subjected to qualitative analysis and therefore not reported in this paper.

### *Procedures*

Each child participated in an individual session lasting approximately 15- 20 minutes, during which they interacted with a set of objects paired with the AR prototype. The researcher introduced the activity, ensured the child was comfortable, and facilitated the interaction only when necessary to maintain task flow. Observations were documented using the A1-A8 rubric

as the child navigated the prototype, performed object scanning, responded to visual and auditory cues, and attempted communication. Parents observed the session and completed the usability questionnaire immediately afterwards.

## Results and Discussion

### *Application Usability Based on Children's Interaction Outcomes*

Observation of five children with ASD during their interaction with the AR prototype revealed varied but generally positive engagement patterns across the eight assessed usability-related dimensions. Children A and D displayed consistently high performance, maintaining full attention throughout the session, responding rapidly to cues, interacting actively with the interface, and completing all tasks independently. This behavior indicates that the application's design elements, such as the visual cues, clear object animations, and direct auditory prompts, were effective for learners with strong baseline receptive and attentional abilities.

In contrast, Children B and E demonstrated more limited engagement, with shorter attention spans, slower response times, and lower levels of spontaneous interaction. Their performance suggested that the current interface may require additional scaffolding for learners who need clear prompts or repeated instructions. Children C showed moderate engagement, performing well initially but experiencing reduced focus and slower responses over time, indicating potential digital fatigue. This pattern highlighted the importance of pacing and session length when designing AR activities for neurodiverse learners.

Overall, the children's interactions outcome showed that the application is usable and engaging for learners who can process visual and auditory cues efficiently, while still benefiting those who require additional support. The variation in performance across respondents underscores the need for adjustable difficulty levels, enhanced feedback mechanisms, and more explicit guidance for children with lower communication readiness.

**Table 1: Summary of Children's Interaction Outcomes across Eight Dimensions**

| Dimension ID | Dimension Detail | Children A | Children B | Children C | Children D | Children E |
|---|---|---|---|---|---|---|
| A1 | Attention | 5<br>Full focus (100%) | 3<br>Approx. 60% | 2<br>Focus declines after 30s | 5<br>Full focus (100%) | 3<br>Moderate focus |
| A2 | Instruction Comprehension | 5<br>Immediate (0 repetition) | 2<br>Need 3-4 repeats | 3<br>Moderate, need 1-2 repeats | 5<br>Immediate (0 repetition) | 2<br>Need 3-4 repeats & assistance. |
| A3 | Interaction | 5<br>High (8) | 2<br>Low (2), Passive, limited interaction | 3<br>Moderate (4) | 5<br>High (7) | 1<br>Very low (1), Passive |
| A4 | Assistance Needed | 5<br>Minimal | 1<br>Very high | 3<br>Moderate (3 times) | 5<br>Minimal (< 2 times) | 1<br>Very high (> 8 times, |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | (> 8 times, strongly dependent on the facilitator to assist) | | | strongly depends on the facilitator to assist) |
| A5 | Response Time | 4<br>~3.0 s<br>Quick and accurate response | 1<br>> 8s<br>Slow response, need support | 3<br>~ 6.5s<br>Slower at the end of the session | 5<br>~2.1s<br>Quick response | 1<br>>8s<br>Slow response, need support |
| A6 | Positive Emotion | 5<br>>6 expressions (smiling, small laugh, show excitement) | 1<br>Neutral & low motivation | 3<br>Declining, excited at the start, but interest declines after minute 2 | 5<br>>6 expressions Consistent positive emotion | 1<br>Minimal |
| A7 | Communication | 5<br>>10 responses | 1<br><2 responses | 3<br>4 responses | 5<br>>10 responses | 1<br><2 responses |
| A8 | Task Completion | 5<br>100% | 2<br>~ 50%, with the facilitator's help | 3<br>80% need assistance at the end of the session | 5<br>100% | 2<br>~ 50%, with the facilitator's help |

***Parent Usability Evaluation***

Parents' evaluations of the application were strongly positive across key usability dimensions, reinforcing the observational findings. Satisfaction received the highest overall rating (mean 4.47), reflecting parents' confidence in the application's educational value and appropriateness for home or classroom use.

Communication support (mean 4.40) was also highly rated, indicating that parents perceived the application as effective in prompting naming, pointing, and responsive behaviors.

Sensory compatibility (mean 4.20) and learnability (mean 4.26) received strong ratings, suggesting that the visual and auditory elements were well tolerated and that the application was straightforward for children to use. Engagement and motivation also received a favorable score (mean 4.07), aligning with observable positive emotional expression among higher-performing children.

The lowest score, Error Handling (mean 3.60), highlighted some meaningful design limitations. Parents noted that children often relied on adult intervention when they made mistakes due to limited self-correction cues. This finding complements the weaker performance of Children B and E and suggested a need for clearer feedback loops and more intuitive recovery mechanisms within the application.

**Table 2: Parent Usability Evaluation Scores**

| Dimension | Mean | Standard Deviation (SD) |
|---|---|---|
| Effectiveness | 3.87 | 0.18 |
| Efficiency | 3.93 | 0.37 |
| Satisfaction | 4.47 | 0.38 |
| Learnability | 4.27 | 0.49 |
| Ease of Use | 4.00 | 0.33 |
| Error Handling | 3.60 | 0.43 |
| Recall/Memory | 4.13 | 0.18 |
| Engagement & Motivation | 4.07 | 0.37 |
| Sensory Compatibility | 4.20 | 0.18 |
| Communication Support | 4.40 | 0.43 |

***Integrated interpretation of Usability***

When synthesized, the children's interaction outcomes and parent evaluation presented a coherent usability profile for the AR prototype. The overall usability rating of mean 4.42 (SD 0.31) demonstrated broad acceptance of the application's functionality, clarity, and sensory suitability. The strongest outcomes were observed among children with higher baseline attention and communication readiness, who benefited from the application's clear visual cues and straightforward interaction flow.

At the same time, results revealed important design considerations. Performance gaps among the lower-engagement children and the low-error handling rating from parents both point towards a need for improved guidance, adaptive scaffolding, and more explicit corrective cues. Addressing these areas would expand the applications' accessibility and effectiveness for a wider range of ASD learners, ensuring that children with varied needs can engage meaningfully with AR-based learning tools.

**Conclusion**

This study evaluated the usability of a user-centered augmented reality object-recognition application designed to support early communication behaviors among children with autism spectrum disorder. Through structured observations of five children and quantitative usability ratings from parents, the findings demonstrated that the prototype is both usable and engaging, particularly for learners with strong baseline communication and attentional skills. Children showed varying levels of attention, interaction, and task completion, with two respondents displaying consistently strong performance across all dimensions. Parent evaluation further

affirmed the application's value, with high ratings for satisfaction, communication support, sensory compatibility, and learnability.

These outcomes indicate that AR, when designed with sensory-friendly and pedagogically grounded principles, can serve as an effective supplementary tool for early communication development. At the same time, the results highlighted areas requiring further refinement. Children who needed greater prompting or who experienced digital fatigue would benefit from adjustable scaffolding, clearer guidance during errors, and more adaptive pacing. Enhancing these design elements will be critical for ensuring that the application supports a broader range of ASD learners.

Future work will extend this research in several directions. First, larger-scale testing with more diverse ASD is needed to validate the generalizability of the findings. Second, longer-term studies may explore how repeated use affects communication behavior, engagement, and skill retention over time. Finally, integrated features such as adaptive difficulty levels, improved error-handling mechanisms, and data-driven progress tracking may further enhance the usability and instructional value of the prototype. Continued collaboration with educators, therapists, and parents will remain essential to refining the system and ensuring its relevance within real-world special education contexts.

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# EMERGING RESEARCH TRENDS ON ARTIFICIAL INTELLIGENCE IN STEM EDUCATION FROM 2020 TO 2025

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***Abstract:*** *Artificial Intelligence (AI) is increasingly influencing Science, Technology, Engineering, and Mathematics (STEM) education by introducing innovative approaches to teaching, learning, and assessment. This study conducts a bibliometric analysis of research on AI in STEM education, focusing on publications indexed in the Scopus database between 2020 and 2025. A total of 3,998 documents were analyzed to explore publication trends, leading countries, primary sources, and document types. The findings indicate a rapid increase in research output over the past five years, marked by significant growth in both journal articles and conference proceedings. This upward trend reflects the academic maturity and dynamic evolution of the field. The United States, China, and India emerged as the most prominent country contributors, while Computer Science, Medicine, and Engineering were identified as dominant subject areas. Journal articles represented the largest share of publications, followed by conference papers and review articles. Overall, the findings highlight the growing influence of AI in STEM education research and provide a a comprehensive view of the field's development.*

***Keywords:*** *Artificial Intelligence, STEM education, Bibliometric analysis, Research trends*

## Introduction

Artificial Intelligence (AI) is rapidly transforming a wide range of sectors, and education emerging as one of the most significantly impacted domains. The integration of AI into educational contexts has been driven by continuous advancements in technologies such as machine learning, natural language processing, and adaptive learning systems, which have collectively enhanced the relevance and applicability of AI within Science, Technology, Engineering, and Mathematics (STEM) education (Joseph & Uzondu, 2024; Shernoff, 2024). Within this context, AI offers transformative potential to support educators and learners alike by enabling more personalized, efficient, and data-driven approaches to teaching and learning. Specifically, AI tools are being applied to create adaptive learning environments, facilitate intelligent tutoring systems, automate assessment processes, and utilize predictive analytics to monitor and improve student performance outcomes (Surya, 2025). Moreover, AI-driven innovations contribute to identifying learning gaps, tailoring instructional content to individual student needs, and fostering student engagement through interactive and responsive learning platforms.

Recent developments such as adaptive learning platforms, intelligent tutoring systems, and learning analytics demonstrate the growing potential of AI to transform educational practices and outcomes (Almaki et al., 2025; Diwanji et al., 2018). These applications completely highlight how AI can enhance engagement, increase teaching efficiency, and promote inclusivity within STEM education environments. However, despite these promising

advancements, ongoing debates persist regarding issues of equity, ethics, data privacy, and the preparedness of educators to effectively integrate AI technologies into their teaching practices (Ismail, 2025). Addressing these challenges remains essential to ensure that the benefits of AI in education are realized equitably and responsibly.

Existing literature shows a growing interest in understanding the evolving role of AI in education. Previous reviews have examined its applications in intelligent tutoring systems, ethical considerations, and teacher preparation, while bibliometric analyses in educational technology and e-learning have revealed publication growth patterns, leading countries, and emerging research themes (Jia et al., 2022). Several focused studies have also investigated the use of machine learning and ensemble learning methods to predict student performance, highlighting both the opportunities and challenges associated with implementing AI in educational contexts (Rahman et al., 2025; Rimal et al., 2025). Collectively, these studies provide an important foundation for understanding AI applications in education, but most focus narrowly on predictive modeling rather than exploring the broader research landscape within STEM education.

Within the context of STEM education, AI research has addressed diverse areas such as simulation-based learning, adaptive problem-solving, and data-driven instructional interventions (Endla et al., 2025; Hasegawa et al., 2025). However, the literature remains fragmented, with limited systematic evaluation of how scholarly output has evolved over time. Critical inquiries remain regarding which countries and institutions are leading this research, what dominant themes have emerged, and how ethical and pedagogical dimensions are being addressed.

Bibliometric analysis provides a valuable approach for addressing these gaps. By examining publication trends, sources, countries, and document types, this method enables researchers to map the intellectual structure and development trajectory of the field (Gan et al., 2022). Therefore, this study aims to provide a bibliometric analysis of emerging research on AI in STEM education, highlighting publication trends and key contributors. Moreover, the present study seeks to analyze publication trends from 2020 to 2025 to capture research growth, identify leading countries and publication venues, and assess the distribution of document types to better understand how knowledge in this area is disseminated. Through these objectives, the study offers a timely and comprehensive overview of the development of AI research in STEM education, providing valuable insights for both scholars and practitioners.

## Research Methodology

This study uses bibliometric analysis to examine the emerging trend and productivity of research on AI in STEM education. Bibliometric analysis, a widely used and rigorous method, allows exploration and analysis of vast amounts of scientific literature (Donthu et al., 2021). In addition, the bibliometric analysis employs a content analysis approach to establish connections between any publication, country, author, or cited author and these connections are presented visually through maps (Su et al., 2021). A research study conducted by Lazarides et al., (2025) and Amiruddin et al., (2025) highlighted the growing popularity of bibliometric analysis as a valuable tool for illustrating the evolving trends in academic research. The methodology of this study comprises two phases: Data Collection and Data Analysis.

### *Data Collection*

The bibliometric study was conducted in the end of November 2025 and data was collected from the Scopus database, spanning from 2020 to 2025. We conducted a search using the keywords "AI" and "artificial intelligence" and "STEM" and "STEM education" across the Scopus database. This search was applied to the article titles, abstracts, and keywords. This study focussed exclusively on the final published articles and used English language filtering as presented in Table 1. After this phase, we identified and retrieved a total of 3,998 records from various fields of study.

Table 1: Search String Keyword

| | |
|---|---|
| Scopus database | TITLE-ABS-KEY ( ( AI OR "artificial intelligence" ) AND ( STEM OR "STEM education" ) ) AND PUBYEAR > 2019 AND PUBYEAR < 2026 AND ( LIMIT-TO ( PUBSTAGE , "final" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) |

### *Data Analysis*

After the data collection phase was completed, the retrieved documents went through the analysis methods. Each document contained bibliometric data, such as the year of publication, author's name, subject area, source title, keywords, affiliation, country, and language. A comprehensive analysis of 3,998 collected documents was conducted across two key areas: performance analysis and frequency analysis. The findings were presented in various formats, including tables and graphs, to illustrate the research trends from different perspectives, such as annual publications, countries, and publication sources. During this phase, the bibliometric analysis was performed by using Microsoft Excel 2016.

## Results and Discussion

This section presents the bibliometric analysis results that address the objectives of this study, which aims to analyse the emerging research trends on AI in STEM education. To address the objectives, a total of 3,998 retrieved documents were analyzed to identify research trends and publication productivity using five bibliometric indicators: annual growth in publications, publication source types, document types, subject areas of documents, and leading countries' contributions.

### *Annual Growth of Publication*

Figure 1 presents the annual growth rate of publication, mapping the total number of documents against their respective year of publication. This graph illustrates the annual increase in the number of documents related to AI in STEM education. As shown in Table 1, the number of publications on AI in STEM education has steady increased from 2020 to 2025. In 2020, only 226 documents were recorded, and this number more than doubled by 2022. Notably, there was a sharp rise occurred in 2023 with 574 documents, followed by a peak in 2024, where 1,100 documents were recorded, the highest recorded number during the period. Although in 2025 shows a slight increase to 1,405 documents, the overall upward trend reflects a significant and continuing growth in research activity within this field.

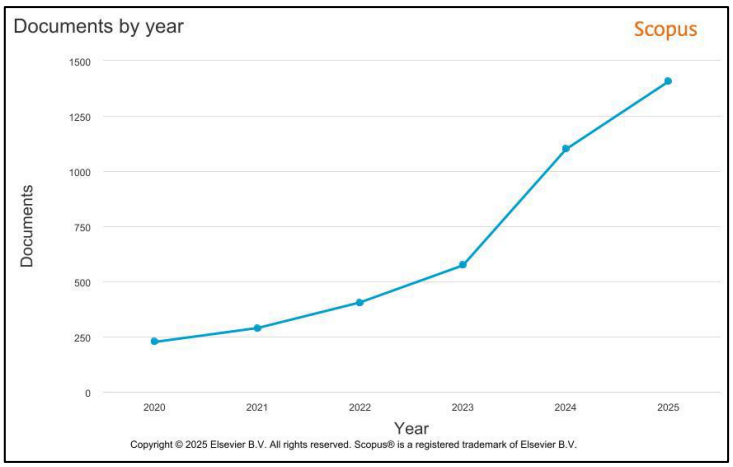



**Figure 1: Annual Growth of Publication**

**Table 1: Documents by Year**

| Year | Documents |
|---|---|
| 2025 | 1405 |
| 2024 | 1100 |
| 2023 | 574 |
| 2022 | 404 |
| 2021 | 289 |
| 2020 | 226 |

This upward trend shows that the research trends of AI in STEM education has experienced rapid growth, particularly in the past three years. This growth is likely attributed to the emergence of generative AI tools and their educational applications, which have generated increased academic interest (Nguyen, 2025; Sandhu et al., 2024). In conclusion, this trend demonstrates the growing significance of AI in education, as well as the outstanding momentum for future research in this field.

### *Publication Source Types*

This study also analyzed the distribution of published documents based on their source types. Five types of retrieved documents were identified: journals, conference proceedings, book series, books, and trade journals. Figure 2 illustrates the distribution of published documents by source type. Journals dominate the research landscape in STEM education, accounting for a substantial 63.0% of the total output. Conference proceedings follow closely behind, contributing 22.0%. Book series and individual books collectively make up 8.1% and 6.9% of the publications, respectively. Trade journals, however, represent a very small portion, comprising only 0.1% of the publications.

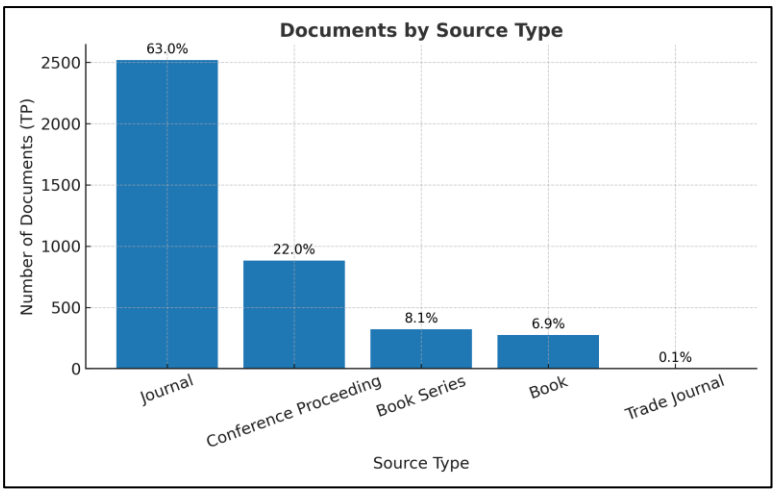



**Figure 2: Document Source Types**

This distribution suggests that most research in this field is disseminated through peer-reviewed journals, reflecting academic maturity and growing recognition of AI in STEM education as a formal research domain. Conference proceedings highlight the topic's dynamic nature, where new findings are often presented before appearing in journals. Contributions in books and book series indicate additional avenues for comprehensive discussions. Overall, journal publications emphasise scholarly validation, while conference outputs indicate ongoing exploration and rapid knowledge sharing.

***Document Types***

The analysis of document types in Figure 3 shows that articles (40.5%) make up the largest share of publications, followed by conference papers (25.7%) and reviews (16.8%). Together, these three categories account for over 80% of the total output. This finding suggests that journal articles remain the primary medium for disseminating research on AI in STEM education, while conferences play a significant role in sharing emerging work. The literature encompasses a diverse range of contributions, including book chapters (7.8%), editorials (3.1%), conference reviews (2.3%), notes (1.3%), books (1.2%), short surveys, and letters (less than 1% each). This suggests that the topic has gained attention not only in formal research but also in academic commentary and broader discussions.

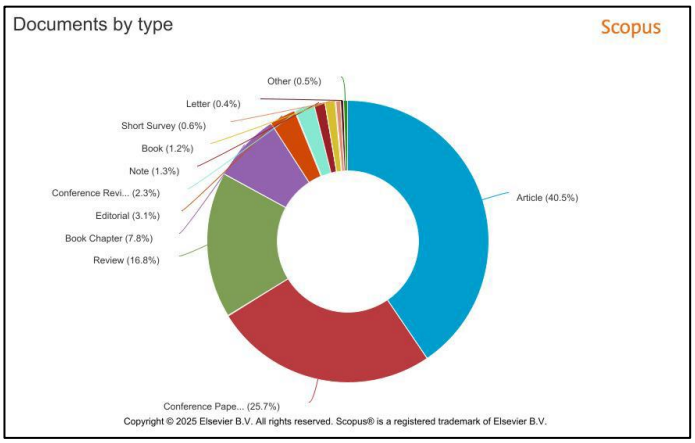


**Figure 3: Documents by Type**

As conclusion, the findings indicate that peer-reviewed journal outputs dominate the field, while conference proceedings continue to be influential in tracking early developments. The presence of reviews suggests a growing consolidation of knowledge, while other document types indicate a diversification in how AI in STEM education research is shared.

***Subject Area of Documents***

This study further analyzed and summarised the distribution of publications across the diverse range of subjects covered in the documents. Figure 4 illustrates the distribution of documents categorised based on their subject matter. Based on the total publication, the topic area distribution shows that AI research in STEM education is mostly centered in Computer Science (19.7%), followed by Medicine (13.0%) and Engineering (12.0%). These three disciplines collectively account for the majority of publications, demonstrating that AI in STEM education is both technologically driven and strongly linked to practical scientific and technical applications.

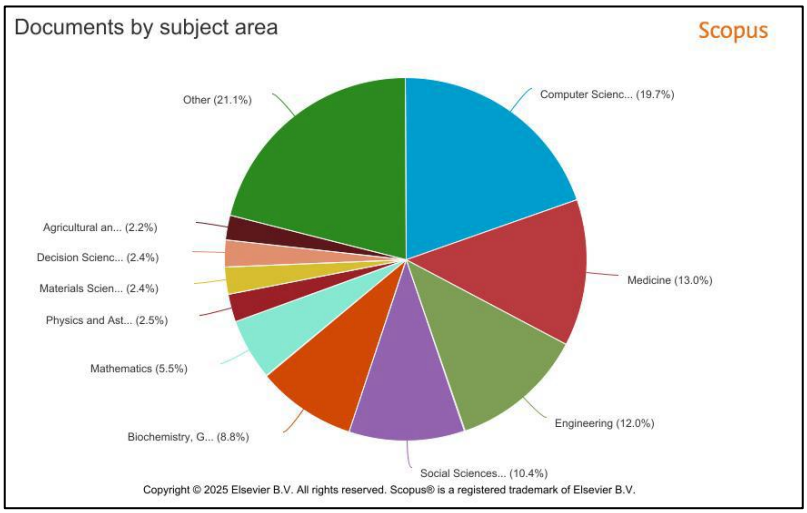



**Figure 4: Documents by Subject Area**

Notably, Social Sciences (10.4%) and Biochemistry, Genetics, and Molecular Biology (8.8%) also make considerable contributions, demonstrating the expanding recognition of AI's involvement in educational research and life sciences training. Fields such as Mathematics (5.5%), Decision Sciences (2.4%), and Physics and Astronomy (2.5%) all demonstrate AI's integration into basic STEM subjects. While combined shares (21.1%) in other fields like as Business, Management and Accounting, Arts and Humanities, and Chemistry show that AI's educational uses are spreading beyond traditional STEM and into multidisciplinary domains.

Overall, the findings show that while Computer Science remains as the key driver, AI in education has gained significance in variety of academic areas. This reflects the adaptability of AI technologies and their potential to influence teaching, learning, and research across the STEM spectrum and beyond.

***Publication by Leading Countries Contributions***

This study examines documents collected based on a country's contribution to publication to find the most productive country in AI in STEM education research. A total of 41 countries from around the world collaborated on this research. Table 2 lists the top 15 most productive countries, each of which has contributed over 70 papers. The United States leads in the number of publications with 28.3%, followed by China (14.3%) and India (9.7%). Other significant contributors include the United Kingdom (6.3%), Germany (6.0%), and Italy (5.2%). Countries including France, Spain, Canada, and Australia each contribute approximately 3%.

**Table 2: Publication by Leading Countries**

| Country | Total Publication (TP) | Percentage (%) |
|---|---|---|
| United States | 1130 | 28.3% |
| China | 573 | 14.3% |
| India | 388 | 9.7% |
| United Kingdom | 251 | 6.3% |
| Germany | 240 | 6.0% |
| Italy | 208 | 5.2% |
| Undefined | 183 | 4.6% |
| Spain | 132 | 3.3% |
| France | 121 | 3.0% |
| Canada | 116 | 2.9% |
| Australia | 108 | 2.7% |
| Japan | 103 | 2.6% |
| South Korea | 91 | 2.3% |
| Netherlands | 73 | 1.8% |
| Saudi Arabia | 71 | 1.7% |

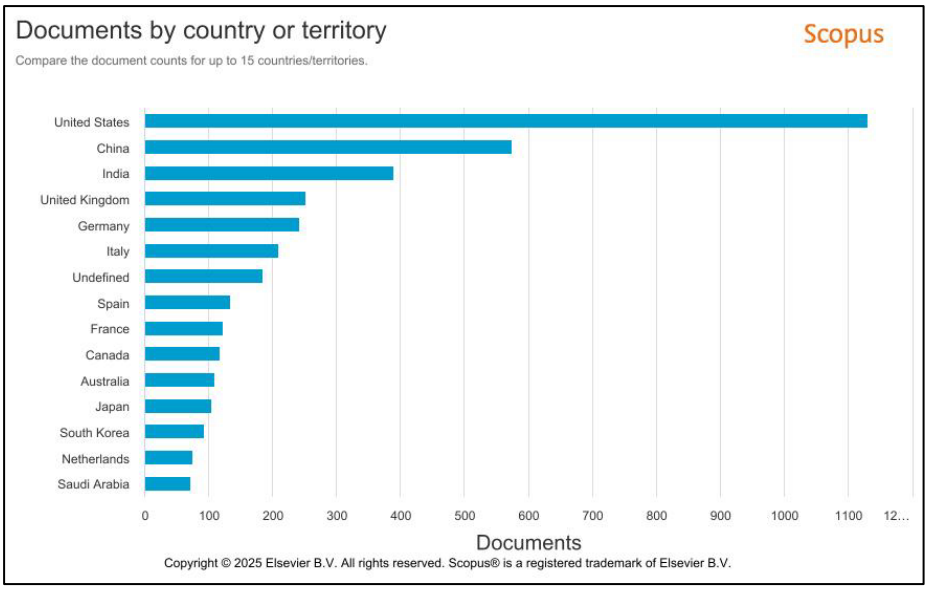



**Figure 5: Distribution Documents by Country**

As shown in Figure 5, the distribution of publications by country indicates that AI research in STEM education is predominantly conducted in a few leading countries, such as the United States, China, and India. These countries collectively account for more than half of all publications in this topic. While European nations and other areas contribute, their output is on a lower scale than the leading countries.

Overall, the findings show that, while there is widespread participation involvement, leadership in this research domain is mostly centered in technologically advanced and research-intensive countries. This highlights the possibility for deeper international collaboration to increase the field's variety and global effect.

## Conclusion

This bibliometric study provides a comprehensive overview of recent research trends in AI within STEM education. The analysis shows a steady increase in publications over the past few years, reflecting the growing significance of AI in shaping teaching and learning practices. The findings show that certain countries are at the forefront of AI research, with a concentration of research publications in specific journals and conferences. Moreover, conference proceedings remain to be a significant outlet, indicating the emerging and dynamic nature of this field. By mapping these patterns, the study offers scholars and practitioners a concise overview of the current research landscape. Although the scope of study is limited to publication trends, sources, countries, and document types, the findings provide a valuable foundation for understanding the evolution of AI in STEM education and serves as a guiding principle for future studies that explores deeper into thematic and application-focused investigations.

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# RESEARCH TRENDS IN LEARING ANALYTICS FOR STEM EDUCATION: A BIBLIOMETRIC STUDY

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***Abstract:*** *Learning analytics has emerged as a growing field of interest, particularly relevant to STEM education, outstanding to its capacity to facilitate evidence-driven decision-making and enhance learner performance through data-driven analysis. This study presents a bibliometric analysis of research on learning analytics within STEM education, with the objective of identifying publication productivity and research trends over time. Using the Scopus database, publications were retrieved and analyzed based on five descriptive bibliometric indicators: annual growth in publications, publication source types, document types, subject areas, and contributing countries. The analysis covers publications indexed between 2010 and 2025. Findings showing an increasing trend, with notable expansion in specific STEM-related subject areas and the emergence of key contributing regions. The study offers an evidence-based overview of publication trends and identifies the main areas of activity in learning analytics research, providing useful insights for educators, researchers, and policymakers in STEM education.*

***Keywords:*** *Learning Analytics, STEM Education, Bibliometric Analysis, Research Trends, Descriptive Bibliometrics*

## Introduction

The disciplines of Science, Technology, Engineering, and Mathematics (STEM) are globally acknowledged as key drivers of economic growth and innovation. Consequently, strengthening STEM education is a dominant objective for nations globally (Ashraf et al., 2024; DeCoito et al., 2024). In the context of the Fourth Industrial Revolution and the escalating demand for 21st-century competencies, equipping a generation with adaptable, innovative, and critically thinking problem-solvers is the utmost importance (Tavdgiridze et al., 2024). In addition, STEM's interdisciplinary nature demands innovative pedagogies that measure and foster conceptual mastery and essential 21st-century skills like problem-solving, critical thinking, and collaboration (Pinar et al., 2025; Warliani et al., 2025).

However, the complexity of integrated learning environments, often leveraging digital platforms, presents a persistent challenge in obtaining and analysing the rich data generated by student interactions. For instance, STEM education encounters persistent challenges, such as high student attrition rates, particularly among underrepresented groups, and the inherent complexity of evaluating comprehensive and interdisciplinary learning (Oliveira et al., 2025). Furthermore, conventional assessment methodologies frequently fail to encompass the affective domain and the development of fundamental non-cognitive skills such as self-efficacy, teamwork, and problem-solving (Al Hamad et al., 2024).

In response to the challenges of the modern educational landscape, which has seen the growth of digital learning platforms and tools, an enormous amount of data has been generated.

Consequently, learning analytics has emerged as a crucial and transformative discipline of research and practice, enabling the effective utilization of the massive educational data resource (Vashishth et al., 2024). Learning analytics utilizes data science techniques to measure, collect, analyze, and report student data and their contexts in understanding and optimisation of learning (Vetrivel et al., 2025).

Within the domain of STEM education, learning analytics provides the means to transform raw digital traces from platform clicks to performance logs into actionable insights (Oyedotun et al., 2025). Several studies demonstrate the potential of learning analytics to move beyond traditional summative evaluation by providing real-time, actionable insights to students, educators, and institutions (Brown et al., 2025; Vashishth et al., 2024). These evolving findings are vital in personalizing education and making timely, evidence-based improvements to the teaching and learning environment. Additional studies have highlighted that learning analytics contributes to evaluating student engagement, predicting academic outcomes, and designing personalized learning recommendations for STEM learners (Sajja et al., 2025).

The reviewed literature highlights the significance of learning analytics in supporting evidence-based education, particularly in STEM disciplines where data-driven instruction is is becoming increasingly adopted. While interest in learning analytics is growing, a systematic examination of the distribution of research efforts across STEM subject areas is lacking. Additionally, publication productivity, document types, and contributions from different countries in STEM-focused learning analytics research remain underreported.

For this reason, a bibliometric study is necessary to provide an updated overview of how research in learning analytics has progressed within STEM education and where scholarly attention has been concentrated in recent years. Bibliometric analysis, a commonly used method, enables researchers to examine publication trends, sources, countries, and document types. The method also allows researchers to map the intellectual structure and development trajectory of a field (Gan et al., 2022).

The present study addresses this gap by identifying research trends in learning analytics within STEM education through descriptive bibliometric indicators. The research questions (RQ) are as follows:

RQ1: What are the annual publication trends in learning analytics research within STEM education?
RQ2: What publication sources and document types are most common in this field?
RQ3: Which subject areas contribute most to learning analytics research related to STEM?
RQ4: Which countries demonstrate the highest research productivity in this domain?

Drawing upon an analysis of publication productivity patterns, this study presents empirical findings that describe the growth, disciplinary distribution, and geographic development of learning analytics research in STEM, that supporting informed decision-making for future research and policy.

## Research Methodology

The present study employs a descriptive bibliometric approach to examine research trends in learning analytics within STEM education. Bibliometric analysis is a systematic and widely

adopted method for exploring large bodies of scientific literature (Donthu et al., 2021). In addition, the approach enables the identification and visualization of relationships among publications, countries, authors, and cited authors through mapping techniques (Su et al., 2021). Recent studies also underscore the increasing utilisation of bibliometric methods to illustrate the evolution of academic research across domains (Amiruddin et al., 2025; Lazarides et al., 2025). Consequently, this study is structured into two primary stages: data collection and data analysis.

### *Data Collection*

In the phase, the bibliometric study was conducted in the end of November 2025. The Scopus database was selected as the data source due to its wide disciplinary coverage and consistent indexing of educational and STEM publications. We conducted a search query across the Scopus database, spanning from 2010 to 2025, using combined terms and keywords related to learning analytics and STEM education. This search query was applied to the article titles, abstracts, and keywords. The study focussed exclusively on the final published articles and used English language filtering as presented in Table 1. After this phase, we identified and retrieved a total of 263 records from various fields of study.

**Table 1: Search String Keyword**

| | |
|---|---|
| Scopus database | TITLE-ABS-KEY ( ( "learning analytic*" ) AND ( STEM OR "STEM education" ) ) AND ( LIMIT-TO ( PUBSTAGE , "final" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) |

### *Data Analysis*

After the data collection phase was completed, the retrieved records were analysed using the specified methods. Each document contained exported metadata records, including the publication year, author's name, subject area classification, source title, document type, and country affiliation. A comprehensive descriptive analysis of 263 collected documents was conducted using two key analysis methods: frequency counts and distribution summaries. The findings were presented in various formats, including tables and graphs, to illustrate research trends from different perspectives, such as annual publications, countries, and publication sources. During this phase, descriptive statistics were employed for analysis, and Microsoft Excel 2016 was used for visualization.

## Results and Discussion

This section presents the descriptive bibliometric analysis results that address the objective of the study, which aims to provide an overview of research trends in learning analytics within STEM education. To fulfil the objective, a comprehensive analysis of 263 retrieved documents was conducted to examine research trends and productivity measurement. This analysis employed five bibliometric indicators: annual publications, publication source types, document types, subject areas, and contributions of countries.

### *Annual Publication Trends*

Figure 1 illustrates the annual number of publications on learning analytics in STEM education from 2010 to 2025. As shown in Table 2, the annual publications by year indicate a very slow

beginning, with no publications recorded between 2010 and 2012 and only minimal activity from 2013 until 2015. From 2016 onwards, there was a noticeable increase in scholarly attention, followed by a sharper rise after 2018. Publication output reached its peak in 2024 before slightly declining in 2025. Over the past decade, there has been a sustained and accelerating interest in learning analytics within STEM contexts. This upward trend indicates a growing academic interest in learning analytics in STEM contexts, particularly over the past five years. This growth aligns with the global shift towards data-driven educational decision-making and the incorporation of educational technologies into teaching and learning methodologies.

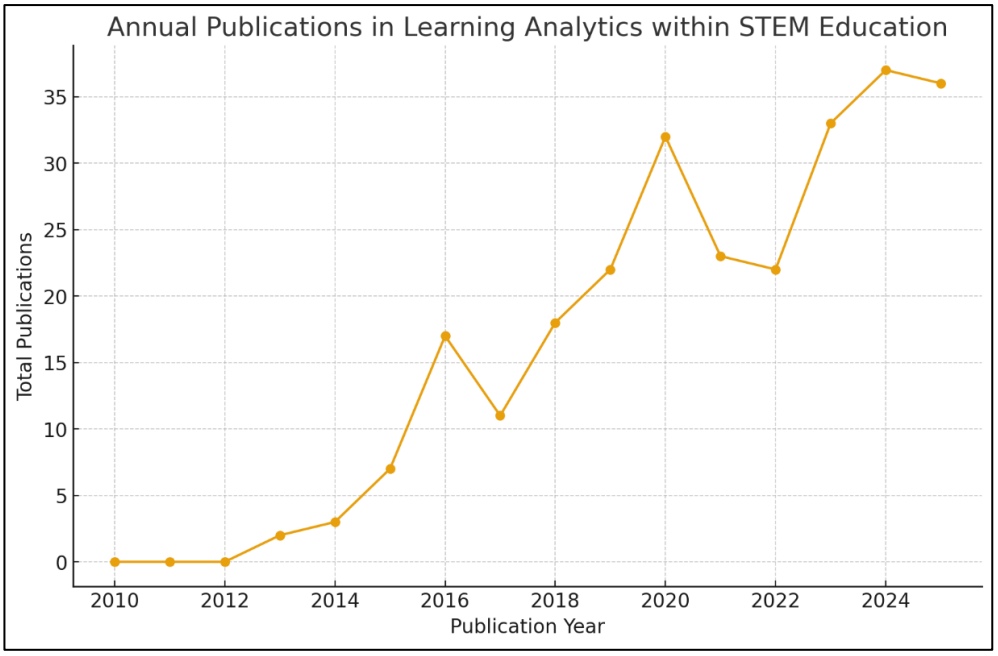



**Figure 1: Annual Publication Trends**

**Table 2: Annual Publications by Year**

| Year | Total Publication |
|---|---|
| 2025 | 36 |
| 2024 | 37 |
| 2023 | 33 |
| 2022 | 22 |
| 2021 | 23 |
| 2020 | 32 |
| 2019 | 22 |
| 2018 | 18 |
| 2017 | 11 |
| 2016 | 17 |
| 2015 | 7 |
| 2014 | 3 |
| 2013 | 2 |
| 2012 | 0 |
| 2011 | 0 |

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***Publication by Source Types***

This study also analyzed the distribution of publications based on their source types. Four types of recorded publications were identified: journal articles, conference proceedings, book series, and books. Figure 2 illustrates the distribution of publications by source type. The results indicate that conference proceeding dominates the publication landscape in learning analytics within STEM education, accounting for nearly half of all outputs (48.3%). Journals are the second most common source (36.5%), reflecting the increasing scholarly maturity and peer-reviewed dissemination of research. Academic publishing comprises a smaller proportion of book series and books (11.0% and 4.2% respectively), indicating that the field is experiencing growth.

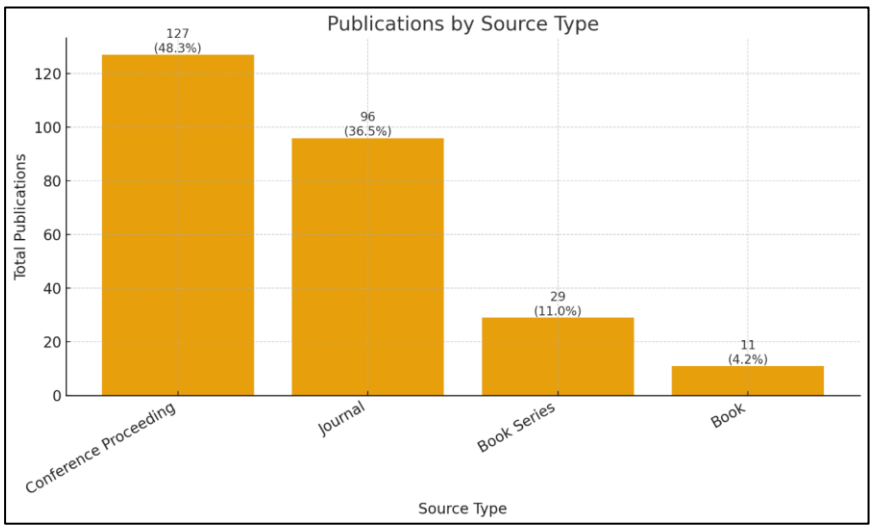



**Figure 2: Publication by Source Types**

***Publication by Document Types***

The analysis of publication by document types, presented in Figure 3, reveals that the majority of the documents within this dataset constitute conference papers (49.43%), with journal articles representing the second-largest category (33.46%). This observation underscores the fact that research dissemination in this field predominantly favours conference-based publications over journal outlets. These findings suggest that the field of learning analytics continues to evolve, and researchers often publish preliminary results in conferences prior to journal publications.

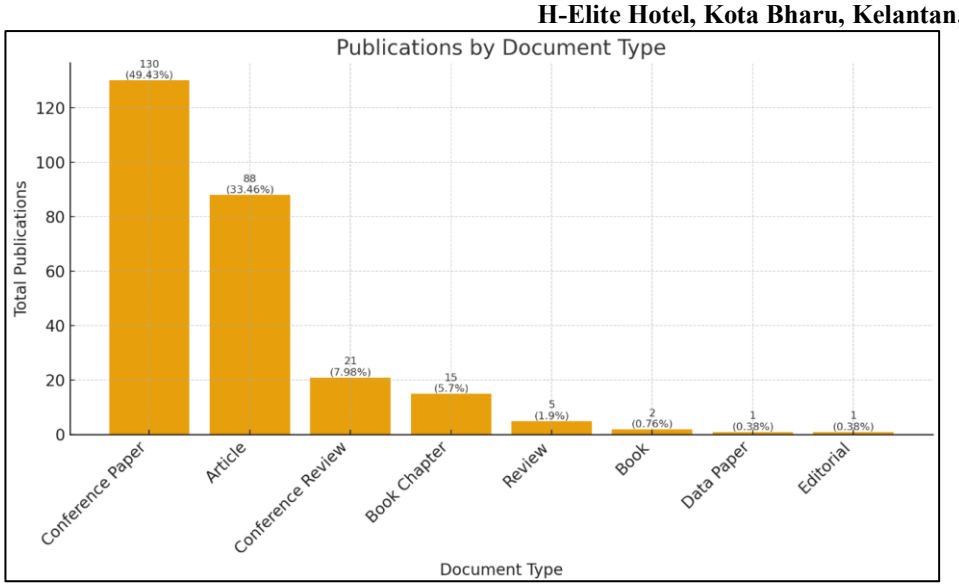



**Figure 3: Publication by Document Type**

The findings are expected to demonstrate the presence of both journal articles and conference papers in terms of publication sources and document types. The high proportion of conference papers suggests that this research area is still emerging. Conference publications often reflect developing research fronts and the early dissemination of ideas. In contrast, an increasing number of journal publications indicate a gradual maturation of the field, with a growing emphasis on theoretical grounding, empirical validation, and rigorous peer review.

***Publications by Subject Area***

This study also analyzed and summarised the distribution of publications across the diverse range of subjects covered in the collected documents. Figure 4 illustrates the distribution of publications by subject area related to learning analytics in STEM education. The results show a highly uneven contribution across fields. Based on the total publication, clearly shows that Computer Science (194 publications) and Social Sciences (157 publications) dominate the research domain, contributing the majority of publications. Engineering (64 publications) and Mathematics (35 publications) also make significant contributions, reflecting strong methodological and technical engagement. Areas with lower frequencies, such as Health Professions, Materials Science, and Energy, are experiencing a gradual increase in research interest in applied areas.

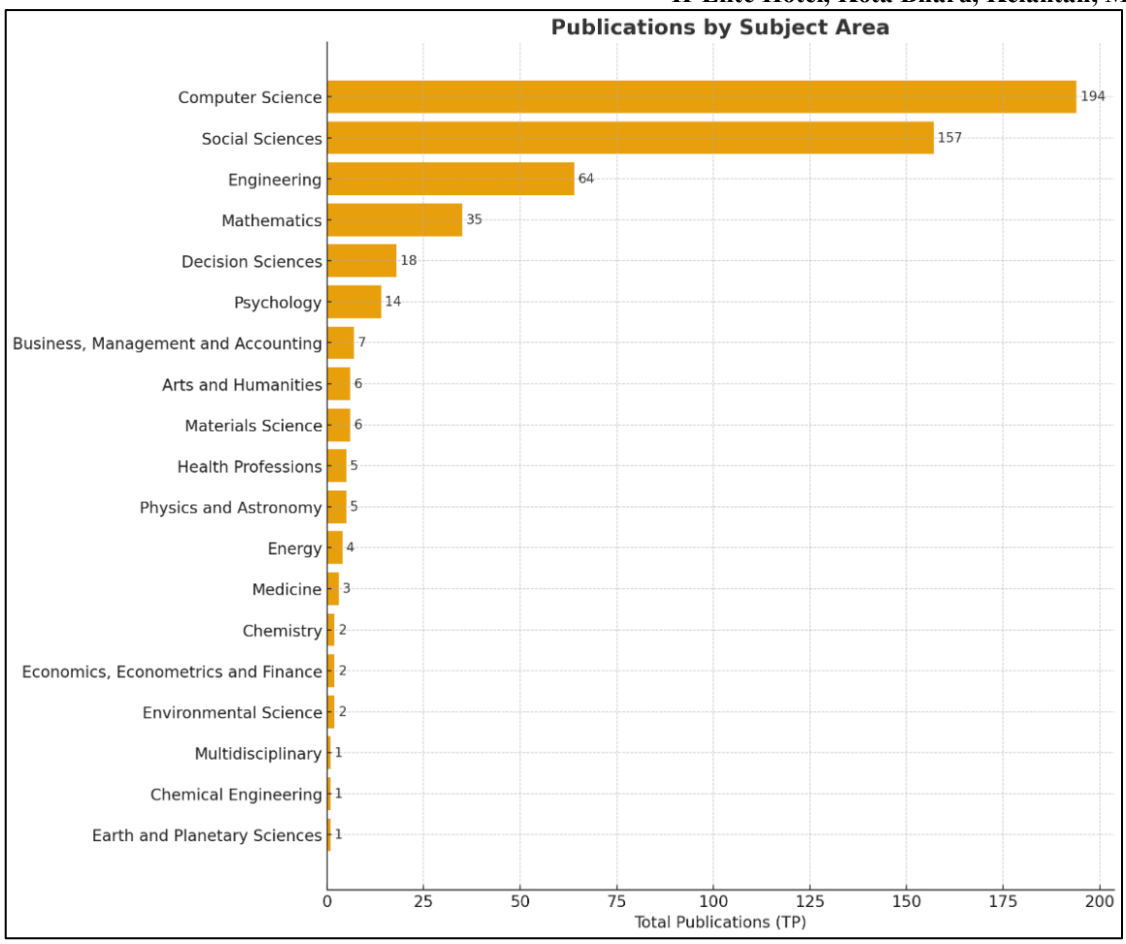



**Figure 4: Publications by Subject Area**

The publication distribution by subject area shows that learning analytics research is predominantly rooted in Computer Science and Social Sciences, with increasing contributions from Engineering and other STEM fields. The dominance of STEM learning environments is expected, given the computational methods and data processing techniques that underpin learning analytics. However, limited representation in areas such as health, energy, and multidisciplinary studies presents opportunities for future cross-domain exploration and application.

***Publication by Country***

This study delves deeper into the collected documents, focussing on the contributions of countries to the publication of learning analytics in STEM education. A global collaboration of 41 countries participated in this research. Figure 5 illustrates the distribution of publications by country, with each country having published over 5 publications. The results show that the United States leads learning analytics research, with 81 publications. This indicates a strong research capacity and early adoption of learning analytics within its academic community.

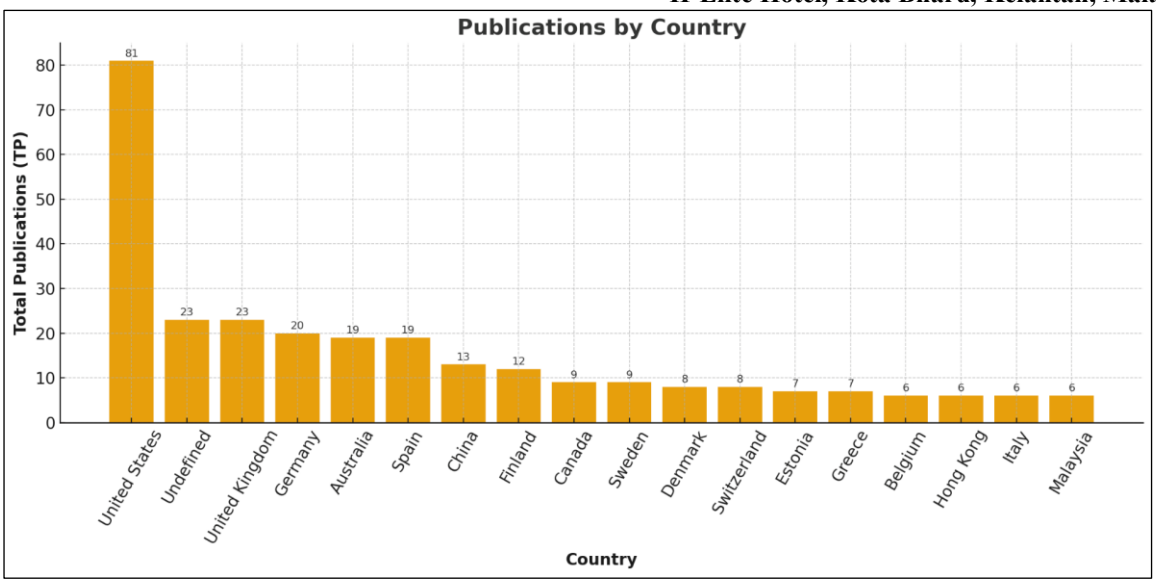



**Figure 5: Publications by Country**

Following this, Undefined (23 publications) and the United Kingdom (23 publications) are also developed research hubs, alongside other countries like Germany (20 publications), Australia (19 publications), and Spain (19 publications). Asian contributions are visible through China (13 publications), Hong Kong (6 publications), and Malaysia (6 publications), suggesting growing regional interest but still comparatively limited output. The lower publication counts from European countries like Estonia, Greece, and Belgium indicate emerging participation rather than established research productivity. Overall, the pattern demonstrates that learning analytics research is predominantly concentrated in Western and developed nations, particularly the United States, while opportunities remain for broader global participation especially among developing countries and institutions aiming to expand research in this area.

## Conclusion

This study examined research trends in learning analytics within STEM education through a descriptive bibliometric analysis. The results demonstrate a steady increase in publication output, diversification of document and source types, and a strong representation of STEM-oriented subject areas, particularly Computer Science and Engineering. The geographical distribution of publications further indicates that research activity is predominantly concentrated in developed regions, although contributions from emerging countries are gradually increasing, reflecting growing international engagement.

Overall, the findings provide an evidence-based overview of how learning analytics research is evolving within STEM education, offering valuable insights for researchers, policymakers, and practitioners seeking to understand publication trajectories, disciplinary patterns, and global contributions. This bibliometric evidence also points to several promising directions for future investigation, including thematic mapping, collaboration network analysis, and keyword evolution, which may further clarify emerging themes and strengthen institutional and national strategies for advancing analytics-driven approaches in STEM learning contexts.

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# HALAL COMPLIANCE ISSUES ON TRENDING FOODS AMONG CHILDREN: SHAFI'I SCHOOL OF ISLAMIC JURISPRUDENCE APPROACH AND HALALAN THAYYIBAN EDUCATION IN BRUNEI

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***Abstract:*** *Trending foods promoted on social media significantly influence children's food choices in Brunei, often prioritizing aesthetics over halal compliance and health. This study examines the halal status of such foods within the Shafi'i school of Islamic jurisprudence and explores the role of halalan thayyiban education in strengthening children's halal awareness. A qualitative design was employed using a semi-structured interview with the Head of the Science Curriculum Unit, Ministry of Education, Brunei, to explore the integration of halalan thayyiban values into the curriculum. Thematic analysis indicates a need for a more systematic educational approach to address challenges in assessing trending foods. The findings highlight that, although Shafi'i principles offer clear guidance on halal food, a stronger integration of halalan thayyiban concepts in science and Islamic studies is required to support maqasid al-shariah and nurture ethical, healthy halal food decisions among children.*

***Keywords:*** *Shafi'I School Of Islamic Jurisprudence, Trending Foods, Halalan Thayyiban Education, Halal Fiqh, Brunei Children*

## Introduction

The advancement of the digital world has led to the rise of trending food culture, becoming a social norm, especially among children. This influence not only shapes eating patterns but also challenges the community's ability to critically assess the halal status of foods. As Brunei Darussalam officially follows the Shafi'i school of Islamic jurisprudence, the issue of halal food must be seriously addressed through a strong fiqh framework and enhanced halal education from an early age.

Recent studies indicate that children's food choices in Brunei are heavily influenced by taste preferences, packaging and digital exposure, which often leads to the consumption of energy-dense, nutrient-poor foods such as sugar-sweetened beverages and fried snacks (Talip et al., 2017). These dietary patterns are contributing to an alarming rise in childhood obesity in the country, where approximately 30% of school-aged children are reported to be either overweight or obese (Global Nutrition Report, 2021). Furthermore, while public awareness of halal is generally high in Brunei due to its Islamic governance, the deeper appreciation of the halalan thayyiban concept, which encompasses both lawful (halal) and wholesome (thayyib), remains insufficient, especially among children (Abdullah et al., 2023).

This gap underscores the need for a more comprehensive and values-driven halal education curriculum that not only imparts technical knowledge but also cultivates ethical awareness and

critical thinking in evaluating food sources. In this regard, Islamic education anchored in Maqasid al-Shariah offers a holistic framework that integrates spiritual, physical and societal well-being, particularly through the protection, preservation and expansion of religion (hifz al-din), life (hifz al-nafs), intellect (hifz al-'aql), lineage (hifz al-nasl), and wealth (hifz al-mal) (Kamali, 2010).

The objective of this study is to analyse halal compliance of trending foods among children in Brunei from the perspective of the Shafi'i fiqh and assess the role of halalan thayyiban education in addressing this issue. The research question is how Halalan Thayyiban education can strengthen halal awareness among children through the educational curriculum.

## Literature Review

### *Shafi'i Jurisprudence and Maqasid Al-Shariah in Food Consumption*

The Shafi'i school of Islamic jurisprudence asserts that halal food must be clean, pure, and sourced through lawful means in accordance with the shariah (Al-Shafi'i, 1980). Food that is doubtful (shubhah) is to be avoided as an act of caution (ihtiyat). These injunctions are closely linked to the objective of hifz al-din, whereby lawful consumption is both an expression of faith and a manifestation of obedience to Islamic law. Within this framework, the concept of halalan thayyiban moves beyond mere legality to encompass wholesomeness, safety, and ethical sourcing. It operationalises broader maqasid al-shariah by safeguarding life (hifz al-nafs) through health, protecting intellect (hifz al-ʿaql) by avoiding harmful substances, and preserving lineage (hifz al-nasl) by ensuring nutritional integrity in childhood diets (Al-Shatibi, 2004). Such a holistic perspective implies that education on food choices must integrate religious rulings with scientific understanding and moral reasoning.
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### *Trending Foods and The Need for Early Educational Intervention*

Trending foods frequently conflict with halalan thayyiban ideals, as they tend to prioritise visual appeal, sensory stimulation, and marketability over nutritional value and halal assurance. Products high in artificial additives, excessive sugars, or non-certified ingredients may therefore entail both physical and spiritual risks (Aziz & Talib, 2021), underscoring the importance of early educational intervention.

### *Curriculum-Based Halal Education in Malaysia*

Malaysia has implemented curriculum-based initiatives that embed halal education across different educational levels. Halal Science modules introduced in selected schools and higher education institutions integrate halal-related topics into science, biology, and consumer studies curricula. Universities such as Universiti Putra Malaysia and the International Islamic University Malaysia have further advanced halal literacy through interdisciplinary research and community engagement, often in collaboration with JAKIM and the Halal Development Corporation (HDC) (Muhamad et al., 2017).

### *Curriculum-Based Halal Education in Indonesia*

Indonesia, which also follows the Shafi'i tradition, has institutionalised halal assurance through the Halal Product Assurance Law No. 33/2014. This legislation has stimulated the

incorporation of halal topics into madrasah curricula and the development of halal literacy modules for youth, supported by bodies such as the Indonesian Ulema Council (MUI) and the National Shariah Council (Majelis Ulama Indonesia, 2018). Community-based programmes further extend halal awareness to parents and local food vendors (Rahman, 2021).

### *Towards An Integrated Halalan Thayyiban Curriculum in Brunei Darussalam*

Brunei Darussalam, guided by the Melayu Islam Beraja (MIB) philosophy and robust national halal certification, has likewise prioritised halal governance. Nevertheless, the systematic integration of halalan thayyiban education into the core curriculum, particularly at the primary level, requires further policy refinement and structured pedagogical implementation. By reflecting on Malaysia's formalised halal curriculum and Indonesia's grassroots halal literacy initiatives, Brunei can design an integrated and culturally resonant educational framework that bridges religious doctrine with scientific literacy. Embedding halalan thayyiban principles within the primary science and Islamic studies curricula would equip children not only with theological understanding but also with practical competencies to make ethical, maqasid-aligned food choices, thereby nurturing a generation that is both spiritually conscious and nutritionally informed.

## Materials and Methods

### *Materials*

The study was conducted within the context of the Brunei Darussalam primary school system, focusing on the integration of halalan thayyiban principles into the national science curriculum. The key "materials" for the research comprised:

- Participant expertise: One key informant, the Head of the Science Curriculum Unit at the Ministry of Education, Brunei Darussalam, selected through purposive sampling based on extensive experience in curriculum design and implementation.
- Documentary context: Existing primary science curriculum documents and policy directions related to values education and food, which formed the background frame for the interview questions.
- Interview instruments: A semi-structured interview guide covering (i) challenges in embedding halalan thayyiban values in the science curriculum, (ii) interconnections between scientific and religious education, and (iii) implications for students' awareness and choices regarding halal food.
- Recording tools: A digital audio recorder was used to capture the interview in full, with prior informed consent from the participant.

These materials were assembled to allow a focused exploration of how halalan thayyiban elements are conceptualised and operationalised within formal primary science education, particularly in relation to children's engagement with trending foods.

### *Methods*

A qualitative research design was adopted to obtain an in-depth, contextual understanding of the integration of halalan thayyiban principles in the primary science curriculum and its relevance to children's consumption of trending foods. Purposive sampling was employed to

recruit a single key informant who holds direct responsibility for science curriculum development at the national level, ensuring access to expert, policy-level perspectives.

One in-depth, semi-structured interview of approximately 60 minutes was conducted in a quiet and conducive setting to encourage reflexive and open engagement. The session was audio-recorded with prior consent. The interview protocol guided the conversation across three main domains: (i) existing and emerging challenges in embedding halalan thayyiban values within the science curriculum; (ii) how scientific content relates to religious and ethical education in practice; and (iii) perceived implications for pupils' awareness, decision-making, and behaviour regarding halal and trending foods.

The audio data were transcribed verbatim. The transcripts were then analysed using thematic analysis, following a six-phase framework (familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report). Manual coding was used to identify patterns related to the Shafi'i school of Islamic jurisprudence, maqasid al-shariah, and the educational framing of trending food issues.

This methodological approach was deemed appropriate for capturing the nuanced meanings attached to halal, health, and aesthetics in children's food choices, while respecting both empirical rigour and Islamic epistemological considerations.

## Results and Discussion

### *Results*

The thematic analysis of the interview with the Head of the Science Curriculum Unit yielded three major themes: (i) relevance of the Shafi'i school of Islamic jurisprudence in assessing trending foods, (ii) halalan thayyiban education as a preventive mechanism within the curriculum framework, and (iii) the role of curriculum and educational institutions in institutionalising halalan thayyiban values.

First, the informant reported that viral food trends circulating on social media have become a dominant driver of primary school children's food preferences in Brunei. These choices are frequently made without scrutiny of ingredients or halal status, despite the presence of synthetic colourants, flavour enhancers and preservatives of uncertain origin. This situation conflicts with the Shafi'i jurisprudential emphasis on avoiding shubhah (doubtful matters) in order to safeguard religious and ethical integrity. Within the broader maqāṣid al-sharīʿah framework, such practices risk compromising hifz al-nafs (preservation of life) and hifz al-ʿaql (preservation of intellect).

Second, the informant highlighted a structural gap in the current primary science curriculum. Although national policy documents, such as SPN21, promote holistic and values-based education, halalan thayyiban concepts are not yet explicitly operationalised in science teaching, especially in relation to consumer health and food safety. As a result, pupils are increasingly exposed to persuasive online food marketing without corresponding curricular guidance to evaluate halal status or health implications.

Third, the informant strongly emphasised the need to embed halalan thayyiban as a core value within the science curriculum, rather than confining it to religious education alone. Thematic analysis showed a clear stakeholder perception that an interdisciplinary approach is required,

integrating Shafi'i fiqh, maqāṣid al-sharīʿah, nutrition science and critical media literacy. The proposed response includes cross-curricular modules, active learning activities (such as food labelling projects and critical analysis of viral foods), and school-wide initiatives to shape responsible food consumption habits.

These themes are synthesised in three conceptual frameworks. Fig. 1 depicts the relationships between modern food trends, Shafi'i jurisprudential principles and the educational gaps that emerge from the current curriculum. Fig. 2 illustrates halalan thayyiban education as a preventive mechanism operating along a pathway from media exposure, through curricular embedding, to ethical and informed dietary choices. Fig. 3 presents a multi-layered curriculum framework comprising knowledge, value and practical layers, supported by school–home–community collaboration.

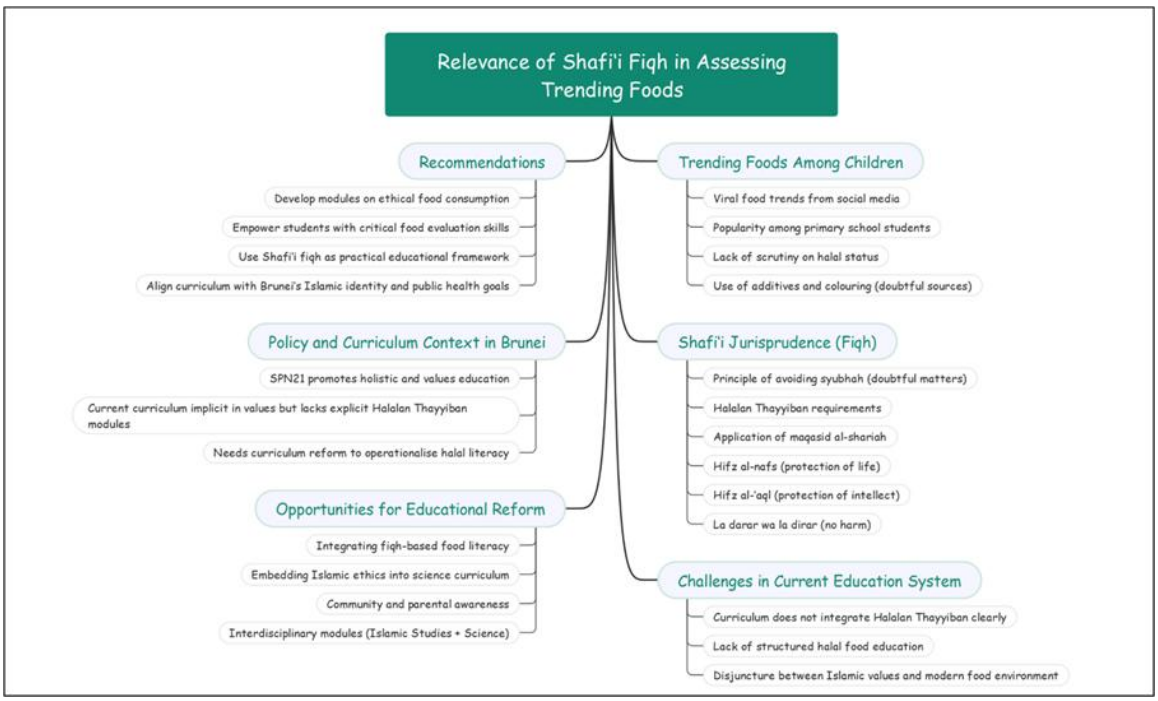



**Figure 1: Thematic Framework Connecting Trending Foods, Shafi'I Islamic Jurisprudence and Educational Strategies**

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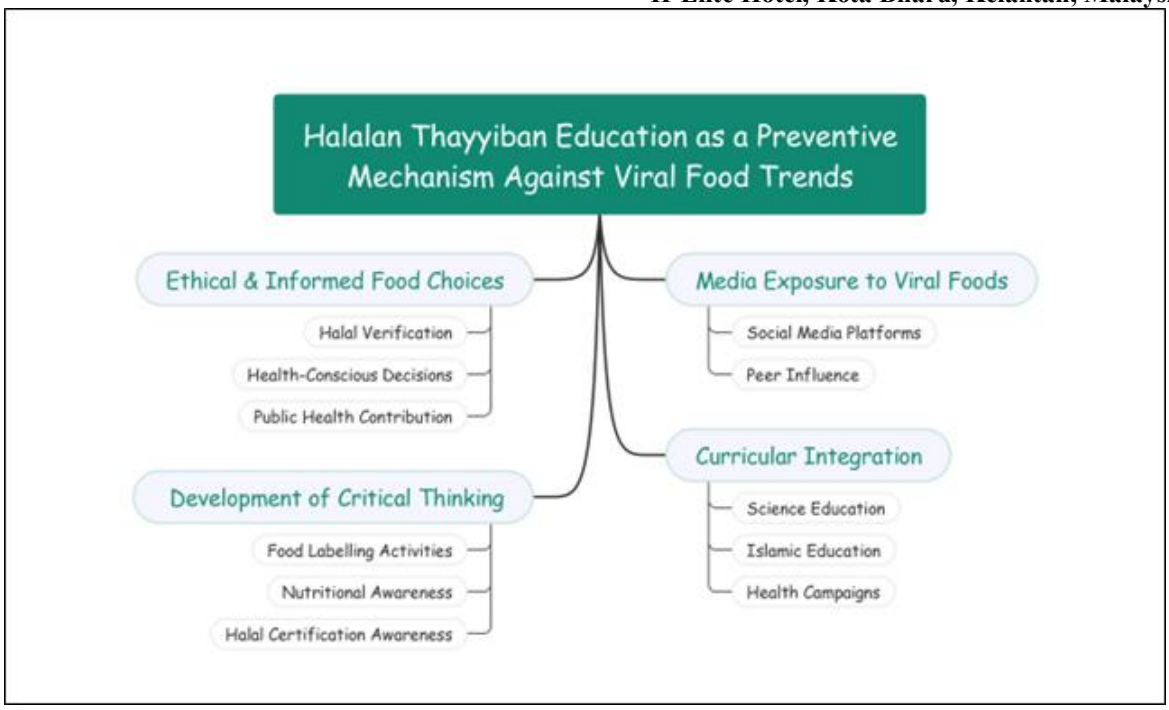



**Figure 2: Thematic Framework of Halalan Thayyiban Education as A Preventive Mechanism Against Trending Foods**

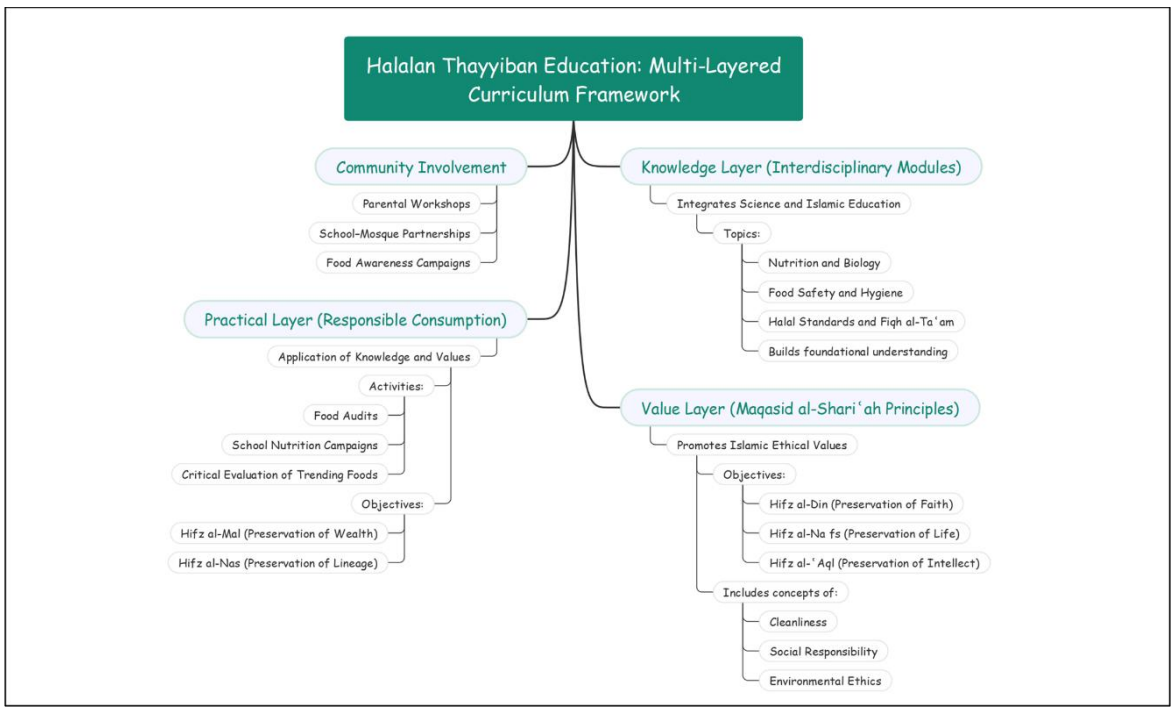



**Figure 3: Multi-Layered Curriculum Framework Integrating Halalan Thayyiban Education**

***Discussion***

The results indicate a clear tension between established Islamic jurisprudential guidance on food and the realities of a media-driven, trend-oriented food environment for children. While the Shafi'i school provides robust criteria for identifying and avoiding doubtful or harmful

products, these criteria are not yet systematically translated into the everyday learning experiences of primary pupils. The reliance of children on visual appeal and social media popularity underscores the need to move beyond implicit value messages towards explicit, structured halalan thayyiban education.

Interpreted through the lens of maqāṣid al-sharīʿah, halalan thayyiban education functions as a proactive and protective framework. By linking hifz al-dīn, hifz al-nafs, hifz al-ʿaql, hifz al-nasl and hifz al-māl to concrete classroom activities and school-wide programmes, the curriculum can address not only the permissibility of food, but also its healthfulness, environmental impact and socio-economic implications. The informant's call to make halalan thayyiban "a way of life" within the curriculum suggests a shift from rule-based instruction to value-driven, action-oriented pedagogy.

The proposed multi-layered curriculum model further clarifies how this shift can be operationalised. At the knowledge layer, interdisciplinary modules can introduce pupils to basic nutrition, food additives, halal certification processes and Shafi'i legal reasoning related to food. At the value layer, maqāṣid al-sharīʿah provides an ethical lens through which pupils can interpret food choices, linking cleanliness, social accountability and sustainability to the notion of thayyib. At the practical layer, projects such as school food audits, nutrition campaigns and critical analysis of viral food trends allow pupils to apply knowledge and values to real-life situations, thereby internalising halalan thayyiban norms.

Importantly, the findings also highlight that schools cannot act in isolation. Parental engagement, mosque-based education and community-level awareness programmes are crucial to reinforcing messages transmitted in the classroom. A coherent ecosystem of influence is needed if children are to resist the powerful pull of social media food trends and instead make decisions aligned with both Islamic principles and public health recommendations.

Overall, the study suggests that integrating halalan thayyiban education across science, health and Islamic studies is a viable and contextually appropriate strategy for Brunei. Such an approach aligns with SPN21's aspiration for holistic, values-oriented education and with national objectives related to food security, public health and moral development. Rather than treating halal literacy as a niche topic, the results support its elevation to a central component of twenty-first century science education in an Islamic context.

## *Conclusion*

Trending food choices continue to pose a considerable challenge to the observance of halal dietary practices, particularly among Muslim children in Brunei Darussalam. Although the Shafi'i school of Islamic jurisprudence offers a well-established framework for determining the halal status of food, the practical application of this framework in daily life calls for a comprehensive and structured educational response.

This study highlights the value of embedding halalan thayyiban education within the broader school curriculum, in alignment with the objectives of maqasid al-shariah. Such integration enables the curriculum to serve not only as a vehicle for delivering scientific knowledge but also as an ethical guide that nurtures informed, morally responsible, and health-conscious food decisions among learners. The adoption of halalan thayyiban principles in education could thus

contribute to the preservation of religion (hifz al-din), life (hifz al-nafs), intellect (hifz al-ʻaql), progeny (hifz al-nasl), and wealth (hifz al-mal).

Based on the findings, it is recommended that educational stakeholders consider including dedicated learning components focused on halalan thayyiban principles. Furthermore, extending halal awareness initiatives to families and local communities through structured activities, such as workshops, seminars, and school–community partnerships may further strengthen intergenerational knowledge sharing and support the cultivation of a halal-conscious culture in an increasingly complex food environment.

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# ḤALĀL QUALITY MANAGEMENT SYSTEM: INGREDIENTS CONTROL PRACTICES IN SINGAPORE'S ḤALĀL INDUSTRY

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***Abstract:*** *Ingredient control practices represent one of the most crucial mechanisms in ensuring Ḥalāl integrity and consumer trust. In the Singaporean context, policies pertaining to ingredient control are embedded within the Ḥalāl Quality Management System (HalMQ), which is administered by Islamic Religious Council of Singapore (MUIS). These comprehensive policies facilitate the authorities as well as Ḥalāl Certificate holders in compliance with ḥalāl standards, particularly in ensuring the integrity, authenticity, traceability and verification of ingredients sourcing, while preventing any breaches of religious principles. Employing a descriptive-analytical approach, this study explores how ingredient control is conceptualized and operationalized within Singapore's HalMQ framework. It highlights the governance mechanisms underpinning ingredient control, addresses best practices and innovations implemented to date, identifies existing challenges, and proposes strategic directions for enhancing ḥalāl management in Singapore thus positioning it as a potential model for other ḥalāl industries in multicultural societies.*

***Keywords:*** *Ḥalāl, MUIS, ḥalāl quality management system (HalMQ), ḥalāl ingredient control practices, obstacles, way forward*

## Introduction

Nowadays, the halal industry has evolved into a global phenomenon, encompassing food production, pharmaceuticals, cosmetics, tourism, and logistics. In the Singaporean context, the country is rapidly catching up of being a globally recognized halal hub, a global nexus for food, trade, and tourism catering to the $2.8 trillion halal market.[1] Despite having a relatively small Muslim population (14.3% of the total population), halal industry in Singapore has flourished and developed one of the most structured and well-regulated systems globally. At the heart of Singapore's halal ecosystem is the Islamic Religious Council of Singapore (MUIS), the sole authority established under the provisions of the Administration of Muslim Law Act (AMLA), and mandated to regulate Muslims religious affairs, including halal certification and regulation. MUIS administers the Halal Quality Management System (HalMQ), which integrates Islamic principles with modern quality management frameworks such as ISO standards. HalMQ adopts a structured approach to halal assurance, through its four modules- ingredient control, process assurance, documentation, and continuous improvement. These components ensure that halal-certified entities uphold integrity, consistency and traceability across the supply chain.

[1] Hafiz M. Ahmed. Singapore aiming to become a global halal hub in: https://www.halaltimes.com/singapore-aims-become-global-halal-hub/2025-04-19)

Among the four components of HalMQ, ingredient control is considered the cornerstone, and the very foundation upon which halal integrity is built. The module is important to ensure that all inputs in food production are halal-compliant, traceable, and free from contamination or doubtful sources. In other words, all materials used must align with Shariah principles of *halal* (lawful) and *tayyib* (wholesome). Effective ingredient control safeguards the integrity of halal certification while enhancing transparency, regulatory compliance, and consumer confidence. Mastering this component enables organizations to strengthen their halal integrity and competitive standing in the global halal market.

This study examines the general notion of halal and its significant, the role of MUIS in halal ecosystem in Singapore, how ingredient control is conceptualized and operationalized within Singapore's HalMQ framework. It highlights the governance mechanisms underpinning ingredient control, reviews best practices and innovations, and identifies existing challenges. Furthermore, the study also proposes ways forward for enhancing halal management in Singapore, positioning the nation as a potential model for halal industries operating in multicultural settings.

## Literature Review

### *Concept of Ḥalāl Food*

Riaz et al. (2003),[2] in their study "*A Shariah Perspective Study on the Concept of Ḥalāl Food*" emphasize the importance of purity, high quality, and hygiene in halal food production and consumption. Ḥalāl food must be prepared and processed in a clean environment, free from impurities and harmful substances, rendering them beneficial for human health. The fundamental Islamic legal presumption is that all things are permissible, unless explicitly prohibited by Allah in the Quran and hadith. The term "*halāl*" is frequently associated with "*tayyib*," signifying that which is wholesome, pure and beneficial.

### *Purity and spirituality*

Sabate (2004)[3] in "Religion, Diet, and Research," highlights how dietary regulations and fasting practices across religious traditions aim to purify both body and mind. Such practices cultivate self-discipline and reflect spiritual commitment. In Islam, fasting – such as during Ramadan – reinforces spiritual discipline while promoting physical well-being. The concept of purity in religion, therefore, links dietary guidelines with spiritual growth and ethical conduct.

### *Traceability*

Traceability refers to the ability to track a product's history, application, or location at every stage of production, processing, and distribution. A review by Yusaini H. Mohamed et al. (2016),[4] highlights halāl traceability as essential element for preserving authenticity and integrity throughout the supply chain. Effective systems require:

[2] Shehla Riaz and Muhammad Ghayyas, 'A Shariah Perspective Study on the Concept of Ḥalāl Food', *Journal of Social Sciences Review* 3, no. 1 (31 March 2023): 86–92, https://doi.org/10.54183/jssr.v3i1.77.
[3] Sabate, Joan. "Religion, diet and research." *British Journal of Nutrition* 92, no. 2 (2004): 199-201.
[4] Mohamed, Y. H., Rahim, A. A., Ma'ram, A. B., & Hamza, M. G. (2016). Ḥalāl traceability in enhancing Ḥalāl integrity for food industry in Malaysia–a review. *International Research Journal of Engineering and Technology*, *3*(3), 68-74

- implementation of traceability mechanisms from raw materials to finished products
- monitoring of supply chains for compliance with halal requirements
- prevention of contamination between halal and non-halal items
- comprehensive documentation and record-keeping at each production stage

These efforts reduce operational risks, facilitate recalls, and strengthen consumer trust.

**Governance and Certification**

Bonne and Verbeke (2008) highlight the importance of governance structures in sustaining halal integrity, noting that religious values influence both production processes and the provision of halal assurance. MUIS institutionalizes this governance through the HalMQ, benchmarked against ISO and HACCP standards. Comparative studies indicate that while Malaysia's JAKIM and Indonesia's MUI/BPJPH implement similar principles, Singapore's HalMQ is distinguished by its strong integration of ingredient control, with systematic documentation, monitoring, and continuous improvement (Talib & Hamid, 2014; Tieman & Ghazali, 2014).[5]

**Findings And Discussions**
***Ḥalāl: Its Essence And Significance***

*Halal* is an Arabic term that literally and technically signifies what is permissible or lawful *"mubāḥ"*[6]. The basis of Ḥalāl in diet is rooted from al-Quran 2:168. Allah says : *O mankind, eat from whatever is on earth [that is] lawful and good and do not follow the footsteps of Satan. Indeed, he is to you a clear enemy."* The verse is a divine command for all human beings to observe and consume only lawful and permissible food, and abstain from what He has prohibited.

In Qurān 2:172, Allah further elucidates the essence of halal. He associates it with wholesome "*ṭayyibāt*". Allah says: *"O you who have believed, eat from the good things which We have provided for you and be grateful to Allah if it is [indeed] Him that you worship."* According to Ibn Kathir, this verse, implies that Allah commands the community of believers to consume the pure and wholesome provisions He has created for them, and to express gratitude to Him, should they truly be His devoted servants.[7]

The opposite of halal is haram, the unlawful. Al-Qur'an specifies unlawful categories in Quran 5:3. Allah says: "*Forbidden unto you are: carrion and blood and swine flesh, and that which hath been dedicated unto any other than Allah, and the strangled, and the dead through*

[5] Talib, H. H. A., & Hamid, N. A. (2014). Halal logistics in Malaysia: A SWOT analysis. *Journal of Islamic Marketing, 5*(3), 322–343. https://doi.org/10.1108/JIMA-06-2013-0042.
Tieman, M., & Ghazali, M. C. (2014). Halal control activities and assurance activities in halal food logistics. *Journal of Islamic Marketing, 5*(3), 406–424. https://doi.org/10.1108/JIMA-05-2013-0039.

[6] See: "Halal" in: *Mujamma' al-Lughah al-'Arabiyyah*. (2004). *Al-Mu'jam al-Wasit*, Egypt: Maktabah al-Syuruq al-Dawliyyah, p.194. See also : Saadi, Abu Jeeb. (1998). *Al-Qamus al-Fiqhi Lughatan wa Istilahan.* Syria: Dar al-Fikr, 2nd edition, p. 99

[7] Ibn Kathir, 'Imad al-Din Abu al-Fida' Ismail Ibn 'Umar. *Tafsir al-Quran al-'Azim*. Beirut-Lubnan: Dar al-Kutub al-'Ilmiyyah, 1998, vol 1, p. 350

*beating, and the dead through falling from a height, and that which hath been killed by the goring of horns, and the devoured of wild beasts save that which ye make lawful, and that which hath been immolated to idols. And that ye swear by the divining arrows. This is abomination*."

Contrary to other religions that base its dietary laws on human authority, Islam acknowledges Allah, as the ultimate authority in determining what is permissible for consumption and what is prohibited. This principle is grounded in the concept of Tawḥīd, the declaration of the Oneness of God, affirming that He alone is worthy to be worshipped, and that He alone is the source of guidance – including laws on diet. Allah provides the ideal mold, or *sibghah* for humanity, suitable across generations. Emphasizing the perfection of this divine guidance, the Quran states: (Our religion is) the mold of God: and who can mold better than God? And it is He Whom we worship. (Quran 2:138)

In Islam, observing halal and complying with its guidelines is of paramount importance. Since it is directly tied to God's command, those who comply are promised reward, and those who violate are subject to accountability. Consuming pure sources contributes to the acceptance of one's worship and supplications.[8] In a hadith narrated by Abu Hurayrah, the Prophet ﷺ says: *"Allah is Ṭayyib (Pure) and only accepts that which is Ṭayyib."*[9]. This underscores the importance of purity in faith and actions: Allah – being good, holy and exalted- accepts only deeds and beliefs that are sincere, righteous and aligned with the Prophet's guidance.

From physical well-being standpoint, adhering to halal and avoiding unlawful consumption carry substantial health benefits. A lawful diet safeguards human life by minimizing exposure to harmful substances, toxins, and contaminated foods, thereby protecting the body from illness and infection. Proper nourishments enables a Muslim to maintain a strength needed to fulfill their obligations to the God.[10] Ultimately, observing halal is far more than a set of dietary restrictions; it is a holistic framework that nurtures faith, protects health, upholds ethical values, and reinforces community life. It bridges the physical and spiritual, guiding believers toward a balanced and responsible lifestyle.

### *Muis and Its Role in Halal Ecosystem in Singapore*

The Islamic Religious Council of Singapore, (MUIS) was founded in 1968 following the enactment of the Administration of Muslim Law Act (AMLA). As a Statutory Board under the Ministry of Community and Youth, MUIS oversees Muslim affairs in Singapore[11] and plays a central role in regulating the halal industry. Among its key responsibilities is the issuance of halal certificates and the supervision of Ḥalāl compliance across the country.[12]

[8] Ibn Kathir, *Tafsir al-Quran al-'Azim*, vol 1, p.350
[9] Hadith Sahih. See: Sahih Muslim, hadith no: 1015
[10] Regenstein, Joe M., Muhammad M. Chaudry, and Carrie E. Regenstein. "The kosher and halal food laws." *Comprehensive reviews in food science and food safety* 2, no. 3 (2003): 111-127.
[11] An Act relating to Muslims and to make provision for regulating Muslim religious affairs and to constitute a council to advise on matters relating to the Muslim religion in Singapore and a Syariah Court.
[12] The Majlis may issue halal certificates in relation to any product, service or activity and regulate the holders of such certificates to ensure that the requirements of the Muslim law are complied with in the production, processing, marketing or display of that product, the provision of that service or the carrying out of that activity.

MUIS introduced its voluntary Halal Certification scheme in 1978 in response to growing demand for halal-certified products and food establishments. To strengthen this effort, MUIS later formed the Halal Certification Strategic Unit to enhance governance, meet rising industry needs, and support Singapore's ambition to become a trusted halal hub. It also developed the Singapore MUIS Halal Standard (SMHS), which provides detailed guidelines for certification. Under AMLA, MUIS is the sole authority legally empowered to issue halal certificates in Singapore.

In 2008, MUIS introduced the Halal Quality Management System (HalMQ) to strengthen compliance within the halal industry through a more structured and systematic framework. Designed to enhance the credibility and global recognition of Singapore's Halal mark, HalMQ sets out systems-based certification requirements, benchmarked against internationally recognised standards. [13] Its implementation not only improves the competitive advantage of certified companies but also meets the rising expectations of Muslim consumers and supports broader international acceptance, particularly for businesses engaged in overseas trade.

### *Ḥalāl Quality Management System*

In Singapore context, the Halal Quality Management System, known as HalMQ, is benchmarked against international standards such as ISO and HACCP.[14] A Halal Quality Management System shares many elements with a conventional Quality Management System, particularly its emphasis on preventive measures rather than relying solely on end-product testing. It evaluates quality specifically from a halal perspective, focusing on:

- Establishing a Halal Team to oversee the system
- Ensuring consistent maintenance of halal integrity throughout the production process
- Implementing clear and transparent procedures to safeguard halal quality
- Developing an effective record-keeping system

HalMQ provides a systematic framework for developing, implementing, and maintaining halal production. Its objective is to ensure that the halal status of a product is safeguarded from the earliest stages of raw material procurement, while also ensuring customer confidence and satisfaction in the halal products and services offered.

There are ten core principles essential for implementing an effective Halal Quality Management System. These ten principles form the foundation of the Ḥalāl Management System and guide its proper application and governance.

a. HQMS Principle 1 - Establish the Ḥalāl Team
b. HQMS Principle 2 - Define the product /nature of business
c. HQMS Principle 3 - Construct flow-charts
d. HQMS Principle 4 - Identify Ḥalāl threats and their respective control measures
e. HQMS Principle 5 - Determination of Ḥalāl Assurance Points (HAPs), their allowable limits and prescribed practices.

[13] Islamic Religious Council of Singapore, *Singapore Muis Halal Standard: General Guidelines for the Development and Implementation of a Halal Quality Management System*, English, MUIS-HC-S002 ( Singapore: Majlis Ugama Islam Singapura, 2007).
[14] Ibid

f. HQMS Principle 6 - Establish monitoring system for each HAP
g. HQMS Principle 7 - Establish corrective actions for each HAP
h. HQMS Principle 8 - Establish documentation system
i. HQMS Principle 9 - Verify the Ḥalāl system
j. HQMS Principle 10 - Review the Ḥalāl system

The most critical part in HQMS module, is the identification of halal threats and Halal Assurance Point (HAP), followed by establishing the appropriate control measures, monitoring procedures, documentation, verification and corrective action procedures at these points. A brief explanation of these elements is as follows:

- **Halal Threat -** refers to any factor that has the potential to render the product as non-halal.
- **Halal Assurance Point** (HAP)- is a step in an operation where proper control and monitoring can eliminate the occurrence of Halal Threat.
- **Determining Control-** involves identifying the specific actions or activities required to eliminate halal threat.
- **Monitoring** - is an act of conducting a planned sequence of observations or measurements of control parameters to assess total conformance with specifications and requirements as stipulated in Halal Quality System.
- **Documentation** – includes all written procedures, work instructions and policies that outline and support these processes.
- **Verification** - involves examining records and assessing operational compliance, including the effectiveness of monitoring systems, personnel compliance to HAPs' operations, deviations and corrective actions taken, results from random sampling, and findings from audit reports.

As part of verifying the Halal system, internal Halal audits must be conducted at least once a year. These audits typically include the following activities:

- Observing personnel responsible for maintaining the HAPs
- Assessing whether the prescribed practices are being implemented
- Ensuring that all required records are properly maintained.

Corrective action procedures are also evaluated at each HAPs. This involves reviewing monitoring records and corrective action records to determine:

- Whether the records are complete and sufficiently detailed.
- Whether they reflect consistent and effective monitoring activities?
- Whether appropriate corrective actions were implemented whenever halal risks or non-conformities were identified.

### *Ingredients Control in Halal Food Production*

The policy on ingredients control in halal food production is enshrined in the following sections of the AMLA:

a. *Section 88A(1), AMLA: The Majlis may **issue Halal certificates** in relation to any product, service, or activity and **regulate the holders of such certificates** to ensure that the requirements of Muslim law are complied with in the production, processing, marketing or display of that product, the provision of that service or the carrying out of that activity.*

b. *Section 88A(5), AMLA: "Any person who, without the approval of the Majlis:*
*• issues a Halal certificate in relation to any product, service or activity; or*
*• uses any specified Halal certification mark or any colourable **imitation thereof**, shall be guilty of an offence and shall be liable on conviction to a **fine** not exceeding $10,000 or to **imprisonment** for a term not exceeding 12 months or **both.**[15]*

To execute this policy, several key initiatives have been undertaken by MUIS, which includes:

**1.Establishment of the Halal Team and Halal Assurance Officer**

The implementation of ingredient control within Singapore's Halal Quality Management System (HalMQ) begins with the formation of a dedicated Halal Team, as mandated by MUIS under the Administration of Muslim Law Act (AMLA). This team must include Muslim personnel, one of whom is appointed as the Halal Assurance Officer (HAO). The HAO is responsible for overseeing and verifying the halal status of all incoming raw materials, processing aids, and additives. It is imperative for HAO to discharge their duties in compliance with MUIS Halal Certification condition clause 3.4 which stipulates:

> "*The applicant shall only order, purchase, receive, store, prepare, cook, offer to sell and sell Halal food and ingredients that have been declared to MUIS*".[16]

This requirement is firmly rooted in Islamic jurisprudence, which underscores the importance of certainty (*al-yaqīn*) and the avoidance of doubtful matters (*shubuhāt*), as reflected in the hadith: "Leave that which makes you doubt for that which does not make you doubt" (al-Tirmidhi, Sunan, no. 2518). By institutionalizing the HAO's oversight, HalMQ ensures that ingredient verification is not merely an administrative procedure but one anchored in religious framework.

The responsibilities assigned to Halal Team under the Halal Certification conditions empower Halal Team - especially the Muslim staff and the HAO- to advise management on religious sensitivities, monitor Halal Assurance Points (HAPs), and endorse supplier documentation.

This structured framework approach integrates fiqh principles with modern governance, ensuring that Halal integrity is safeguarded from the very beginning of the supply chain.[17]

[15] Attorney General Chambers, "Administration of Muslim Law Act 1966: Part 5A Halal and Haji Matters," "Administration of Muslim Law Act 1966 - Singapore Statutes Online: https://sso.agc.gov.sg/Act/AMLA1966.,July 1, 1968

[16] Majlis Ugama Islam Singapura - Halal Certification Conditions. See: https://file.go.gov.sg/hcc-fpa.pdf

[17] It is stated in Halal Certification Conditions version 4 clause 3.15 : The **Halal Assurance Officer** shall: (a) **advise the food business on Halal food matters as well as cultural and religious sensitivities relating to**

The supervisory role of the Halal Assurance Officer is vital in bridging religious obligations with industry practices. In fiqh, the principle of *sadd al-dharā'i* (blocking the means to harm) necessitates proactive measures to prevent contamination and avoid doubtful inputs. The HAO operationalizes this principle by rejecting non-compliant ingredients and ensuring that only approved and certified suppliers are engaged. This responsibility aligns with the Qur'anic injunction: *"O mankind, eat from whatever is on earth [that is] lawful and good"* (Qur'an 2:168), which underscores the dual requirement of Halal (lawful) and Tayyib (wholesome).

In practice, the HAO verifies supplier certifications, inspects product specifications, and ensures that all documentation is complete and accurate. **Table 2** outlines the risk categories and the corresponding documents required from suppliers during procurement and delivery. Within the Halal Team, the HAO, thus serves as the cornerstone of ingredient control, ensuring continous compliance with both Shariah principles and regulatory requirements.This supervisory oversight is further reinforced by MUIS regulations, which require Halal-certified establishments to maintain internal teams capable of conducting unscheduled evaluations and corrective actions when necessary.

**2.Controlled Procurement Process and Management of Halal Threats Identification and Halal Assurance Points (HAPs)**

Ingredient control within HalMQ is operationalized through rigorous documentation and traceability systems. Process starts from Procurement department during buying process. Principle 2 of HalMQ requires the declaration of product and menu listings, including item names, supplier details, certification bodies, and packaging artwork. These documents must be submitted to Halal officers for verification and acceptance process. **(Procurement flowchart shows the process).**

Principle 4 ensures that Halal threats are identified during operational processes and that appropriate control measures are implemented to eliminate or minimise the risk of unrecognised raw ingredients entering the halal premise. This step serves as a critical first line of defense in managing inbound supplies from suppliers. To uphold principle 4, the Halal Assurance officer (HAO) must be stationed at Halal Assurance point, forming Principle 5 of Halal Quality Management System. This represents a critical control point where HAO performs verification of all inbound ingredients purchased from suppliers.

During the inbound verification process, it is essential that suppliers provide complete product information with proper labelling. Labels must include details on:

(a) product name and description,
(b) manufacturer/brand owner's name;
(c) manufacturer/brand owner's address.
(d) abattoir / plant number;
(e) Halal slaughtering and packing date;

**them**;(b) spearhead or assist in complying with the conditions stipulated in this document (c) endorse the original invoices and delivery orders mentioned in Clause 3.13(e)(viii) with –i. his / her signature ii. his / her name, iii. date of verification. https://file.go.gov.sg/hcc-fpa.pdf

(f) Halal mark or equivalent.

**3.Monitoring and Corrective Action**

Monitoring systems forms the operational backbone of ingredient control within HalMQ. Principle 6 mandates planned sequences of observations or measurements to ensure compliance with Halal Assurance Points (HAPs). These monitoring systems adsress critical questions:

- What needs to be monitored,
- How it will be monitored,
- When and how frequently monitoring will occur,
- Who will conduct the monitoring.

This structured approach echoes the fiqh principle of *sadd al-dhara'i*, which mandates proactive measures to prevent potential harm. In practice, monitoring activities involve verifying supplier deliveries, inspecting storage conditions, and ensuring segregation of halal and non-halal materials.

Corrective actions are necessary for restoring control when monitoring identifies non-compliance. Principle 7 requires that corrective actions must be executed immediately upon detection of halal threats, including rejecting non-compliant items and updating supplier records. In practice, corrective actions follow a clear chain of command, ensuring that Halal teams are promptly informed and empowered to respond decisively. Preventive actions are equally emphasized, to minimise the risk of recurrence, creating a proactive framework that strengthens ingredient control. By institutionalizing both corrective and preventive actions, HalMQ ensures that Halal integrity is not compromised by isolated incidents but is continuously maintained through systematic, resilient processes.

**3.Documentation, Traceability, and Verification**

Principle 8 mandates comprehensive record-keeping, to ensure that all supplier invoices, halal certification documents, and product specifications are maintained in either physical or digital formats. High risk items require additional documentation, including photographs of raw materials clearly showing manufacturer details. This essential documentation is crucial for meat and poultry products.

Health certificates play a key role in verification, providing essential information such as the country of origin, slaughterhouse details and the identity of the slaughter provider. Since meat and poultry involve specific slaughtering procedures, it is crucial that the slaughterhouse complies with the Religious Ruling (Fatwa) of the exporting country. In Singapore under AMLA, religious rulings or fatwas are legally binding, and non-compliance constitutes an offence. For example, fatwas in Singapore forbids he use of gas stunning in the slaughtering process.

This emphasis on documentation underscores the need for clear evidence of compliance. The Qur'an 2:172 commands believers to consume only what is pure and wholesome, linking meticulous record-keeping documentation to religious obligations of transparency and accountability. In practice, robust documentation systems enable traceability, allowing auditors

to verify the Halal status of ingredients throughout the supply chain. Such traceability is essential for managing food recalls, preventing fraud, and maintaining consumer trust.

Traceability systems in Singapore's HalMQ are increasingly supported by technological innovations. By integrating traceability into ingredient control, HalMQ operationalizes the fiqh principle of *maslahah* (public interest), ensuring that consumer welfare is protected through transparency and accountability. This disciplined approach to documentation also aligns with international standards, as frameworks such as ISO and HACCP recognize record-keeping as a cornerstone of quality assurance.

Verification processes further reinforce ingredient control by ensuring strict compliance with prescribed halal practices. Principle 9 requires internal Halal audits to be conducted at least once a year, encompassing random sampling, monitoring system reviews, and assessment of corrective actions. In practice, verification involves observing personnel compliance at Halal Assurance Points, reviewing monitoring records, and assessing the effectiveness of corrective actions.

This systematic approach ensures that documentation is not merely procedural but actively enforced. By embedding verification into ingredient control, HalMQ maintains continuous and adaptive compliance, capable of addressing emerging challenges such as disruptions in global supply chain. Verification also enhances international recognition, aligning HalMQ with global audit standards, and positioning Singapore as a model for sustainable and reliable Halal certification systems.

**4.Continuous Improvement**

Continuous improvement within HalMQ is achieved through the integration of the Plan-Do-Check-Act (PDCA) cycle. This cyclical approach ensures that ingredient control measures are regularly reviewed, implemented, monitored, and updated. The PDCA cycle reflects the Qur'anic principle of consuming only what is *tayyib* (pure and wholesome), reinforcing the need for Halal systems to remain responsive to evolving industry challenges.

In practice, organizations review ingredient control plans, implement supplier verification protocols, monitor compliance at Halal Assurance Points (HAPs), and update processes whenever threats or changes are identified. This commitment to continuous improvement fosters resilience, enabling Halal-certified establishments to adapt effectively to global supply chain disruptions, technological advancements, and shifting consumer expectations.

***Halal Ingrediant Implementation Control: Addressing the Obstacles***

Despite a structured framework, several challenges persist in implementing Halal ingredient control. A key issue is traceability as many establishments face difficulties in verifying the halal status of raw materials, particularly when suppliers fail to provide recognized certification or accurate documentation. These gap undermines transparency and consumer trust, echoing concerns highlighted in the literature on halāl traceability such as Enhancing Ḥalāl Integrity for Food Industry in Malaysia – A Review, by Yusaini H. Mohamed et. al (2016). Addressing this challenge requires stricter enforcement of documentation standards, and greater harmonization of certification requirements across jurisdictions. Without robust traceability systems, Halal integrity remains vulnerable to fraud and misrepresentation.

Supplier-related challenges also pose significant obstacles to effective ingredient control. Establishments often face shortages of Halal-certified raw materials, leading to reliance on uncertified or doubtful sources. Differences in slaughter practices, such as stunning methods, further complicate supplier compliance, as not all practices are recognized by MUIS. These challenges reflect the *fiqh* principle of *shubuhat* (doubtful matters), where uncertainty about permissibility undermines Halal integrity. Supplier shortages also highlight the need for stronger supply chain governance, including approved supplier programs and regular audits. MUIS emphasizes the importance of supplier verification, requiring Halal Assurance Officers to endorse invoices and delivery orders. Without reliable suppliers, ingredient control cannot be sustained, compromising both regulatory compliance and consumer confidence.

In addition, process-related challenges further complicate ingredient control. Flowcharts often fail to accurately reflect actual operations, with generic diagrams that omit critical steps such as procurement or storage. Monitoring systems may be inadequately implemented, with personnel unable to demonstrate oversight of Halal Assurance Points. Corrective actions are sometimes adhoc rather than systematic, undermining resilience. These weaknesses compromise principal accountability, as oversight mechanisms fail to prevent or correct non-compliance. Addressing process challenges requires stricter enforcement of flowchart accuracy, enhanced training for Halal Team members, and institutionalization of corrective actions through clear chains of command. Preventive actions must also be emphasized, ensuring that non-compliance does not recur. By addressing process-related challenges, HalMQ can sustain ingredient control as a structured and resilient system, preserving Halal integrity across diverse industry contexts.

***Way Forward***

1. **Supply Chain Governance**
   - Approved Supplier Programs: Work only with certified halal suppliers who undergo regular audits by the authority and supplier.
   - Ingredient Traceability: Implement blockchain or digital ledger systems to track every ingredient from source to final product.
   - Segregated Logistics: Ensure halal and non-halal raw materials are transported in separate containers/vehicles.

2. **Facility & Process Segregation**
   - Dedicated Production Lines: Where possible, use separate equipment and storage areas for halal and non-halal products.
   - Cleaning Validation: Adopt validated cleaning protocols to maintain optimum food hygiene and food safety.
   - Zoning in Plants: Physically separate halal zones with clear signage, restricted access, and color-coded tools.

**3. Labelling and Information Sharing**
   - Clear Labelling: Ensuring that Ḥalāl products are clearly labelled with traceability information that includes sourcing and processing details.

**4. Monitoring and Feedback Systems**

- Consumer Feedback Mechanisms: Establishing systems for consumers to report concerns or issues regarding Ḥalāl products, which can help identify weaknesses in the traceability chain.
- Continuous Improvement Programs: Implementing feedback loops that allow continuous assessment and improvement of Ḥalāl traceability systems based on consumer and stakeholder input.

**5. Collaboration Among Stakeholders**

- Industry Partnerships: Encouraging collaboration between suppliers, manufacturers, and certification bodies to share best practices and improve traceability systems.
- Government and Regulatory Support: Involving government bodies to create policies that support Ḥalāl traceability initiatives and provide funding for technology upgrades.

**6. Training and Capacity Building**

- Training Programs for Industry Players: Offering training sessions for manufacturers and suppliers on Ḥalāl standards, traceability practices, and compliance requirements.
- Workshops for Consumers: Organizing workshops to educate consumers on how to identify genuine Ḥalāl products and the significance of traceability.
- Halal Awareness Programs: Train staff at all levels — from procurement to production — on halal principles and contamination risks.
- Halal Assurance Officers: Appoint dedicated personnel responsible for monitoring and reporting.
- Cultural Sensitivity: Build a workplace culture that respects halal values, reducing negligence or shortcuts.

Concentrating on integrity, traceability, and the associated monitoring systems. Some key elements are recommended for enterprise.

**1. Ḥalāl and Food Safety standards**

- Ḥalāl-ness: Products must meet the criteria of being permissible under Islamic law.
- Cleanliness and Safety: The products should be hygienic and safe for consumption.
- Nutritional Value: Products must be nutritious and beneficial for health.
- Ethical Standards: Compliance with Islamic business ethics, including fair trade and animal welfare, is essential

2. **Certification & Regulatory Alignment**

- Global Standards Harmonization: Align with major halal certification bodies to ensure international acceptance.
- Continuous Audit Programs: Internal halal committees should conduct surprise audits and mock recalls.
- Documentation Discipline: Maintain meticulous ingredient records, batch logs, and halal assurance reports.

## Conclusion

The implementation of Halal ingredient control within Singapore's Halal Quality Management System (HalMQ) demonstrates the successful integration of Islamic jurisprudence with modern quality management practices. By institutionalizing competent Halal Teams, mandating accurate declarations, and embedding flowcharts, Halal Assurance Points (HAPs), monitoring systems, and corrective actions, HalMQ ensures that Halal integrity is safeguarded across the supply chain. These measures operationalize Qur'anic injunctions on lawful and wholesome consumption while addressing contemporary challenges such as traceability gaps, supplier shortages, and process inefficiencies. Best practices, including, AI-driven monitoring, and harmonization of certification standards, further strengthen resilience and consumer confidence. Despite existing challenges, Singapore's HalMQ positions itself as a replicable model for multicultural societies, demonstrating that Halal ingredient control is not only a religious obligation but also a strategic industry practice that sustains credibility, competitiveness, and global recognition in the expanding Halal economy.

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*An Act relating to Muslims and to make provision for regulating Muslim religious affairs and to constitute a council to advise on matters relating to the Muslim religion in Singapore and a Syariah Court.*

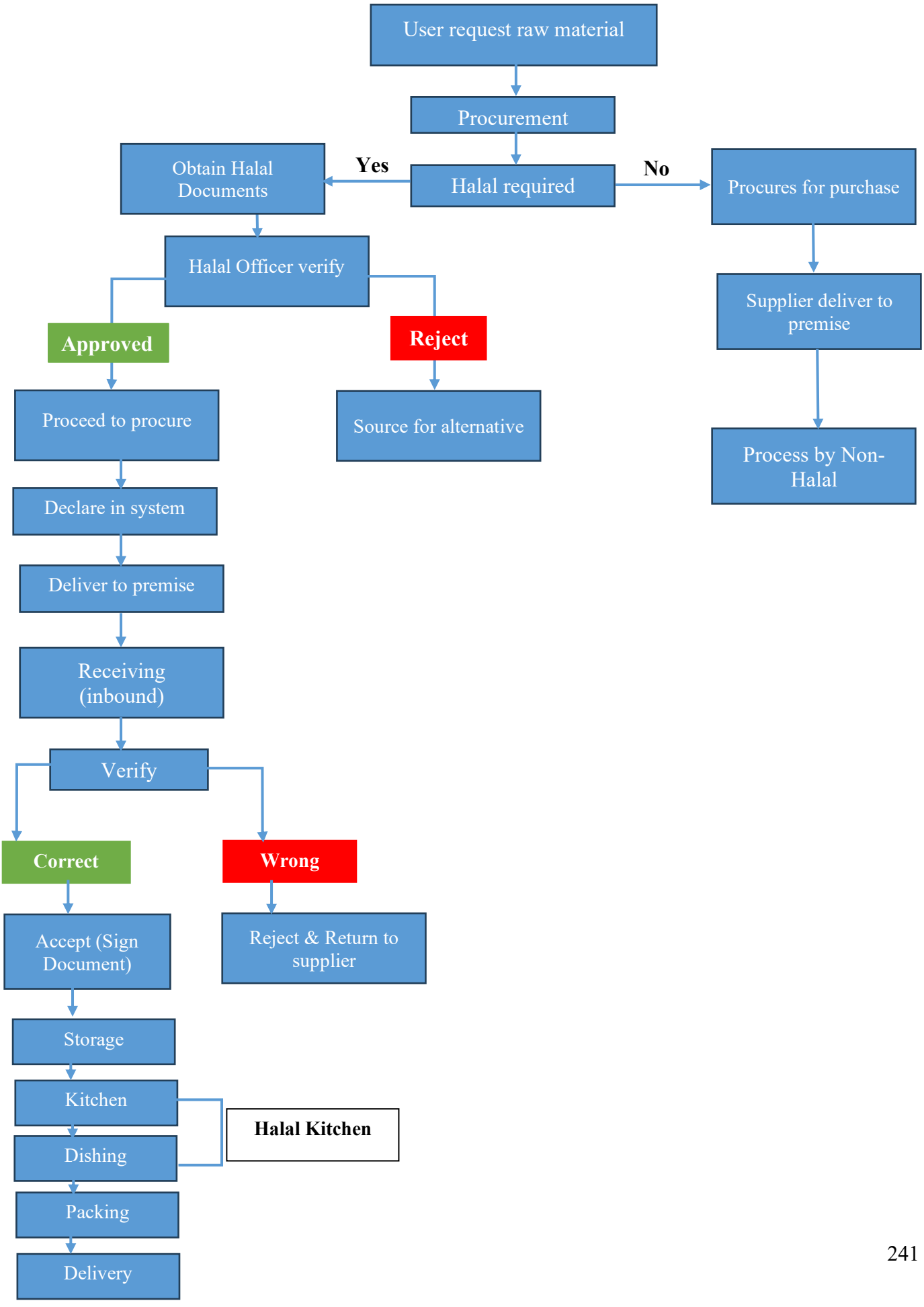
*The Majlis may issue halal certificates in relation to any product, service or activity and regulate the holders of such certificates to ensure that the requirements of the Muslim law are complied with in the production, processing, marketing or display of that product, the provision of that service or the carrying out of that activity.*

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**Procurement Process Flow Chart**



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## Table 1: Example Of Principle 4 To Principle 7 For Ḥalāl Quality Management System

| **Principle 4**<br>**Identify Ḥalāl threats & their control measures** | | | | **Principle 5**<br>**Determination of Ḥalāl Assurance Points, their Allowance Limits & Prescribed Practices** | | **Principle 6**<br>**Monitoring System** | | | | **Principle 7**<br>**Establish corrective actions for each Ḥalāl Assurance Point.** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location** | **Ḥalāl threat** | **Process Step** | **Control Measures** | **Ḥalāl Assurance Point** | **Allowable Limit** | **What** | **How** | **When** | **Who** | **Corrective Action** | | **Preventive Action** |
| Procurement office | Procurement of non-Ḥalāl raw materials / processing aids (e.g. non-Ḥalāl chicken) | Procurement of raw materials | ▪ Obtain Ḥalāl certificates for meat / poultry items ▪ Obtain Ḥalāl certificates, product specifications, detailed Ḥalāl questionnaire and/or laboratory analysis report for non-meat and poultry raw materials<br>▪ Attain approval prior to procurement of ALL raw materials | 1 | Zero tolerance | Ḥalāl status of raw materials | ▪ Check Ḥalāl certificates for meat / poultry items<br>▪ Check Ḥalāl certificates, product specifications, detailed Ḥalāl questionnaire and/or laboratory analysis report for non-meat and poultry raw materials<br>▪ Attain approval prior to procurement of ALL raw materials | Procurement of raw materials | Purchasing Executive | ▪ Cancel order<br>▪ Call supplier<br>Inform Purchasing Manager<br>Ḥalāl Team member) Fill up Ḥalāl Incident report form | Retrain officer involved in the procurement step<br>Establish approved supplier | Periodically audit suppliers<br>▪ Consider use of technology to prevent human error during order placement |

**Table 2: Ḥalāl Risk Management and Documents required for Traceability**

| Types of Ḥalāl Risk | Low | Medium – Low | Medium – High | High |
|---|---|---|---|---|
| **Definitions** | Primarily derived from non-animal sources, which are unprocessed or minimally processed | Primarily derived from non-animal sources that go through further processing without any animal-based additives | Have been highly processed, may involve fermentation or have animal derived substances added | Contain flavouring, gelatine or meat and its derivatives |
| **Types of Documents Required** | | General questionnaire (if necessary) | General questionnaire<br>• MUIS-recognised Ḥalāl certificate* or laboratory analysis report (if necessary) | MUIS recognised Ḥalāl certificate* |
| **Examples of ingredients** | • Vegetables<br>• Fruits<br>• Pure seafood<br>• Legumes & lentils<br>• Rice<br>• Salt & sugar<br>• Ice<br>• Spices<br>• Synthetic chemicals | Soy bean products<br>• Flour<br>• Olive oil<br>• Sesame oil<br>• Vegetable oil<br>• Synthetic vinegar<br>• Noodles<br>• Pasta<br>• Food additives (excluding animal-derived E400s) | Enzymes<br>• Yeast<br>• Cheese & byproducts<br>• E400s Food additives (animal derived)<br>• Canned foods<br>• Confectionery & pastry<br>• Dairy products<br>• Processed seafood<br>• Sauces & condiments<br>• Pure vinegars | Meat & meat based items<br>• Poultry & poultry-based items<br>• Beef extracts<br>• Beef tallow<br>• Chicken skin<br>• Chicken fat<br>• Flavourings<br>• Gelatine |

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A comparative table of HalMQ (Singapore), JAKIM (Malaysia), and MUI/BPJPH (Indonesia) halal certification systems. This highlights governance, scope, processes, and unique features.

| Aspect | HalMQ (Singapore) | JAKIM (Malaysia) | MUI/BPJPH (Indonesia) |
|---|---|---|---|
| Authority | Majlis Ugama Islam Singapura (MUIS) | Department of Islamic Development Malaysia (JAKIM) | Majelis Ulama Indonesia (MUI) for fatwa; Badan Penyelenggara Jaminan Produk Halal (BPJPH) for administration |
| Legal Basis | Administration of Muslim Law Act (AMLA) | Trade Descriptions Act 2011; Malaysian Standards (MS 1500:2019) | Halal Product Assurance Law No. 33/2014; Government Regulation No. 39/2021 |
| System Framework | Halal Quality Management System (HalMQ), benchmarked against ISO & HACCP | Halal Assurance System (HAS) with MYeHALAL portal | Halal Product Assurance System (SJPH / HAS 23000) |
| Core Principles | 10 principles: Halal Team, product definition, flowcharts, Halal threats, HAPs, monitoring, corrective actions, documentation, verification, review | Documentation, internal Halal committee, site audit, certification decision, annual monitoring | Preparation, audit by LPH, fatwa by MUI, certificate issuance by BPJPH |
| Scope | Food, catering, manufacturing, logistics; Eating Establishment Category 1 exempt from full HalMQ | Food, cosmetics, pharmaceuticals, logistics, services (hotels, hospitals, airlines) | Mandatory for food, beverages, cosmetics, pharmaceuticals, consumer goods; phased for MSMEs |
| Audit & Monitoring | Internal Halal audits at least once a year; monitoring Halal Assurance Points (HAPs) | JAKIM conducts site audits; ongoing monitoring and renewal required annually | LPH conducts inspections; MUI issues fatwa; BPJPH issues certificate;validity 4 years (renewal required) |
| International Recognition | Recognized regionally; benchmarked against | Globally recognized; JAKIM approves foreign certification | Recognition of foreign halal certificates if |

| | | | |
|---|---|---|---|
| | ISO/HACCP for credibility | bodies in >40 countries | accredited by BPJPH and MUI |
| Unique Features | Strong emphasis on ingredient control and Halal Assurance Points; PDCA cycle for continuous improvement | Malaysia consistently ranks top in Global Islamic Economy Index; wide sector coverage | Largest Muslim-majority market; mandatory halal certification for almost all products by law |

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# STUDENT PERCEPTIONS OF GAMIFICATION IN CYBERSECURITY EDUCATION: A QUANTITATIVE STUDY GROUNDED IN LANDER'S THEORY OF GAMIFIED LEARNING

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***Abstract:*** *This quantitative study examines students' perceptions of gamification in cybersecurity education, guided by Landers' Theory of Gamified Learning, which suggests that game elements affect learning indirectly through motivational and behavioural mechanisms. As cybersecurity concepts are often abstract and demanding, understanding learner responses to gamified instructional strategies is essential for designing effective pedagogical interventions. Data were collected from 143 undergraduate students enrolled in a cybersecurity fundamentals course at Politeknik Sultan Idris Shah following their participation in a gamified learning module incorporating points, levels, challenges, and immediate feedback. Descriptive analyses showed consistently high mean scores across all constructs, indicating strong enjoyment, attention, creativity, perceived learning, and sustained motivation. Reliability testing demonstrated excellent internal consistency for all scales ($\alpha \geq .80$). Key game elements such as challenges, levelling systems, points, and instant feedback were perceived as the most motivating and contributed substantially to behavioural and cognitive engagement. Pearson correlation analysis revealed strong and significant associations among gamification experience, learning motivation, game element perceptions, and engagement ($r = .71$ to $.87$), supporting Landers' theoretical proposition that game elements influence learning primarily through motivational pathways. These findings provide empirical evidence that well-designed gamification can enhance students' cognitive, affective, and behavioural engagement in cybersecurity learning environments. The study underscores the importance of aligning game mechanics with learners' motivational needs to maximise engagement and learning outcomes. Limitations include reliance on self-reported data and the short duration of the intervention. Future research should investigate long-term effects, examine individual game elements in depth, and explore adaptive or AI-driven gamification to personalise cybersecurity learning.*

***Keywords:*** *Gamification, Cybersecurity Education, Student Perceptions, Learning Motivation, Gamified Learning Theory*

## Introduction

Gamification refers to the integration of game design elements—such as points, levels, challenges, and feedback, into non-game contexts to enhance motivation, engagement, and participation (Morais et al., 2022; Shahzadi et al., 2025). The concept, first introduced by Pelling (2002), emphasizes using selected game mechanics to influence user behaviour and sustain interest without developing a full game environment. In education, gamification aims to make learning more interactive and enjoyable by providing meaningful goals, progress

indicators, and timely feedback that encourage learners to stay engaged. Recent studies show that gamification can effectively improve student motivation and participation, particularly through elements such as badges, rewards, and leaderboards (García-Iruela et al., 2021). The Theory of Gamified Learning (Landers, 2014; Ahmad & Maat, 2023) further explains that game elements influence learning indirectly by enhancing learners' motivational states, which then affect behavioural and cognitive engagement.

Although gamification has been widely explored in general education, its application in cybersecurity education remains underexamined. This gap is significant, as effective cybersecurity learning requires sustained engagement, critical thinking, and behavioural awareness, areas where gamification has strong potential (Baxter et al., 2016). With rising cyber threats and the need for digital resilience, students must be equipped with engaging and effective learning experiences that help them recognize risks and adopt safe online practices (Sodikin & Hikmawan, 2023).

Thus, this study aims to investigate students' perceptions of gamification as a motivational strategy in cybersecurity education and to identify which game elements most effectively contribute to their engagement and willingness to participate. However, the efficacy of specific gamified approaches in fostering deeper understanding and skill development within cybersecurity contexts particularly among diverse student populations remains an area requiring further investigation (Karagiannis & Magkos, 2020; Waluyo & Tran, 2023).

## Problem Statement

Gamification is increasingly used in higher education, yet its effectiveness within technical fields such as cybersecurity remains insufficiently understood, particularly regarding how students perceive and respond to gamified learning (Huitema & Wong, 2025). Although past studies highlight the general benefits of gamification, there is limited evidence identifying which specific game elements genuinely motivate cybersecurity learners and foster sustained engagement rather than short-term participation (Jaramillo-Mediavilla et al., 2024; Morais et al., 2022). Existing reviews indicate that gamification outcomes vary depending on contextual and learner-related factors (Pham, 2022), suggesting that its success cannot be assumed across all settings.

Cybersecurity education presents additional challenges, as students often perceive the content as abstract and difficult, requiring pedagogical strategies that meaningfully support motivation and engagement (Ahmed et al., 2024; Sendjaja et al., 2024). Concerns have also been raised about the declining effectiveness of gamification over time, particularly when novelty fades or when extrinsic rewards overshadow intrinsic learning goals (Shahzadi et al., 2025). Given these issues, a clear gap remains in understanding students' perceptions of gamification in cybersecurity learning and determining which game elements are most effective in sustaining engagement. Without this insight, gamified interventions risk becoming superficial, misaligned with learner needs, and ultimately pedagogically ineffective.

### *Research Questions*

1. What are students' perceptions regarding the efficacy of gamified interventions as motivational tools within cybersecurity education?

2. Which specific gamified elements are perceived by students to significantly enhance engagement and foster willingness to participate in cybersecurity learning

### *Research Objectives*

1. To explore students' perceptions of gamification in cybersecurity education.
2. To identify game elements perceived as most motivating and engaging for cybersecurity learners.

## Literature Review

This section reviews studies on gamification in education, with emphasis on its use in technical areas such as cybersecurity. Gamification enhances learning by using elements such as points, badges and challenges that encourage participation and interest (Morais et al., 2022; Gwenhure & Nam, 2025). The Theory of Gamified Learning by Landers (2014) explains that game elements influence learning through motivation and behaviour. Gamification is highly relevant in cybersecurity education because the field requires active involvement and problem-solving. Students' perceptions, including their motivation, interest and acceptance of technology, shape how effectively gamified activities support learning. This review summarises current research on educational gamification, theoretical foundations, applications in cybersecurity and the importance of learner perception in influencing engagement.

### *Gamification in Education*

Gamification involves the strategic integration of game design elements, such as points, badges, leaderboards, feedback mechanisms, and challenges, into educational contexts (Mao & Lucas, 2024; Qudsi, 2024). This approach aims to enhance student motivation and engagement, ultimately improving learning outcomes across various academic disciplines (León et al., 2021). The application of gamification extends beyond general engagement to specialized fields such as cybersecurity, where it is used to foster interest and address the shortage of professionals (Balon & Baggili, 2023; Kim et al., 2025). While gamification is designed to enhance motivation and engagement, research on its direct influence on learning outcomes presents a complex picture. Nevertheless, evidence suggests that gamification can positively promote enjoyment, increase persistence, and contribute to better learning outcomes (Panmei & Waluyo, 2022). Game-based learning incorporates features shown to sustain students' focus, enhance motivation toward achieving goals, encourage constructive competition, support productive teamwork, and facilitate effective communication. Its primary objective is to increase student participation throughout the teaching and learning process (Balalle, 2024).

### *Theoretical Frameworks of Gamified Learning*

The integration of game elements can indirectly influence learning by shaping students' motivational states, consistent with Landers' (2014) Theory of Gamified Learning. This theoretical framework emphasizes that effective gamification design addresses psychological needs, such as autonomy, competence, and relatedness, to optimize intrinsic motivation (Zeng & Fisher, 2023). According to Landers (2014), game elements exert an indirect influence on learning by modulating psychological or behavioral mediators, including motivation, attention, and time-on-task. Empirical findings support this perspective, for example, demonstrating that

leaderboards can increase the duration of learning engagement (Landers & Landers, 2014). However, some studies indicate that while gamification may enhance engagement, it does not consistently result in significant improvements in learning outcomes, particularly in complex technical subjects (Rokhaniyah et al., 2025).

Landers (2014) also highlighted the importance of establishing a theoretical framework specific to gamification, drawing from research on serious games. He argued that when two concepts share substantial similarities, it is necessary to identify their distinguishing features and explore their theoretical connections rather than creating separate definitions, taxonomies, or models. This approach aligns with the principle of parsimony in scientific inquiry, which posits that researchers should avoid introducing multiple theoretical constructs when a single well-defined construct suffices (Cole et al., 2012). Such a framework prevents fragmentation of resources in developing parallel constructs and promotes a unified effort toward advancing knowledge within the field (Le, Schmidt, Harter, & Lauver, 2010).

### *Gamification in Cybersecurity Education*

Gamification is not equivalent to developing fully featured video games; rather, its focus is on engaging users through game mechanics that support meaningful learning progress and enjoyment (Kappen & Nacke, 2013; Deloitte, 2019). When structured effectively through well-designed quests and learning activities, gamification can encourage learners to develop problem-solving skills and progress through content at their own pace (Birk et al., 2016; Hinton et al., 2019; Wood & Reiners, 2014). Various tools are available for creating gamified learning environments, including learning management systems such as Moodle, Blackboard, and eClass, which facilitate the development of interactive educational content (Kim & Werbach, 2016; Triantafyllou et al., 2025).

Within this framework, gamified learning including activities such as escape room simulations has shown promise as a pedagogical approach for teaching and reinforcing cybersecurity knowledge and skills across educational levels (Srivatanakul, 2024). These methods often incorporate competitive elements, such as leaderboards and points, which can enhance student engagement and promote self-regulation (Mao & Lucas, 2024). However, the perceived effectiveness of specific gamified elements in cybersecurity education varies, as students respond differently to competitive features depending on their individual motivational profiles (Sisson & Whalen, 2021). Overall, enhanced student interaction and collaboration, improved learning experiences, and higher engagement levels contribute to better academic performance and student achievement (Ahshan, 2021).

### *Student Perceptions and Motivational Theories*

Research shows that gamification can enhance student engagement yet more evidence is needed to understand its long-term effects on knowledge retention and sustained motivation. Recent studies call for further investigation into how specific game elements such as leaderboards, badges, and rewards shape learning experiences. Personalised learning is also becoming an important focus in digital education, as technology can support adaptive activities that meet individual needs (Idowu, 2024). With the rise of hybrid learning environments, researchers highlight the importance of identifying effective ways to combine online and face-to-face instruction to strengthen participation and performance. Teacher readiness is another critical factor, as educators require appropriate preparation for technology-integrated teaching

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to support student engagement (Ahshan, 2021). Digital equity must also be considered to ensure all learners have fair access to technological resources and learning opportunities (Balalle, 2024).

Student perceptions play a central role in gamified learning. Gamified elements such as rewards, competition, and interactive challenges have been shown to enhance engagement when aligned with learner needs (Smirani & Yamani, 2024). These effects are often driven by intrinsic motivation, as Self-Determination Theory (SDT) emphasises the importance of autonomy, competence, and relatedness for deep and sustained learning (Kwok & Childers, 2022). However, studies also caution that poorly designed gamification, particularly when competitive pressure becomes overwhelming, can lead to stress and reduced motivation (Lazarov et al., 2025). Understanding these varying perceptions is essential for designing effective gamified activities that support intrinsic motivation and improve learning outcomes in cybersecurity education.

## Methodology

This study used a quantitative approach to examine students' perceptions of gamification in cybersecurity education. Data were collected through a structured questionnaire to explore how specific game elements influence motivation and engagement. The methodology allows for statistical analysis of relationships between gamified experiences, learning motivation, and student engagement, providing evidence-based insights for designing effective gamified learning interventions.




**Figure 1: Methodology**

### *Research Design*

This study employed a quantitative correlational research design to examine the relationships between students' perceptions of gamification, their motivational states, and their engagement in cybersecurity education. This design aligns with Landers' (2014) Theory of Gamified Learning, which posits that game elements indirectly influence learning through mediating psychological and behavioral constructs. A quantitative approach allows for the statistical analysis of these associations and supports the identification of significant predictors of both behavioral and cognitive engagement in a gamified cybersecurity fundamentals course.

### *Participants and Sampling*

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The study involved Semester 2 and Semester 3 undergraduate students who were enrolled in or had previously completed a cybersecurity course at Politeknik Sultan Idris Shah. The total population consisted of N = 226 students. Based on Krejcie and Morgan's (1970) sample size guidelines, approximately 140 participants were required, and 143 students were successfully recruited, meeting the recommended threshold for correlational analysis. Convenience sampling was used to target students with direct exposure to the gamified module, an approach commonly applied in technology-enhanced learning studies (Etikan, 2016). Participation was voluntary, and anonymity was ensured, resulting in a sample that reasonably represented learners' perceptions of the gamified cybersecurity instruction.

### *Data Collection Instruments*

The study employed a structured questionnaire comprising four validated components to measure students' perceptions, motivation, and engagement in gamified cybersecurity learning. Figure 2 provides an overview of the four instruments used in this study, including their theoretical origins, subdimensions, and sample constructs. All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

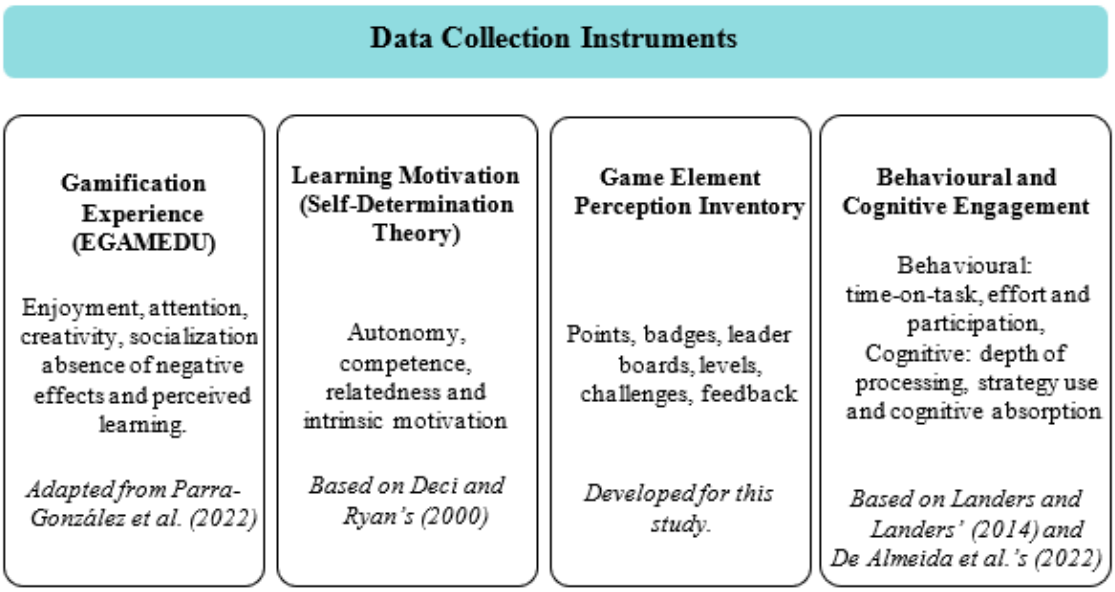



**Figure 2: Data Collection Instruments**

### *Data Analysis*

Data were analysed using IBM SPSS Statistics. Descriptive statistics were first generated to summarise students' responses across all constructs. Normality was assessed through skewness and kurtosis values, and all variables fell within acceptable ranges, indicating that the data met parametric assumptions. Reliability analysis using Cronbach's alpha showed that all scales demonstrated acceptable internal consistency ($\alpha \geq 0.70$). Pearson correlation analysis was subsequently performed to examine the relationships among gamification experience, motivation, and behavioural and cognitive engagement. This analytical approach aligns with Landers' Theory of Gamified Learning, which posits that gamification influences learning indirectly through motivational and behavioural pathways. The combined use of descriptive, normality, reliability, and correlational procedures ensured analytical rigour and supported valid interpretation of the findings.

## Results and Findings

### *Descriptive Statistics*

Descriptive analysis was conducted to examine students' perceptions of the gamified cybersecurity module across six sub-constructs of the Gamification Experience scale, namely Enjoyment, Attention, Creativity, Socialization, Absence of Negative Effects, and Perceived Learning. The interpretation of mean values was guided by the recommended Likert-scale categorisation proposed by Pallant (2020). Table 1 summarises the interpretation range used to classify the mean scores obtained for each construct.

**Table 1: Mean Score Interpretation**

| Mean Range | Interpretation |
|---|---|
| 1.00–2.33 | Low |
| 2.34–3.66 | Moderate |
| 3.67–5.00 | High |

Source: Pallant (2020)

Descriptive statistics were computed for the six components of Gamification Experience, namely Enjoyment, Attention, Creativity, Socialization, Absence of Negative Effects, and Perceived Learning. As shown in Table 2, students reported consistently high levels of positive perception across all six sub-constructs, with mean scores ranging between 4.23 and 4.63.

**Table 2: Descriptive Statistics for Gamification Experience**

| Sub-Construct | No. of Items | Mean (M) | Interpretation |
|---|---|---|---|
| Enjoyment | 3 | 4.63 | High |
| Attention | 3 | 4.48 | High |
| Creativity | 3 | 4.49 | High |
| Socialization | 3 | 4.44 | High |
| Absence of Negative Effects | 3 | 4.23 | High |
| Perceived Learning | 3 | 4.41 | High |

The results show that students reported consistently high perceptions of the gamified learning environment, with mean scores ranging from 4.23 to 4.63 on a 5-point scale. Enjoyment recorded the highest mean (M = 4.63), indicating that students found the activities engaging and enjoyable. Attention (M = 4.48) and Creativity (M = 4.49) also scored highly, suggesting that the gamified design supported focus and encouraged creative problem-solving during cybersecurity tasks. Perceived Learning (M = 4.41) and Socialization (M = 4.44) further show that students felt the module enhanced understanding and supported interaction with peers. Absence of Negative Effects recorded the lowest mean (M = 4.23) but remained within the high range, indicating minimal stress or cognitive overload. Overall, these findings reflect strong acceptance of the gamification strategy, implying that features such as points, levels, challenges, and immediate feedback effectively enhanced students' learning experiences in the cybersecurity module.

Descriptive statistics were computed for the four components of learning motivation based on the Self-Determination Theory framework: autonomy, competence, relatedness, and intrinsic motivation. As shown in Table 3, students reported high levels of motivation across all sub-constructs, with mean scores ranging between 4.40 and 4.49.

**Table 3: Descriptive Statistics for Motivation**

| Sub-Construct | No. of Items | Mean (M) | Interpretation |
|---|---|---|---|
| Autonomy | 3 | 4.46 | High |
| Competence | 3 | 4.44 | High |
| Relatedness | 3 | 4.40 | High |
| Intrinsic Motivation | 3 | 4.49 | High |

Autonomy recorded a mean of 4.46, indicating that students felt a strong sense of choice and control during the gamified learning activities. Competence (M = 4.44) also scored highly, suggesting that students perceived themselves as capable of completing the gamified cybersecurity tasks. Relatedness, with a mean of 4.40, indicates that students generally felt connected and supported during the learning process, while intrinsic motivation emerged as the highest motivation dimension (M = 4.49). This finding suggests that students were internally driven to engage with the cybersecurity activities due to interest, enjoyment, and personal satisfaction derived from the gamified environment. Overall, the results show that the gamified learning approach successfully enhanced students' psychological needs of autonomy, competence, and relatedness, while also fostering strong intrinsic motivation consistent with the core principles of Self-Determination Theory.

Descriptive statistics were also computed for the Game Element Perception Inventory, which consists of two sub-constructs: Game Motivation and Game Engagement. As shown in Table 4, students reported high levels of positive perception towards the game elements embedded in the cybersecurity learning module.

**Table 4: Descriptive Statistics for Game Element Perception**

| Sub-Construct | No. of Items | Mean (M) | Interpretation |
|---|---|---|---|
| Game Motivation | 9 | 4.50 | High |
| Game Engagement | 9 | 4.48 | High |

Game Motivation recorded a mean score of 4.50, indicating that students found elements such as points, challenges, leveling systems, and rewards highly motivating. These game features appear to support goal setting, persistence, and a sense of achievement throughout the learning activities. Game Engagement also recorded a high mean score (M = 4.48), suggesting that students perceived the game elements as effective in maintaining attention, encouraging active participation, and sustaining interest during cybersecurity tasks. Overall, these findings demonstrate that the game mechanics incorporated in the module were well-received and contributed positively to learners' engagement and motivational states. This supports the view that well-designed gamified components can enhance both the motivational appeal and the interactive quality of learning experiences.

Descriptive statistics were also computed for the Behavioural and Cognitive Engagement construct, which reflects the extent to which students participated actively and invested mental effort during the gamified cybersecurity learning module. As shown in Table 5, both dimensions recorded high mean scores, indicating strong engagement among students throughout the learning process.

**Table 5: Descriptive Statistics for Behavioural and Cognitive Engagement**

| Construct | No. of Items | Mean (M) | Interpretation |
|---|---|---|---|
| Behavioural Engagement | 3 | 4.46 | High |
| Cognitive Engagement | 3 | 4.43 | High |

Behavioural Engagement recorded a mean score of 4.46, suggesting that students demonstrated consistent involvement in class activities, followed instructions attentively, and actively participated in challenges integrated within the gamified module. These results imply that the gamification features successfully encouraged students to stay focused and interact meaningfully with the learning materials. Cognitive Engagement also yielded a high mean score (M = 4.43), indicating that students exerted substantial mental effort while engaging with cybersecurity tasks. They reported thinking deeply, applying strategies, and persisting through problem-solving activities. This suggests that the gamified module not only captured students' attention behaviorally but also stimulated higher-order cognitive processing. These findings demonstrate that the gamified cybersecurity module effectively promoted both behavioural and cognitive dimensions of engagement. The combination of points, challenges, immediate feedback, and goal-oriented tasks appears to encourage learners to participate actively while also fostering deeper thinking and sustained cognitive involvement.

### *Reliability Analysis*

Reliability analysis was conducted to assess the internal consistency of all measurement scales used in this study. Cronbach's alpha coefficients were examined for each major construct, including Gamification Experience, Learning Motivation, Game Element Perception, and Behavioural and Cognitive Engagement. According to Nunnally (1978), a Cronbach's alpha value of .70 and above indicates acceptable reliability for research instruments, while values above .90 reflect excellent internal consistency. Table 6 presents the reliability coefficients for all constructs.

**Table 6: Reliability Coefficients for All Constructs**

| Construct | No. of Items | Cronbach's Alpha (α) | Interpretation |
|---|---|---|---|
| Gamification Experience | 18 | .958 | Excellent |
| Learning Motivation | 12 | .953 | Excellent |
| Game Element Perception | 18 | .971 | Excellent |
| Behavioural and Cognitive Engagement | 6 | .923 | Excellent |

All constructs demonstrated excellent internal consistency, with Cronbach's alpha values ranging from .923 to .971, exceeding the minimum threshold of $\alpha \geq .70$ recommended by Nunnally (1978). Gamification Experience ($\alpha = .958$) and Game Element Perception ($\alpha = .971$) showed particularly high reliability, indicating stable and consistent responses toward the implemented game elements. Learning Motivation also recorded strong reliability ($\alpha = .953$), confirming that the SDT components were measured accurately. Behavioural and Cognitive Engagement demonstrated similarly high reliability ($\alpha = .923$), suggesting consistent reporting of students' participation and cognitive involvement. Overall, the results confirm that all measurement instruments were highly reliable and suitable for subsequent statistical analyses.

### *Normality Assessment*

Before conducting the Pearson correlation analysis, the normality of the data was examined using skewness and kurtosis values**,** which were generated alongside the descriptive statistics. According to Kline (2011), skewness values within the range of ±2 and kurtosis values within ±7 are considered acceptable indicators of univariate normality for behavioural research.

Across all constructs, including Gamification Experience, Motivation, Game Element Perception, Behavioural Engagement, and Cognitive Engagement, the skewness values ranged between approximately –1.58 and –0.76, while kurtosis values ranged between –0.77 and 2.82, all of which fall well within the recommended acceptable ranges. These results indicate that all variables exhibit acceptable univariate normality, allowing the use of parametric analyses, including Pearson correlation.

***Correlation Analysis***

Pearson correlation analysis was conducted to examine the relationships among the major constructs of this study: Gamification Experience, Motivation, Game Elements, and Behavioural and Cognitive Engagement. Pearson's r was selected because all variables exhibited acceptable normality (Kline, 2011), making parametric correlation appropriate. Correlation strength was interpreted using the guidelines by Cohen (1988).

**Table 7: Interpretation of Correlation Strength**

| R Value | Interpretation |
|---|---|
| 0.10 – 0.29 | Weak |
| 0.30 – 0.49 | Moderate |
| 0.50 – 1.00 | Strong |

Source: Cohen (1988)

As shown in Table 8 (Correlation Matrix), all correlations were strong, and statistically significant at $p < .001$.

**Table 8: Correlation Matrix between Constructs**

| | | Experience | Motivation | Game Element | Behavioural and Cognitive |
|---|---|---|---|---|---|
| Experience | Pearson Correlation | 1 | .818** | .799** | .714** |
| | Sig. (2-tailed) | | <.001 | <.001 | <.001 |
| | N | 143 | 143 | 143 | 143 |
| Motivation | Pearson Correlation | .818** | 1 | .825** | .815** |
| | Sig. (2-tailed) | <.001 | | <.001 | <.001 |
| | N | 143 | 143 | 143 | 143 |
| Game Element | Pearson Correlation | .799** | .825** | 1 | .873** |
| | Sig. (2-tailed) | <.001 | <.001 | | <.001 |
| | N | 143 | 143 | 143 | 143 |
| Behavioural and Cognitive | Pearson Correlation | .714** | .815** | .873** | 1 |
| | Sig. (2-tailed) | <.001 | <.001 | <.001 | |
| | N | 143 | 143 | 143 | 143 |

**. Correlation is significant at the 0.01 level (2-tailed).

A very strong positive correlation was found between gamification experience and motivation ($r = .818$, $p < .001$). This indicates that students who experienced the gamified module more positively were also more motivated to participate in the learning activities.

Gamification experience was strongly correlated with game elements ($r = .799$, $p < .001$), suggesting that students who enjoyed the module also perceived the points, levels, challenges, and feedback mechanisms as effective.

Motivation showed a strong positive relationship with behavioural–cognitive engagement ($r = .815$, $p < .001$). Highly motivated students demonstrated greater involvement, attention, and cognitive effort during the gamified cybersecurity tasks.

The strongest correlation emerged between game elements and behavioural–cognitive engagement ($r = .873$, $p < .001$), indicating that well-designed game mechanics significantly contributed to increased student engagement.

Overall, all key constructs demonstrated strong, and significant interrelationships, supporting the theoretical assumptions of Landers' Theory of Gamified Learning, which proposes that game elements enhance learning outcomes through motivational and behavioural pathways. The results confirm that motivation serves as a key mechanism linking students' gamification experience with engagement in cybersecurity learning.

## Discussion

This study set out to examine students' perceptions of gamification within a cybersecurity learning context and to identify the specific game elements perceived as most motivating and engaging. The results provide compelling evidence that gamification is positively received by learners and plays a significant role in enhancing both motivation and engagement. The discussion below is structured according to the two research questions and corresponding research objectives.

### *Students' Perceptions of Gamification in Cybersecurity Education*

Descriptive findings show that students reported consistently high levels of gamification experience, motivation, and engagement, indicating strong acceptance of the gamified module. This pattern aligns with recent evidence that gamified environments can enhance interest, enjoyment, and learning satisfaction (Dawson et al., 2025; Nguyen Viet & Nguyen-Viet, 2023). High ratings in enjoyment, attention, and creativity suggest that the game elements created a more immersive and stimulating learning experience, which is particularly valuable in cybersecurity education where concepts can be abstract. Similar outcomes were noted by Khan et al. (2025), who reported improved attentiveness and persistence in gamified cybersecurity tasks.

Motivation scores were also high across autonomy, competence, relatedness, and intrinsic motivation, supporting findings that gamification strengthens psychological needs and fosters sustained motivation (Navarro-Patón et al., 2025; Sappaile et al., 2025). The strong intrinsic motivation observed indicates that students were driven not only by rewards but by genuine interest and enjoyment. Overall, the results reinforce that gamification is an effective

motivational tool in cybersecurity learning, consistent with research highlighting its benefits in technical and related domains (Babu et al., 2025).

### *Game Elements that Enhance Engagement and Participation*

The findings indicate that students identified several game elements as particularly motivating, especially challenges, leveling systems, points and immediate feedback. These elements recorded the highest mean scores and showed the strongest associations with behavioural and cognitive engagement. The results are consistent with recent evidence that game mechanics promoting challenge, mastery progression and rapid feedback substantially improve learner engagement (Smirani and Yamani, 2024; Xu et al., 2023). Challenges enhance focus and persistence, leveling systems strengthen perceptions of competence through clear progress structures and immediate feedback supports continuous learning through timely guidance.

The importance of these elements in the context of cybersecurity aligns with research demonstrating that gamified cybersecurity tasks improve decision making, engagement and willingness to attempt complex scenarios (Hussain et al., 2020; Malone et al., 2021). Overall, the findings suggest that the integration of well-designed game elements that emphasise mastery, progression and real time feedback plays a central role in supporting student engagement within cybersecurity education.

### *Relationship Between Gamification, Motivation, and Engagement*

The correlation analysis revealed strong positive relationships among gamification experience, motivation, game element perception, and behavioural and cognitive engagement. This pattern is consistent with Landers' Theory of Gamified Learning, which explains that game elements shape learning outcomes through motivational and behavioural mechanisms (Landers, 2014). Recent research supports this view and highlights motivation as a central psychological pathway that connects gamified design with improved learning behaviours and performance (Li et al., 2024; Schaper et al., 2022). The findings in this study strengthen these claims because students who viewed the gamified module more positively also reported higher motivation and demonstrated deeper engagement in cybersecurity learning.

## Conclusion

This study concludes that gamification is perceived positively by students and serves as an effective motivational and engagement-enhancing tool in cybersecurity education. Students identified several key game elements, particularly challenges, levels, immediate feedback, and points as highly influential in fostering interest, motivation, and participation.
The strong correlations among gamification experience, motivation, and engagement validate the theoretical assumptions of Landers' model and reinforce the pedagogical value of gamification in technical subjects. As cybersecurity education continues to expand in importance, gamified instructional approaches offer a promising strategy for improving learning experience, sustaining engagement, and facilitating deeper conceptual understanding. Such integration, by tailoring content delivery to individual learning styles and leveraging sentiment analysis for adaptive feedback, could significantly amplify the motivational and learning benefits observed in this study (Harrasi et al., 2025).

Future research is encouraged to examine the long-term effects of gamification, compare different gamification designs, and explore adaptive or AI-driven approaches to personalising cybersecurity learning experiences.

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# DIRECTIONAL EFFECTS IN ROBOTIC MILLING OF UHMWPE: AN EMPIRICAL STUDY ON SURFACE ROUGHNESS

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***Abstract:*** *Industrial robots are advantageous in machining due to their workspace and versatility, yet their compliance-dominated dynamics unpredictably compromise surface quality. Although extensive research has addressed on vibration control during robotic machining of metals and fibre-reinforced composites, the empirical characterization of process parameters in soft polymer machining is still underexplored. This research focuses on the relationship between feed direction and surface roughness in UHMWPE milling, providing insights into toolpath planning methods suitable for polymer production. An experimental study utilized a KUKA KR120 R2700 six-axis robot equipped with a high-speed spindle and a 10 mm two-flute HSS end mill. Finishing cuts of 0.1, 0.2, and 0.3 mm depth were performed in both X and Y feed directions, fixing a spindle speed of 9500 rpm and feed rate of 1080 mm/min without lubrication. Contact profilometry with standardized evaluation length was taken to determine surface roughness parameters (Ra, Rq, Rz). The tool center point (TCP) was held constant, and the posture of the robot remained constant between different depths tested in each feed direction. The feed along the Y-axis recorded the least Ra values (1.64 - 1.87 µm), while in the X-axis feed ranged from 1.66 up to 1.94 µm. Within the X-axis feed, surface quality was evidently better as shown from the lower Rq values (2.0 - 2.5 µm) accompanied with high linear predictability ($R^2 > 0.99$) as opposed to the Y-axis feed (2.35 - 2.40 µm). In the case of Rz, the dominant direction effect relied on the amount of cut depth applied. For the X-axis feed, results were better at shallow depth (0.2 mm), while Y-axis feed was better at 0.3. There was little directional dependency with tool adhesion. feed direction clearly influenced UHMWPE surface roughness, indicating that optimization of milling parameters is required. The directional behaviour is primarily governed by the robot's structural dynamics, contrast between compliant platforms and conventional rigid CNC machines. The guidance for flexible manufacturing highlights the feed selection should be tailored to the application, aligning with quality objectives like average smoothness or peak control.*

***Keywords:*** *Robotic milling, UHMWPE, feed direction, surface roughness, robot kinematic*

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## Introduction

The use of industrial robots in machining has increased due to their large workspace, multi-axis capabilities, and lower investment costs compared to dedicated multi-axis CNC machine tools (Wang et al., 2023). Recent reviews of robotic machining have shown their ability to process large or complex parts, combine machining and handling operations in the same cell, and provide flexibility in reconfiguration for low to medium volume production. However, these advantages come at the cost of structural rigidity and dynamic stiffness. The serial kinematic layout of industrial robots relies on posture and the body stiffness of the tandem robot arm is relatively low at only 1 N/μm, which is 1/50 of that of conventional CNC. Therefore, it makes the robot more susceptible to deflection in cutting force and vibration in milling (Wen et al., 2023).

Consequently, vibration and chatter have been cited many times as among the most serious issues of robotic machining, which directly affects the dimensional accuracy, surface integrity and tool life. Guo et al. (2022), Liu et al. (2022), and Sun et al. (2023) address chatter suppression through three complementary approaches: Guo developed active contact milling to stabilize robots without using conservative parameters (Guo et al., 2022), Liu used redundant degrees of freedom optimization to achieve chatter-free cutting depth (Y. Liu et al., 2022), and Sun used transfer learning to predict the boundaries of stability with varying tool-workpiece combination (Sun et al., 2023). A combination of these methods shows a change in the parameter tuning to the adaptive, data-based and force-controlled approaches. More importantly, although Guo and Liu concentrate on the structural constraints of robots, Sun can consider material-tool variability, and such an extension is required to implement solution integration between mechanical optimization and intelligent modeling.

Recent studies have thus drawn a sizeable amount of scientific attention to the dynamic behaviour of robot structures, emphasizing the significance of the vibration analysis (Joshi et al., 2024). Chatter and vibration are well known as the essential processing parameters which have a direct affect on the surface roughness and sustainability in machining (Abellán-Nebot et al., 2024). This understanding highlights the necessity of predictive stability analysis and the development of advanced suppression strategies including pose optimisation, magnetorheological absorbers, and active contact-force actuators. The literature shows that in robotic milling, the configuration of machining (position of robot posts, tool overhang, spindle orientation), as well as process parameters (spindle speed, feed rate, depth of cut), are closely related to the level of vibrations (Cordes et al., 2019; Ji et al., 2024; Mohammadi et al., 2022). The majority of existing studies have concentrated on metals and the trimming of fibre-reinforced composites, where processes dominated by demanding cutting forces and rigid structural behaviour. In comparison, research into robotic milling of soft engineering polymers remains limited, where cutting forces are modest but vibration and chatter still pose serious threats to surface integrity. Table 1 summarises some representative studies on robotic milling of metals and composite to contextualise this contribution and indicate that similar work has not been done with soft polymers.

**Table 1 Representative studies on robotic milling of metals and composites: evidence of limited work on soft engineering polymers**

| Author/ Year | Machine | Machining Strategy | Material | Surface Roughness (µm) |
|---|---|---|---|---|
| **(J. Liu et al., 2024)** | Six-axis industrial robot with high-speed spindle (custom robotic milling setup) | Ball-end milling, posture-dependent vibration analysis, dry milling | Aluminum alloy 7075-T6 | 0.1 – 0.8 depending on posture and parameters |
| **(Yan et al., 2024)** | KUKA KR500 robot + ES779 high-speed milling head | Additive–subtractive hybrid manufacturing, HASM | WAAM-fabricated Al-alloy (5052 series) | 2.013 µm (best surface quality) |
| **(Ni et al., 2022)** | Robot Mitsubishi RV-4FRL-1D-S11 with spindle NAKANISHI (max 30,000 rpm) | Flat-end milling (contouring finishing) Fixed robot posture | 7075-T651 aluminium alloy (high-strength aerospace grade) | 0.374 – 3.131 |
| **(Da Silva et al., 2019)** | 8-axis robotic milling system (Motoman SV3X + 2-axis worktable, EM25N-5000-J4 spindle) | Rough cut (zigzag tool path, posture chosen to avoid collisions) Finish cut (zigzag contour, tool orientation optimized using stiffness indices) | ABS chemical wood | ~0.5 mm error (surface irregularities, not reported in µm) |
| **(Mousavi et al., 2018)** | ABB IRB6660 industrial robot + Fischer MFW 1412/36 spindle (max 36,000 rpm) | Slot milling along straight trajectory, posture optimized via functional redundancy | Aluminum | 2.5 - 11 |

The current review affirm that soft engineering polymers are still unexplored in spite of the development of robotic milling of rigid materials. Notwithstanding the focus of robotic machining studies on metals and composites, UHMWPE has concurrently become a vital engineering polymer in biomedical, tribological, and many applications due to its superior wear resistance, low friction, and remarkable impact strength. Despite its attractive properties, UHMWPE remains notorious for the challenges of producing high-quality surfaces during machining. The combination of low thermal conductivity and comparatively low melting temperature encourages local heating and smearing, whereas the ductile nature of it encourages the development of continuous chips, burrs on the edges and accumulated material sticking to the cutting tool. Most studies on machining UHMWPE materials have used CNC machines as shown in Table 2. From the observations of previous studies, spindle speed, feed rate and depth of cut have significant effects on surface roughness, burr formation and cutting force. In addition, surface finish can also be achieved depending on sharp tools, limited depth of cut and precise adjustment of chip load.

**Table 2 Summary of CNC milling studies on UHMWPE surface roughness optimization**

| Author/ Year | Machine | Material | Spindle Speed (rpm) | Feed Rate (mm/min) | Depth of Cut (mm) | Surface Roughness µm |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **(Piska & Urbancova, 2022)** | CNC milling | UHMWPE | 764 | 315, 450, 630 | 1 | 0.774 |
| **(Lopes et al., 2021)** | CNC milling | UHMWPE | 9500 | 1767 | 0.035 – 0.110 | 0.82 – 3.38 Optimum: 1.13 |
| **(Lestari et al., 2019)** | CNC milling | UHMWPE | 6500 – 7500 | 1000 – 2000 | - | 0.57 – 1.75 optimum: 0.143 |

Nonetheless, optimisation and empirical characterisation of cutting parameters to process UHMWPE in robotic milling is remain limited. Current studies of robotic machining have focused on dynamic modelling and chatter control to machining metals and composite materials, but there is comparatively literature on the role of spindle speed, feed rate, and depth of cut setting in a vibration-aware way. Specifically, limited experimental studies that supplement: (i) a process combination that is specifically intended to mitigate vibration, such as, constant robot posture and short tool overhang with (ii) a methodical exploration of surface-related responses, such as, surface roughness, dimensional accuracy and chip morphology.

This paper addresses the identified gap through an experimental investigation of robotic UHMWPE milling, with particular attention to feed direction effects in low-vibration machining. The study is guided by two research questions (RQ1) What is the influence of feed direction (Y-axis versus X-axis) on surface roughness parameters (Ra, Rq, Rz)? (RQ2) Do directional effects depend on the different depths of cut (0.1-0.3 mm)? Previous finding with robotic milling (Ni et al., 2022) had reported high quality surface and reduced vibration when feeding along the Y direction than the X direction due to direction-dependent stiffness of serial robots. This research reports a pilot-scale validation of the stated trend with respect to UHMWPE surface finishing. The work uses constant robot posture, short tool overhang and shallow finishing passes to determine stable machining conditions that help reduce vibration-related surface defects. The results present initial evidence and create a useful foundation of optimization of robotic polymer machining parameters that may be performed later through statistical analysis.

## Methodology

### *Materials and Workpiece Preparation*

This study employs Ultra-High Molecular Weight Polyethylene (UHMWPE) to investigate robotic milling as a CNC alternative. The polymer, provided by Röchling Engineering Plastics Sdn. Bhd., as a neat thermoplastic that has low thermal conductivity and high viscoelasticity that dictate heat build-up and elastic recovery during precision milling. Specimens with dimensions of $50 \times 50 \times 50$ mm were prepared from as-received stock, deburred, and conditioned for 24 h at $23 \pm 2$ °C and $50 \pm 5\%$ relative humidity, in line with ISO 291:2008 standards. Table 3 presents the essential thermomechanical parameters, which were used to define process limits and mitigate risks of thermal softening and surface degradation. All machining trials were performed under dry cutting conditions, eliminating lubricant or coolant to minimize polymer-intrinsic thermo-mechanical effects and to simulate industrial robotic milling setups that operate without coolant delivery systems.

**Table 3 UHMWPE material properties used in the experiment**

| Properties | Value | Unit |
|---|---|---|
| Density | 0.93 | g/cm$^3$ |
| Yield Stress | 20 | MPa |
| Tensile Modulus of Elasticity | 680 | MPa |
| Melting Temperature | 135 | °C |
| Heat Deflection Temperature | 79 | °C |
| Coefficient of Thermal Expansion | 150-230 | $\times 10^{-6}$ K$^{-1}$ |
| Dielectric Strength | 45 | kV/mm |




### *Simulation Setup*

SprutCAM simulation serves as a vital step in robotic machining virtual workflows to validate toolpaths, assess robot kinematics, and detect potential collisions prior to physical trials. The path programming joint axes are also defined as the kinematic chain (A1-A6) and tool-fixed coordinate frame. The joint angles of Table 4 were fixed at all depths in each direction of feed (X-feed and Y-feed), as no posture comparisons is made across depths in a direction. The X-feed and Y-feed positions are different due to the fact that various joint setups are required to achieve the two toolpath directions. This pre-experimental validation is particularly important in robotic manufacturing due to the multidimensional nature of six-axis motion. Furthermore, the nature of the interaction between the toolpath and the material geometry creates the need to perform an extensive validation process. This approach aims to obtain accurate machining results without compromising operational efficiency and safety standards (Wan Jusoh et al., 2025). Figure 1 shows the simulation Sprutcam software.

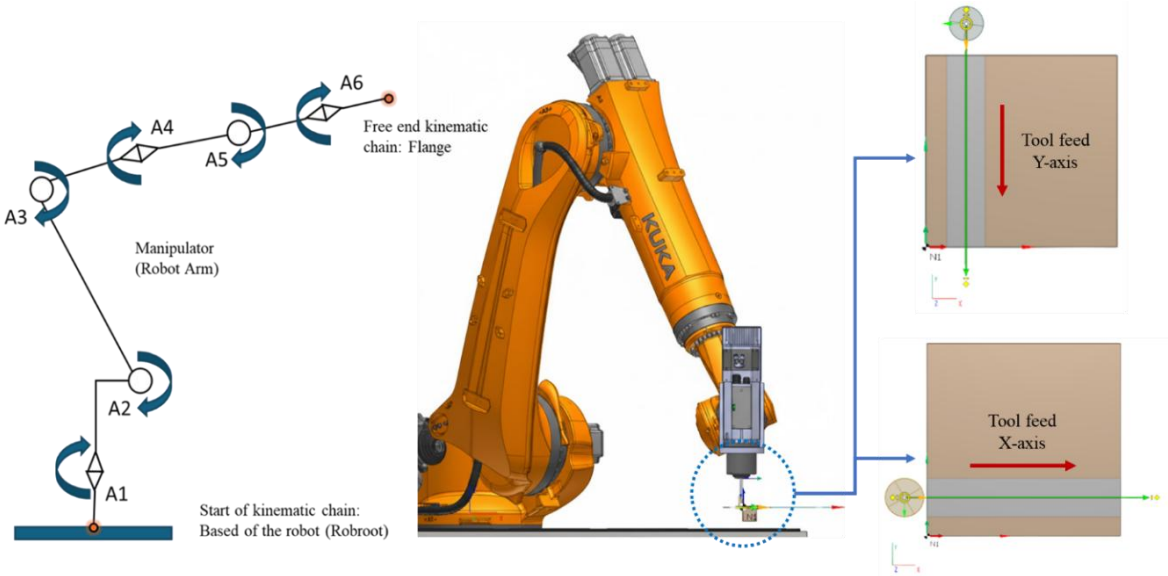



**Figure 1 Simulation Sprutcam to simulate different tool feed direction**

**Table 4 Robot kinematic chain**

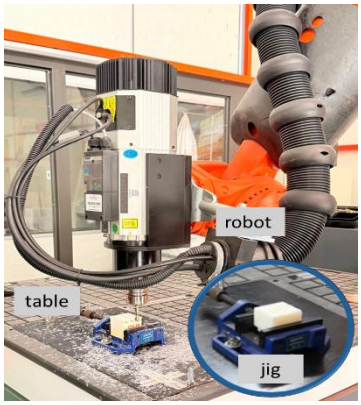
| Axis | Joint | Angular Value (°) | |
|---|---|---|---|
| | | X-axis feed direction | Y-axis feed direction |
| A1 | Joint 1 | 48.554 | 43.365 |
| A2 | Joint 2 | −69.797 | −64.480 |
| A3 | Joint 3 | 128.261 | 119.801 |

| Axis | Joint | Angular Value (°) | |
|---|---|---|---|
| | | X-axis feed direction | Y-axis feed direction |
| A4 | Joint 4 | 133.985 | 93.680 |
| A5 | Joint 5 | 66.918 | 87.457 |
| A6 | Joint 6 | −157.893 | −145.403 |

## Experimental Setup

A KUKA KR120 R2700 industrial robot (QUANTEC series, KUKA Robotics, Augsburg, Germany) equipped with a high-speed spindle (GDL70-24Z/9.0, HQD Mechatronic Division, Changzhou, China) was employed for the milling experiments. The robot features a high workstation capacity and nominal repeatability of ±0.05 mm in accordance with ISO 9283, with detailed specifications relevant to path precision and load capacity provided in Table 5.

**Table 5 Kuka KR120 R2700 technical data (Wan Jusoh et al., 2025)**




| Parameter | Value | Unit |
|---|---|---|
| Maximum reach | 2701 | mm |
| Rated payload | 120 | kg |
| Maximum payload | 167 | kg |
| Maximum supplementary load, rotating column / link arm / arm | 300 / 130 / 150 | kg |
| Pose repeatability (ISO 9283) | ± 0.05 | mm |
| Number of axes | 6 | - |
| Mounting position | Floor | - |
| Footprint | 754 x 754 | mm |
| Weight approx. | 1069 | kg |

The experiments were fitted with a high-speed spindle and a 10 mm two flute HSS flat end mill. Each experiment was conducted at constant spindle speed of 9500 rpm and feed rate of 1080 mm/min to determine the influence of depth of cut and feed direction on the surface roughness. The block of UHMWPE was placed in a mechanical vice that was attached to the table of the robot cell, and the clamping layout remained the same throughout the experiments. A Tool Center Point (TCP) was assigned to the end of the end mill geometry. A tool pressenter procedure on a flat reference surface was used to measure the tool length and setting coordinates. The same TCP (X 300.33 Y 0.09 Z 85.41 with a tool overhang of 74.46mm) was set in Sprutcam to ensure the tool tip Z position accurate before machining.

The coordinate system of the workpiece was referred to the UHMWPE block. The origin was put at the upper left front corner of the block, the X and Y axes were parallel with the long and short sides of the workpiece respectively and the Z axis was at right angles to the robot surface. Position of the workpiece was X 974.86 Y -1406.31 Z 411.69. The workpiece base was set identically in SprutCAM and the robot controller to ensure that the programmed toolpath corresponded precisely with the actual machining operation. To compare the feed direction, the sole programmed variation was the toolpath direction, set either along +Y or −X. There were no changes in the TCP and workpiece base positions. The upper surface of all of the UHMWPE blocks was planarised by face-milling operation on the same spindle-tool

combination before the finishing tests. Multiple overlapping passes were executed to remove the saw-cut layer and establish a flat reference surface. Face milling was then applied, and the Z0 of the workpiece coordinate system was re-defined on this planar surface.

The finishing experiments were then conducted on this prepared face at shallow axial depths of cut (0.1, 0.2 and 0.3 mm). One straight contour pass was programmed at the chosen depth of each given run in either the Y-axis direction or the -X-axis direction. The robot joint (A1-A6) was keep constant at all cutting depth levels but the joint arrangement is not the same in the X- and Y-feed toolpaths because of kinematic limitations. Therefore, any X-Y variations can be indicative of combined effects of feed direction and pose-dependent compliance. The measurement of surface roughness was made at the three points of each machine track, slightly outside the lead-in and lead-out segment tracks, to eliminate lead-in/lead-out effects and the error bars plotted are ±1 standard deviation (SD). The measurements were obtained using a Mitutoyo SJ-401 contact stylus profilometer (Mitutoyo Corporation, Kawasaki, Japan) whose cut-off length $\lambda_c$, 0.8, and evaluation length, 4.0 mm ($5\lambda_c$), were used.

**Result and discussion**

The common behavior of Y-axis feed to achieve lower average roughness is similar to what was reported by (Ni et al., 2022) that Y-direction feeding can lead to lowering of vibration than X-direction because of directional stiffness variance in serial robots. The results in Figure 2 show that Y-axis feed always generated lower Ra values of all cutting depths between 1.642 and 1.867 µm when compared to 1.661-1.936 µm in X-axis. The two feed directions were highly linearly correlated with depth of cut ($R^2$>0.93), and the surface roughness was found to increase linearly with the cutting depth. It was particularly noted that the X-axis feed had a better predictability ($R^2$=0.9981) with a stronger depth sensitivity (slope=0.1372) than Y-axis ($R^2$=0.9333 and slope=0.1123). Directional benefit of Y-axis feed increased with deeper cuts at 0.3 mm depth, confirming the literature results of preferential feed orientation in machining of polymers. Produced error bars overlap in clear depths (0.1-0.2 mm), however, in these circumstances, indicating that the practical importance of this advantage is limited.

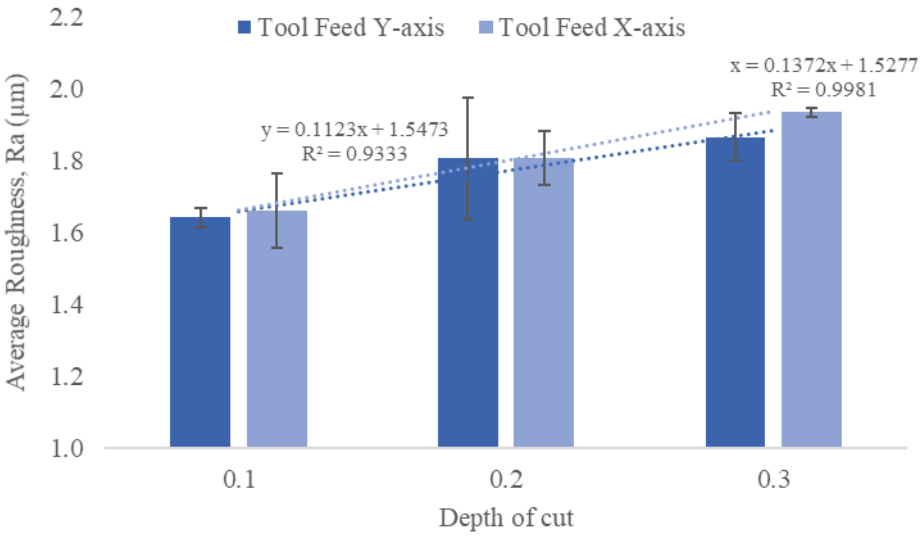



**Figure 2 Effect of depth of cut on average surface roughness (Ra) for Y-axis and X-axis feed directions**

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In contrast to the Ra trends, Figure 3 indicates that X-axis feed achieved a consistently lower Rq (2.0-2.5 µm) than Y-axis (2.35-2.40 µm). This paradoxical action offers important information on the surface generation processes. The Y-axis Rq was quite stable throughout the depths ($R^2$=0.6396) which meant that the roughness properties were depth-independent and had a significant degree of variation (large error bars at 0.1 mm). On the other hand, X-axis was displayed as almost perfect linear ($R^2$=0.9996) with predictable growth between 2.0 and 2.5 µm. Experimental results imply that Y-axis feed direction yields reduced average height with occasional peaks, whereas X-axis feed provides smoother profiles free of severe irregularities, as Rq is more sensitive to larger deviations compared to Ra. This effect of directional stiffness has not been documented in CNC machining but arise naturally in serial-kinematic robotic systems, reflecting axis-specific modal variations.

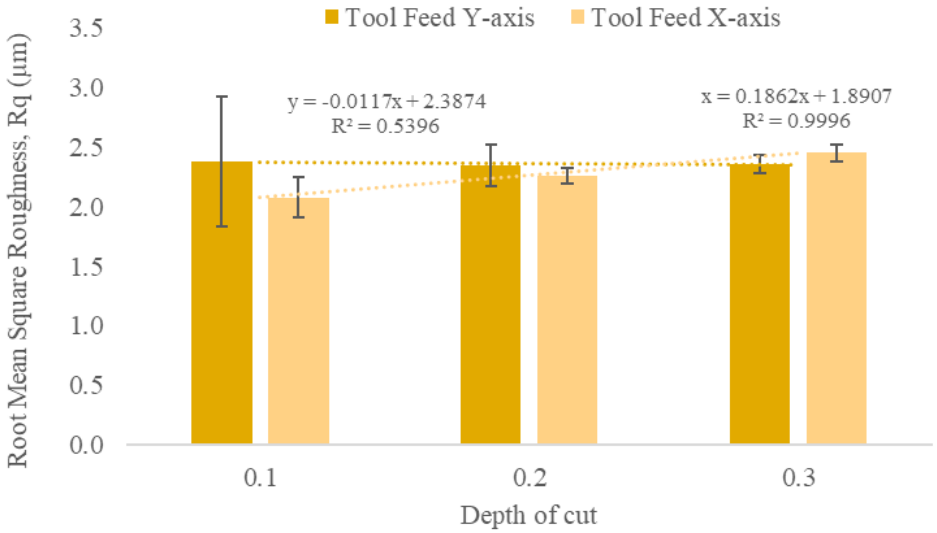



**Figure 3 Effect of depth of cut on root mean square roughness (Rq) for Y-axis and X-axis feed directions**

Figure 4 shows depth-sensitive directional preference towards Rz parameter. At shallow cut (0.1 mm) the directions had a similar result (9.18 vs 8.99 µm). The clear advantage on X-axis at intermediate depth (0.2 mm): 10.23 µm versus 11.99 µm. Interestingly at a deepest cut (0.3 mm) the Y-axis retrieval was better in Y with 11.01 µm over X-axis 11.82 µm. This crossover effect shows a change in failure domination mechanisms with an increase in cutting forces. X-axis was highly predictive ($R^2$=0.9949) over the entire range of depths, and Y-axis was poorly correlated ($R^2$=0.4108), indicating irregular peak formation in this direction. The predictability of X-axis feed makes precise process planning feasible, even though absolute Rz values are marginally higher at greater depths.

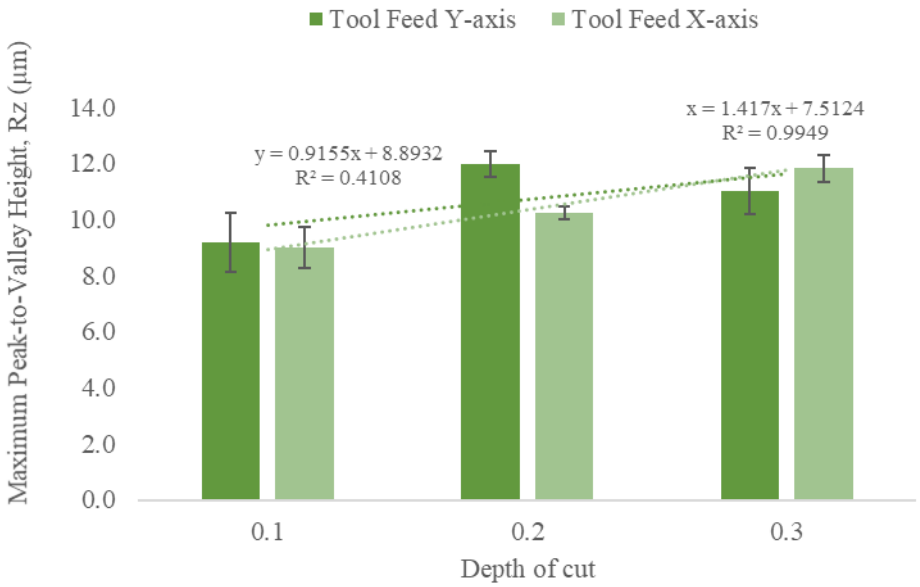



**Figure 4 Effect of depth of cut on maximum peak-to-valley height (Rz) for Y-axis and X-axis feed directions**

These results prove that the optimization of feed direction should be application-specific. The Y-axis feed is preferable when overall smoothness is the primary requirement, while X-axis feed provides greater control over peak deviations and ensures more consistent process predictability through Rq. The significant differences of directing feeds observed in this pilot data set (n=3 measurements per direction) are bigger than standard CNC variations. Nonetheless, no inferential statistics were done; hence these findings can be viewed as an initial tendency that needs to be validated by using a higher sample size and tighter posture between directions.

Figure 5 depicts the tool state after finishing passes at depths of 0.1, 0.2, and 0.3 mm. At 0.1 mm depth, the flank and corner areas appear nearly free of wear, with minimal UHMWPE residue adhering to the cutting edge. When the depth of cut is raised to 0.2–0.3 mm, adhered chip clusters become more noticeable around the tool corner, indicative of greater build-up associated with larger axial engagement. The observed trend aligns with the incremental increase in Ra, Rq, and Rz at higher depths of cut, attributable to greater chip load and contact length that led to intensified rubbing and local heating, driving adhesion.

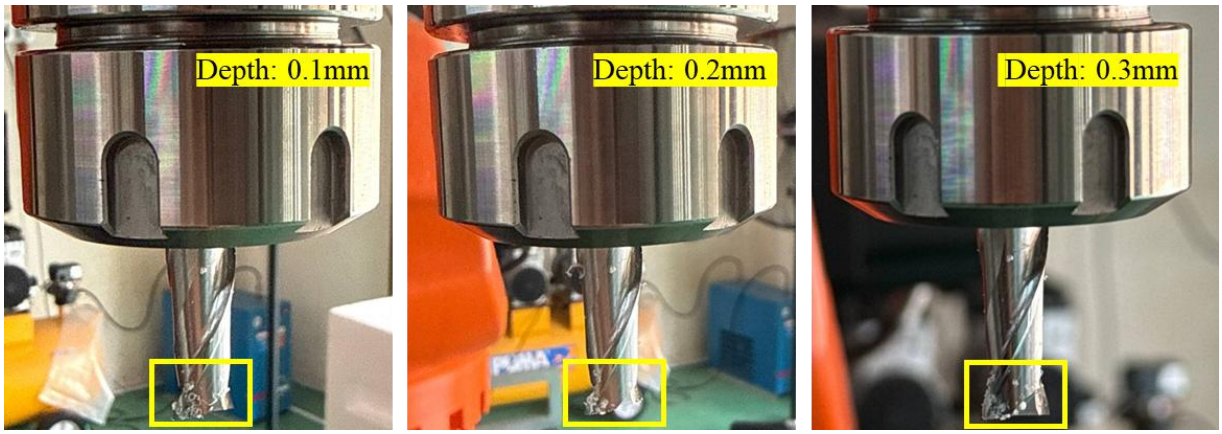


**Figure 5 Tool condition showing UHMWPE adhesion at different depths of cut**

No apparent strong directional trend was seen on the adhesion images. The tools used for Y-axis and –X-axis feed had equivalent rates of build-up at the same depth. Together with the roughness measurements, this indicates that for UHMWPE finishing using a short, rigid tool and shallow depths of cut, the robot is working in a fairly stable vibration regime. Within this regime, accessibility and path-planning considerations drive the choice between Y-axis and X-axis feed, while surface finish is governed more by cutting depth than by feed orientation.

## Conclusion

The pilot study indicates that feed direction influences UHMWPE surface roughness in robotic milling, though the magnitude of this effect depends on depth of cut. Even so, depth of cut remained the most significant determinant within the experimental range. X-axis feed was associated with improved Rq and highly predictable performance, while Y-axis feed provided a slight advantage in Ra. The dominance of robot structural characteristics in shaping these outcomes underscores the distinction between compliant robotic platforms and rigid CNC machining systems. Application-specific feed selection is therefore recommended to meet quality requirements in robotic manufacturing. Future research should examine the interaction between feed direction, robot pose variability, and extended parameter ranges to establish comprehensive toolpath optimization guidelines for polymer machining.

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# ENGLISH PROFICIENCY IN KELANTANESE ISLAMIC SCHOOLS: AN SLR OF CHALLENGES, STRENGTHS, AND PEDAGOGICAL IMPLICATIONS.

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***Abstract:*** *English proficiency in Kelantanese Islamic schools remain a critical concern, with students frequently exhibiting limited competency despite the national curriculum's emphasis on English as a second language. While the importance of English for academic success and employability is well-documented, students in religious stream education face unique systemic challenges. This study presents a systematic literature review of evidence published between 2020 and 2025 to synthesize the current state of English proficiency in these contexts. The review identifies a persistent gap between expected standards and actual students' abilities, driven by the 'dual-curriculum burden', where excessive subject loads significantly reduce instructional contact hours. Through a thematic analysis of recent empirical studies, the findings indicate that learners in these settings struggle predominantly with listening, writing, and foundational literacy, exacerbated by a misalignment between school-based assessment and proficiency benchmarks. However, evidence also highlights learner responsiveness to scaffolded, genre-based instruction and digital autonomy. The paper concludes that proficiency in Kelantanese Islamic schools requires more than remedial teaching; it demands structural curriculum integration through strategies such as Content and Language Integrated Learning (CLIL) and targeted English for Islamic Purposes (EIP) modules to resolve the tension between religious and academic priorities.*

***Keywords:*** *English Proficiency, Kelantanese Islamic Schools, Instructional Challenges, Pedagogical Interventions, Curriculum Alignment*

## Introduction

In alignment with the Prime Minister's directive and the MBMMBI policy, the Ministry is restructuring the English Language Teaching Centre (ELTC) to significantly enhance English proficiency among teachers and students as part of its national reform agenda. This strategy leverages key initiatives from the Malaysia Education Blueprint 2013-2025, such as the Highly Immersive Programme (HIP), the Dual Language Programme (DLP), and professional upskilling schemes, to firmly establish English as a language of knowledge and international communication (Ministry of Education Malaysia, 2025). Despite these high-stakes imperatives, the mastery of English among Malaysian learners varies considerably across demographic and institutional contexts, with rural and religious-based institutions often facing pronounced disparities compared to their urban counterparts (Ismail & Abdullah, 2020).

Kelantanese Islamic schools, particularly those operating under state or private religious authorities, constitute a unique educational ecosystem where rigorous Islamic studies, Arabic

language instruction and traditional pedagogies coexist with the national English curriculum. While these institutions aim to deliver holistic education, persistent concerns have been raised regarding the proficiency gap between their students and national averages (Norzaidi et al., 2021).

In light of the escalating demands of globalised workforce, addressing these proficiency deficits is both timely and essential for ensuring that graduates from religious streams remain competitive beyond their immediate communities. Consequently, this article presents a systematic literature review to examine the current state of English proficiency in Kelantanese Islamic schools. By synthesizing existing empirical findings related to learner performance, instructional constraints, and teacher capacity, the review aims to provide a comprehensive overview of the sector's challenges and strengths. Ultimately, this synthesis proposes evidence-based pedagogical strategies designed to bridge the proficiency gap while respecting the unique cultural and curricular identity of Islamic education.

## Background of the Study

The educational landscape of Islamic schools in Kelantan is distinguished by a rigorous dual-curricular framework, which integrated theological components, such as Quranic studies, Arabic, Fiqh, Tauhid, and Islamic Civilization, alongside the national academic syllabus comprising English, Mathematics, and Science. While this model aspires to produce holistic human capital, the practical implementation often inadvertently marginalizes academic subjects, particularly English.

The curricular structure is heavily weighted towards religious instruction, with students typically navigating an extensive repertoire of 10 to 13 distinct subjects. Within this crowded timetable, instructional hours for English are frequently compromised. Furthermore, the linguistic environment is characterized by an institutional hierarchy that privileges Arabic as the primary language of religious access, often relegating English to a secondary, functional tier.

Despite these structural constraints, the unique ethos of these institutions fosters distinct learner strengths. Students often exhibit high levels of discipline and intrinsic motivation rooted in their religious study habits or traits that constitute significant educational affordances for language acquisition. When paired with culturally responsive instructional strategies, these behavioural attributes can be leveraged to overcome environmental limitations. Against this backdrop, this study employs a systematic literature review to explore the complexities surrounding English proficiency in this context, highlighting the interplay between systemic challenges latent learner strengths, and the pedagogical implications for enhancing outcomes.

## Research Problem

Although English remains a core component of the national curriculum in Malaysia, students from Islamic schooling backgrounds continue to demonstrate a persistent gap between expected proficiency standards and actual language abilities. Empirical investigation into religious education streams reveal that this performance deficit is multifaceted, with factors such as teacher attributes, learner attitudes and internal learning difficulties playing significant roles even at the tertiary level (Abdullah et al., 2023).

A primary driver of this proficiency gap is the scarcity of opportunities for communicative, immersive English exposure. A recent study of secondary students in Islamic religious schools found that learners were forced to rely primarily on self-initiative metacognitive, social and cognitive strategies to develop speaking skills, highlighting a critical lack of structured communicative instruction within the classroom (Sahidan et al., 2025). This deficit is exacerbated by the 'curriculum crowding' phenomenon, where the prioritization of religious subjects, such as Arabic and Quranic studies, systematically reduces the contact hours and practical exposure available for English acquisition.

Furthermore, a significant misalignment exists between teaching methods, assessment design, and proficiency goals. Findings suggest that many institutions lack pedagogical strategies that foster functional competence, favouring instead traditional, exam-oriented approaches that prioritize rote over usage (Abdullah et al., 2023). Consequently, a 'competence-performance' gaps emerges, where students may successfully pass standardized examinations without achieving genuine communicative competence.

Given these systemic constrains and unique contextual realities, there is an urgent need for targeted pedagogical strategies that can balance the demands of the religious curriculum while providing balance religious curriculum demands while providing meaningful, scaffolded English learning opportunities. Therefore, this study aims to examine these interrelated factors within Kelantanese Islamic schools and, through a systematic synthesis of evidence, propose context-sensitive recommendations to address the proficiency gap.

## Objectives of the Study

The primary objectives of this study are to synthesize existing empirical evidence regarding the current state of English proficiency among students in Kelantanese Islamic schools and to critical analyze the instructional, environmental, and systemic determinants influencing their performance. Specifically, the review aims to deconstruct how factors such as dual-curriculum demands, limited classroom exposure, and institutional culture intersect to shape learners' linguistic development.

Furthermore, the study seeks to evaluate the efficacy of potential pedagogical and technological interventions including structured literacy approaches, genre-based writing instruction, and digital learning tools. By assessing these strategies against the unique constraints of the religious schooling context, the research aims to propose evidence-based recommendations that enhance English proficiency while supporting students' broader academic and professional trajectories.

## Literature Review

Recent Malaysian scholarship has critically examined the drive to align local English proficiency measures with the Common European Framework of Reference (CEFR). Baharum et al. (2021) investigated the correlation between internal university competence scores and CEFR-aligned test, revealing only a weak-to-moderate positive correlation. Their findings underscore the complexity of benchmarking, suggesting that alignment is not merely an administrative exercise but a continuous process requiring rigorous curriculum revision and validation studies (Baharum, et al., 2021). This misalignment is particularly pertinent to the school context, where national curricula set high communicative expectations, yet local

assessment practices and the teaching that supports them, may not yet reflect the functional competencies implied by CEFR descriptors.

Furthermore, research consistently identifies listening and writing as recurrent areas of deficit in Malaysian classrooms, particularly in non-urban settings. Recent studies emphasize that these macro-skill difficulties often stem from gaps in foundational literacy and phonological awareness. Zin et al. (2023) established a strong positive correlation between teachers' beliefs in explicit phonics instruction and their actual classroom practices, arguing that systematic foundational support is a prerequisite for broader language development. For Kelantanese Islamic school students, who often exhibit significant weakness in basic literacy, this literature suggests that remedial interventions must prioritize phonics and listening strategies to build the necessary scaffolding for complex writing tasks.

On the other hand, intervention research among rural and indigenous populations offers valuable insights for pedagogies tailored to resource-constrained environments. Ganapathy et al. (2022) compared process-based approaches with genre-based pedagogy among Orang Asli secondary students, reporting significant gains in descriptive writing performance and student motivation with the latter. The study recommends integrating explicit grammar support into genre-based frameworks to meet the specific needs of learners with limited prior exposure.

These findings are highly transferable to the Kelantanese Islamic school context, suggesting that structured, explicit instruction in which combines genre awareness with linguistic scaffolding, may be more effective than purely communicative methods for students starting from low proficiency baselines.

Teacher agency remains a central determinant of classroom outcomes. Malaysian studies indicate that instructional quality is heavily influenced by teachers' perceptions of contact hours, assessment loads, and the role of language itself. More recently, Husin and Radzuan (2021) have argued for continuous professional development that targets workplace-relevant skills.

Adapting such models for Islamic school is critical, as teachers in these dual-curriculum settings require specialized strategies to navigate the tension between religious academic demands and student-centred language teaching.

While foundational studies on technology in Kelantan date back in 2020, recent scholarship continues to advocate for multimedia as a vital tool for bridging the exposure gap. Melvina and Julia (2021) found a positive relationship between learner autonomy and proficiency gains, suggesting that technology-assisted language learning (TALL) is most effective when it fosters self-regulated practice. This is corroborated by Ganapathy et al. (2022), who documented positive student engagement with pedagogies that incorporate digital resources. However, Husin and Radzuan (2021) caution that interventions must be accessible and locally relevant as a critical consideration for Islamic schools where digital infrastructure may vary.

Collectively, the literature from year 2020 to 2025 reveals a convergence of evidence pointing to a systemic mismatch between policy aspirations and classroom realities. Four key themes emerge as followings:

1. Assessment-Curriculum Dissonance: The alignment between local assessment and international frameworks (CEFR) fragmented (Baharum et al., 2021).
2. The Necessity of Scaffolding: Learners in rural or underserved contexts thrive not on immersion alone but on structured, genre-based instruction supported by explicit linguistic focus (Ganapathy et al., 2022).
3. The Foundational Prerequisites: Early mastery of phonics is identified as non-negotiable predictor of later success in reading and writing (Zin et al., 2023).
4. Digital Autonomy: Technology serves as a crucial compensatory tool for limited environment exposure, provided it supports learner autonomy (Melvina & Julia, 2021).

Despite these convergent themes, there remains a notable scarcity of empirical research focused specifically on Kelantanese Islamic schools. Most existing data is extrapolated from general rural or indigenous contexts, leaving a gap in understanding how the specific religious curriculum and institutional culture of Kelantan interact with these broader challenges. This systematic review addresses this gap by synthesizing the available evidence to propose context-sensitive interventions tailored to this unique educational environment.

## Methodology

This study employs a Systematic Literature Review (SLR) methodology grounded in qualitative thematic analysis. This research design was selected to critically synthesize and consolidate existing empirical evidence regarding English proficiency within the Malaysian Islamic school context. By integrating findings from diverse source, the study aims to reconstruct a holistic view of the recurring challenges, systemic constraints, and pedagogical opportunities specific to the Kelantanese educational landscape.

Data for this synthesis were rigorously selected from peer-reviewed journal articles, empirical research reports, and academic dissertations published between 2020 and 2025. This timeframe was chosen to ensure the inclusion of the most recent post-pandemic educational realities.

The selection process prioritized studies focusing on four core thematic clusters: (1) English proficiency benchmarking in Malaysia; (2) learner performance in rural and religious-stream contexts; (3) pedagogical strategies in Islamic education; and (4) technology-enhanced language learning (TELL) for low-proficiency students.

Selected studies underwent a multi-stage review process to ensure relevance, methodological quality, and alignment with the research objectives. Following the initial screening, findings were systematically extracted and subjected to inductive thematic coding. Key data points, including specific skill deficits, instructional bottleneck, and learner behaviours, were identified and grouped into broader analytical categories. Through recursive refinement, these categories were synthesized into four primary themes: (1) proficiency gaps; (2) pedagogical limitations; (3) effective instructional strategies; and (4) the role of digital intervention. This process allowed for the emergence of an integrated framework explaining the proficiency landscape in Kelantanese schools.

However, as this study relies on a secondary synthesis of existing literature, several limitations are acknowledged. First, the absence of primary fieldwork means the analysis depends heavily on the methodological rigour and reporting quality of the cited studies. Second, there is a scarcity of empirical research focused exclusively on Kelantanese Islamic schools;

consequently, findings from comparable rural and religious contexts in Malaysia have been extrapolated to inform the analysis. While this necessitates cautious interpretation, the synthesis nonetheless provides a robust, evidence-based foundation for understanding current challenges and designing targeted future interventions.

## Findings and result

The synthesis of recent literature indicates a recurring pattern of proficiency deficits among learners from rural and religious-school backgrounds. Analysis of perception-based survey among rural Malaysian ESL students reveals that a significant majority struggle with receptive and productive skills; specifically, over 66% of respondents indicated difficulties in listening comprehension, while more than 70% expressed low confidence in writing English comfortably (Abdullah et al., 2023). These statistical indicators suggest that beyond complex communicative tasks, students face critical hurdles in foundational literacy and grammar. Additionally, the literature underscores that limited vocabulary breadth, compounded by minimal exposure to authentic spoken and written English, acts as a primary barrier developing functional competence in these resource-constrained contexts.

Then, multiple studies highlight that these proficiency gaps are sustained by systemic instructional and environmental constraints. A primary factor is the 'time poverty' inherent in religious educational settings; these contexts often lack adequate contact hours for English due to the prioritization of the religious curriculum, leading to insufficient immersion and practice (Muhammad et al., 2024). Consequently, teachers frequently revert to traditional, teacher-centred methods and rote learning rather than employing communicative or contextualised pedagogy, which severely restricts opportunities for authentic language use (Abdullah et al., 2023; Ag-Ahmad, Syed Mohamad & Majilang, 2023). This issue is exacerbated by assessment misalignment, where school-based evaluations prioritize exam strategies over the communicative goals of the CEFR. As a result, a 'competence-performance gap' emerges where students may pass examinations via memorisation without acquiring real-world communicative skills (Abdullah et al., 2023).

However, despite these structural challenges, the literature identifies distinct areas of pedagogical opportunity. Evidence suggests that when provided with appropriate scaffolding, learners in marginalized contexts demonstrate significant responsiveness. For instance, a quasi-experimental study involving indigenous (Orang Asli) students, a demographic sharing similar socio-educational traits with rural religious learners, found that a genre-based pedagogical approach significantly improved descriptive writing scores, with students reporting the method as highly motivating (Ganapathy et al., 2022). This indicates that structured, explicitly scaffolded instruction can yield meaningful improvements even among low-proficiency learners. Additionally, research supports the efficacy of blended of multimedia-based learning in Malaysian ESL contexts (Hassan et al., 2021). These modes offer the flexibility and autonomy necessary to provide repeated exposure, serving as a vital compensatory tool for students lacking an immersive English environment.

Besides, teacher-related factors emerge as a critical determinant of proficiency outcomes. Qualitative inquiries into teachers' perspectives reveal educators in less-resourced, religious, or rural schools feel significantly constrained by heavy workloads, insufficient teaching resources, and exam-oriented syllabi that prioritize results over communicative competence (Ag-Ahmad, Syed Mohamed & Majilang, 2023). In such high-pressure environments, the

implementation of essential strategies, such as systematic phonics, foundational literacy support, and interactive communicative activities, becomes inconsistent. This variability in instructional quality contributes to the perpetuation of low proficiency levels across student cohorts.

To provide a consolidated view of these interrelated factors, the key findings regarding proficiency levels, instructional constraints, learner attributes, and teacher capacity are synthesized in Table 1 below.

**Table 1: Thematic Synthesis Of Factors Influencing English Proficiency In Kelantanese Schools**

| No. | Theme | Key Findings | Evidence |
|---|---|---|---|
| 1. | Proficiency Levels | Receptive and productive deficits | A perception-based survey indicates significant struggles, with over 66% of rural ESL learners reporting difficulty in listening comprehension and 70% lacking confidence in writing (Abdullah et al., 2023). |
| | | Foundational gaps | Weaknesses in foundational literacy and grammar are prevalent, exacerbated by limited vocabulary breadth which hinders functional competence (Abdullah et al., 2023). |
| | | Exposure deficit | The lack of authentic spoken and written English exposure in rural contexts remains a primary barrier to communicative readiness (Sahidan et al., 2025). |
| 2. | Instructional Constraints | Time poverty | Religious school timetables are heavily prioritized (10-13 subjects), resulting in insufficient contact hours and immersion opportunities for English (Muhammad et al., 2024). |
| | | Pedagogical constraints | Teachers frequently rely on teacher-centred, rote-learning methods rather than communicative pedagogy due to systemic pressures (Ag-Ahmad, Syed Mohamad & Majilang, 2023). |
| | | Assessment misalignment | School assessments often diverge from national CEFR benchmarks, fostering a 'competence-performance gap' where students pass exams without acquiring real-world skills (Abdullah et al., 2023). |
| 3. | Learner Attributes | Efficacy of scaffolding | Indigenous and rural students show significant improvement in writing scores and motivation when taught using structured, genre-based pedagogical approaches (Ganapathy et al., 2022). |
| | | Digital engagement | Blended and multimedia-based learning modes have proven effective in enhancing engagement and providing the autonomy needed to compensate for low-immersion environments (Hassan et al., 2021). |
| 4. | Teacher Capacity | Systemic barriers | Teachers are reported of being constrained by heavy workloads, resource shortages, and exam-oriented |

| | | | |
|---|---|---|---|
| | | | syllabi limit their ability to focus on communicative competence (Ag-Ahmad et al., 2023). |
| | | Literacy instruction | The implementation of systematic phonics and foundational literacy strategies remains inconsistent, despite evidence linking teacher beliefs in phonics to enhance student outcomes. (Zin et al., 2023). |

**Discussion**

The synthesis of recent evidence reveals that the proficiency deficit in Kelantanese Islamic schools is not merely a pedagogical failure but a symptom of broader systemic dissonance. The persistent weaknesses in listening and foundational literacy are inextricably linked to a 'competence-performance gap', where instructional practices and assessments diverge from the communicative goals of the curriculum. This aligns with findings in Malaysian higher education, where Baharum et al. (2021) identified that partial alignment with international frameworks like the CEFR often results in inconsistent proficiency trajectories. In the religious school context, this misalignment is exacerbated; while the curriculum aspires to global communicative standards, the reality of resource constraints and exam-oriented accountability forces teachers to prioritize performative rote learning over genuine competence. Thus, student with low proficiency should be re-conceptualized not as a deficit of learner ability, but as a rational response to an educational setting where structural constraints preclude deep language acquisition.

Furthermore, a critical theoretical tension emerges when juxtaposing Communicative Language Teaching (CLT) ideals against the institutional reality of Islamic schooling. The cultural and temporal architecture of these schools-characterized by a prioritization of religious subjects, creates a distinct 'dual-curriculum paradox'. Research by Sahidan et al. (2025) indicates that the heavy emphasis on religious coursework significantly reduces the time and cognitive space available for authentic English exposure, thereby arresting vocabulary development and listening comprehension. This prioritization, while reflecting core institutional values, inadvertently positions English as a secondary 'academic subject' rather than a functional tool for communication. Consequently, the failure of communicative methodologies in these settings may be less about teacher unwillingness and more about a structural incompatibility, where the time-intensive demands of language immersion compete directly with the immediate imperatives of religious scholastic achievement.

Despite these systematic barriers, the review highlights significant 'pedagogical affordances' that can be leveraged for improvement. The positive learner response to genre-based writing approaches echoes the work of Ganapathy et al. (2022), suggesting that students in these rigorous environments respond well to explicit, structural scaffolding rather than unstructured immersion. This finding challenges the notion that rural learners are disengaged; rather, they acquire pedagogies that provide clear cognitive schemas, a preference likely reinforced by the disciplined nature of their religious studies. Similarly, the efficacy of technology-assisted learning offers a vital compensatory mechanism. As noted by Melvina and Julia (2021), digital tools that foster learner autonomy can bypass classroom time constraints, allowing students to access authentic language input independently. This suggests that technology in Islamic schools should not be viewed as a luxury, but as an essential equity tool to bridge the exposure gap. From a macro-pedagogical perspective, these findings underscore the urgent need for a

shift from 'remedial' to 'context-sensitive' interventions. Effective improvement requires a curriculum design that acknowledges the dual-burden of the learner.

This entails moving beyond generic teacher training towards specific professional development in 'low-resource, high-accountability' strategies, such as integrating phonics into early literacy to address the foundational gaps identified by Zin et al. (2023). Furthermore, integrating autonomy-supportive practices must be done with sensitivity to local infrastructure; technology must be accessible and culturally relevant to be sustainable. Ultimately, addressing the proficiency crisis in Kelantanese Islamic schools requires a holistic policy approach that aligns assessment realities with curriculum goals, validating English not just as a global skill, but as a complementary asset to the students' religious identity.

## Conclusion

This systematic literature review has critically examined the state of English proficiency in Kelantanese Islamic schools, synthesizing evidence from 2020 to 2025 to deconstruct the unique challenges within the educational context. The findings confirm that while students in these religious streams recognize the instrumental values of English, their actual proficiency remains constrained by deep-seated structural and pedagogical factors.

The review highlights that the 'competence-performance gap' in listening and writing is not merely a symptom of instructional deficits but a result of systemic dissonance. The 'dual-curriculum burden', where students typically navigate upwards of 12 subjects, creates a cognitive and temporal overload that renders traditional Communicative Language Teaching (CLT) less effective. In this environment, English often competes unfavourably with religious priorities, leading to a 'time poverty' that restricts authentic exposure. Despite these challenges, the analysis reveals significant pedagogical potential, learners are highly responsive to scaffolded, genre-based instruction and demonstrate increased autonomy when engaged with culturally relevant digital tools.

To address the structural incompatibility of the current system, this study proposes a shift from remedial interventions to curriculum integration. Policymakers should explore Content and Language Integrated Learning (CLIL) models tailored for Islamic education, such as English for Islamic Purposes (EIP). In this framework, English serves as the medium of instruction for lower-stakes religious content (e.g., *Sirah* or *Islamic History*), thereby increasing contact hours without extending the school day. Furthermore, such as approach contextualizes language learning within the students' primary identity, reframing English from a 'foreign' academic subject into a functional tool for global Islamic discourse.

Ultimately, sustainable improvement in Kelantanese Islamic schools requires a holistic reimagining of the curriculum. Future interventions must move beyond isolated drills and focus on creating an ecosystem where English and religious studies are viewed not as competitors, but as complementary assets in shaping a globally competent Muslim generation.

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# ESTABLISHING EXPERT CONSENSUS THROUGH A THREE-ROUND DELPHI VALIDATION FOR A DIGITAL IMPLEMENTATION READINESS INSTRUMENT

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***Abstract:*** *This study reports on a three-round Delphi process conducted to validate an expert-based instrument designed to evaluate readiness for large-scale digital implementation initiatives. The identified technique was employed to systematically achieve consensus among experts representing public agencies, academia, and industry. Statistical analysis across the three rounds revealed progressive convergence, with mean values consistently above 4.0, median scores ranging from 4 to 5, and standard deviation values narrowing substantially by Round 3, indicating improved agreement among panelists. Items with persistent variation were refined or merged to enhance conceptual precision and clarity. The final instrument demonstrated strong content validity and high consensus reliability, providing a robust foundation for assessing digital governance and implementation readiness. The study underscores the utility of the Delphi method in developing validated instruments for complex sociotechnical ecosystems and contributes methodological insights for digital transformation research and policy innovation.*

***Keywords:*** *Delphi Method, Expert Consensus, Instrument Validation, Digital Implementation Readiness, Governance Assessment*

## Introduction

The acceleration of digital transformation across public-sector and organizational ecosystems has intensified the need for reliable mechanisms to assess readiness for large-scale digital implementation. Governments and institutions worldwide are increasingly deploying complex digital initiatives involving data integration, interoperability, cross-agency collaboration, and long-term governance arrangements (Mergel et al., 2019; Janssen et al., 2020). However, the success of such initiatives depends not only on technological capability but also on governance alignment, stakeholder preparedness, and sustainable operational structures (Vial, 2021; Verhoef et al., 2021).

Digital implementation readiness is widely recognized as a multidimensional concept encompassing governance and policy frameworks, technical infrastructure, data management capabilities, human and organizational capacity, and sustainability considerations (Dwivedi et al., 2020; Pereira et al., 2018). While numerous digital readiness models, maturity frameworks, and assessment indices have been proposed, particularly within the domains of e-government, smart cities, and digital governance, many operate at a high conceptual level and lack empirically validated, item-based measurement instruments suitable for practical application at the implementation level (Gil-Garcia et al., 2018; Meijer & Bolivar, 2016). This limitation

constrains their usefulness for decision-makers who require concrete diagnostic tools to evaluate preparedness prior to deployment.

The development of validated instruments for complex digital ecosystems presents distinct methodological challenges. Digital transformation initiatives typically involve multiple stakeholders with diverse expertise, priorities, and institutional perspectives, making consensus on relevant readiness indicators difficult to achieve through conventional survey-based approaches alone (Luna-Reyes et al., 2012; Tilson et al., 2010). In such contexts, structured expert judgement plays a critical role in ensuring content validity, conceptual clarity, and contextual relevance of measurement instruments (DeVellis, 2017; Boateng et al., 2018).

The Delphi method offers a systematic and iterative approach for eliciting and refining expert consensus in areas characterized by complexity, uncertainty, or limited empirical evidence (Okoli & Pawlowski, 2004; Linstone & Turoff, 2011). By combining controlled feedback, anonymity, and multiple rounds of evaluation, the Delphi technique has been widely applied in information systems, digital governance, and policy research to validate constructs, prioritize indicators, and develop robust measurement instruments (Hsu & Sandford, 2007; Bannister & Connolly, 2020). Quantitative indicators such as mean, median, and standard deviation are commonly employed to assess convergence and stability of expert opinions across rounds, providing empirical evidence of consensus formation.

Despite its recognized strengths, there remains limited empirical documentation on the application of multi-round Delphi processes specifically for validating digital implementation readiness instruments within complex sociotechnical ecosystems. Existing studies often focus on conceptual frameworks or maturity models, with less emphasis on the rigorous validation of underlying measurement items (Anthopoulos, 2019; Al-Hujran et al., 2015). Addressing this gap is essential to strengthening methodological rigor and enhancing the practical applicability of readiness assessments in digital transformation initiatives.

Accordingly, this study aims to establish expert consensus on the constructs and indicators of a digital implementation readiness instrument using a three-round Delphi method. By systematically analyzing convergence patterns across iterative rounds, this research demonstrates how structured expert validation can enhance content validity and consensus reliability in instrument development. The findings contribute methodologically to digital governance and information systems research and offer practical insights for assessing readiness in large-scale digital implementation contexts.

## Literature Review

### *Digital Implementation Readiness in Complex Digital Ecosystems*

Digital implementation readiness refers to the extent to which an organization or ecosystem is prepared to adopt, integrate, and sustain digital initiatives effectively. In the context of public-sector and large-scale digital systems, readiness is increasingly viewed as a multidimensional construct rather than a purely technical condition (Vial, 2021; Dwivedi et al., 2020). Successful digital implementation requires alignment across governance structures, technical infrastructure, data management practices, human capabilities, and long-term sustainability mechanisms (Mergel et al., 2019; Verhoef et al., 2021).

Prior research has conceptualized readiness through various frameworks and maturity models, particularly within e-government, smart city, and digital governance domains. These models commonly emphasise dimensions such as leadership commitment, regulatory alignment, interoperability, cybersecurity, data quality, stakeholder collaboration, and organizational capacity (Gil-Garcia et al., 2018; Meijer & Bolivar, 2016; Anthopoulos, 2019). While these frameworks provide valuable conceptual guidance, many operate at an aggregate or strategic level, limiting their applicability for assessing readiness at the operational or implementation stage (Pereira et al., 2018).

International benchmarking instruments, such as the global digital governance and e-government survey, further highlight the importance of readiness factors but are primarily designed for macro-level comparison rather than project-level diagnosis (Janssen et al., 2020; UNDESA, 2022). As a result, there remains a gap between high-level readiness assessments and the need for validated, item-based instruments that can support decision-making in specific digital implementation contexts.

### *Instrument Development and Validation in Digital Governance Research*

The development of reliable measurement instruments is a critical component of empirical research in digital governance and information systems. Valid instruments enable systematic assessment, comparison, and evaluation of complex constructs such as readiness, maturity, and capability (DeVellis, 2017). In digital transformation research, however, instrument development is particularly challenging due to the evolving nature of technologies, institutional diversity, and context-specific requirements (Luna-Reyes et al., 2012).

Best practices in scale and instrument development emphasize the importance of content validity, construct clarity, and expert involvement during early stages of instrument design (Boateng et al., 2018; Hair et al., 2011). Content validity ensures that measurement items adequately represent the conceptual domain of interest, while clarity reduces ambiguity and enhances interpretability across diverse respondent groups. In public-sector digital initiatives, where multiple stakeholders with differing expertise are involved, expert validation becomes especially critical (Tilson et al., 2010).

Despite this, many studies in digital governance rely on adapted instruments or self-developed survey items without sufficient documentation of systematic validation procedures. This limitation raises concerns regarding measurement reliability and compatibility across studies (Bannister & Connolly, 2020). Addressing this methodological gap requires structured approaches that can accommodate expert judgement while providing empirical evidence of consensus and stability.

### *The Delphi Method for Expert Consensus and Instrument Validation*

The Delphi method is a well-established technique for achieving structured consensus among experts through iterative rounds of evaluation and controlled feedback (Linstone & Turoff, 2011). Originally developed for forecasting and policy analysis, the method has been widely adopted in information systems, healthcare, governance, and technology studies, particularly in contexts characterized by complexity, uncertainty, or limited empirical data (Okoli & Pawlowski, 2004; Hsu & Sandford, 2007).

A defining feature of the Delphi method is its ability to balance qualitative expert insight with quantitative analysis of agreement. Experts independently evaluate proposed items or constructs across multiple rounds, with anonymized feedback provided between rounds to encourage reflection and convergence without dominance effects (Linstone & Turoff, 2011). Statistical indicators such as mean, median, and standard deviation are commonly used to assess the degree of consensus, with decreasing variability across rounds indicating convergence and stability (Okoli & Pawlowski, 2004).

In instrument development, the Delphi method has been shown to be particularly effective for refining measurement items, resolving conceptual ambiguity, and establishing content validity (Boateng et al., 2018; Hair et al., 2011). Recent studies in digital governance and transformation research have employed the Delphi technique to validate indicators related to digital maturity, governance capability, and technology adoption, demonstrating its suitability for complex sociotechnical systems (Anthopoulos, 2019; Al-Hujran et al., 2015).

However, existing applications often report Delphi outcomes descriptively, with limited emphasis on convergence patterns across rounds or explicit consensus thresholds. There remains a need for empirical studies that systematically document multi-round Delphi validation processes, particularly for readiness instruments intended for use in large-scale digital implementation contexts (Pereira et al., 2018). Addressing this gap strengthens both methodological rigor and practical relevance.

### *Synthesis and Research Gap*

The reviewed literature highlighted three key observations. First, digital implementation readiness is inherently multidimensional and cannot be adequately assessed through single-factor or purely technical measures. Second, while conceptual frameworks and indices are abundant, empirically validated, item-based readiness instruments remain limited. Third, the Delphi method offers a robust yet underutilized approach for validating such instruments through structured expert consensus.

Building on these insights, this study applies a three-round Delphi method to validate a digital implementation readiness instrument, with explicit attention to convergence, consensus thresholds, and item refinement across rounds. By doing so, the research addresses an important methodological gap in digital governance and contributes a validated foundation for readiness assessment in complex digital ecosystems.

## Methodology

### *Research Design*

The study adopted a qualitative-quantitative Delphi research design to validate a digital implementation readiness instrument through structured expert consensus. The Delphi method was selected due to its suitability for addressing complex, multidimensional constructs where empirical evidence is limited and expert judgement is essential (Linstone & Turoff, 2011; Okoli & Pawlowski, 2004). By combining iterative feedback with statistical analysis of convergence, the method enables systematic refinement of measurement items while minimizing bias arising from dominant individuals or group dynamics (Hsu & Sandford, 2007).

A three-round Delphi process was employed, consistent with prior studies demonstrating that three iterations are generally sufficient to achieve stable consensus without imposing excessive burden on expert participants (Okoli & Pawlowski, 2004; Boateng et al., 2018). The research focused on establishing content validity, clarity, and agreement among experts regarding the relevance of readiness indicators for large-scale digital implementation contexts.

### *Expert Panel Selection*

Expert selection followed purposive sampling principles, prioritizing depth of experience and relevance to digital governance and large-scale digital systems. Experts were invited based on the following criteria:

1. A minimum of five years of professional experience in digital governance, ICT policy, data management, or large-scale digital implementation, including related fields such as geospatial, geolocation systems
2. Direct involvement in organizational or cross-sector digital initiative
3. Representation across academia, public-sector agencies, and industry

This multi-sectoral composition was intended to capture diverse perspectives while maintaining domain relevance, as recommended in Delphi-based instrument validation studies (Hsu & Sandford, 2007; Hair et al., 2011). A total of twelve experts participated consistently across all three rounds, meeting recommended Delphi panel size ranges for consensus-oriented studies (Okoli & Pawlowski, 2004).

### *Instrument Structure*

The preliminary instrument comprised 50 items organized into two sections: (i) a construct definition section and (ii) an evaluation section covering key readiness elements for large-scale digital implementation. The evaluation section operationalized readiness through nine elements: (1) leadership commitment and strategic sponsorship, (2) policy, legal and regulatory readiness, (3) institutional capacity and role clarity, (4) data governance and operational procedures, (5) stakeholder demand and value proposition, (6) stakeholder engagement and awareness, (7) resourcing and funding readiness, (8) technology infrastructure and skills capability and (9) core system features supporting standardization, interoperability, security and accessibility.

These elements reflect the interdependence of institutional, technical, and human dimensions commonly emphasized in digital governance and digital transformation literature (Vial, 2021; Mergel et al., 2019; Pereira et al., 2018). All items were rated using a five-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”), with 3 labelled as “Somehow agree”, consistent with common practice in instrument validation and Delphi studies (Boateng et al., 2018).

### *Delphi Procedure*

The Delphi process was conducted over three sequential rounds, with structured feedback provided between rounds to facilitate reflection and convergence.

Round 1 focused on qualitative evaluation. Experts reviewed each item for relevance, clarity, and conceptual completeness. Open-ended feedback was solicited to identify ambiguous wording, overlapping items, or missing dimensions. Based on this feedback, items were refined, reworded, or merged to improve conceptual precision, consistent with content validation practices recommended by DeVellis (2017).

Round 2 involved quantitative evaluation of the refined instrument. Experts rated all items using the five-point Likert scale. Descriptive statistics, including mean, median, and standard deviation, were calculated to assess central tendency and dispersion. Items exhibiting higher variability were flagged for further refinement, reflecting partial disagreement or differing interpretations (Okoli & Pawlowski, 2004).

Round 3 aimed to confirm consensus stability. Aggregated results from Round Two, including group means and standard deviations, were shared anonymously with the panel. Experts were then asked to re-evaluate the items with visibility of prior group responses. This feedback mechanism encouraged convergence while preserving independent judgement, a core principle of the Delphi technique (Linstone & Turoff, 2011).

### *Consensus Measurement and Analysis*

Consensus was assessed using a combination of mean, median, and standard deviation values, following established Delphi research conventions (Hsu & Sandford, 2007; Okoli & Pawlowski, 2004). The following thresholds were applied:

- High consensus: Standard deviation $\leq 0.50$
- Moderate consensus: Standard deviation between 0.51 and 0.80
- Low consensus: Standard deviation $> 0.80$

Progressive reduction in standard deviation across rounds was interpreted as evidence of convergence and increasing agreement among experts. Alignment between mean and median values was used to assess response stability and skewness. This analytical approach enabled both item-level and instrument-level evaluation of consensus reliability (Boateng et al., 2018; Hair et al., 2011).

### *Ethical Considerations*

Participation in the Delphi process was voluntary, and expert responses were anonymized to ensure confidentiality and minimize social influence. Experts were informed of the study objectives and the iterative nature of the process prior to participation. Anonymity and controlled feedback were maintained throughout all rounds, consistent with ethical guidelines for Delphi research (Hsu & Sandford, 2007).

## Results and Discussion

This section presents the findings of the three-round Delphi process and discusses the progression of expert consensus across iterative rounds. The analysis emphasizes convergence patterns using descriptive statistics such as mean, median, and standard deviation to demonstrate the empirical robustness and stability of the validated digital implementation readiness instrument.

### *Delphi Round 1: Initial Variation and Conceptual Refinement*

The first Delphi round revealed generally positive expert agreement on the proposed readiness indicators, while revealing areas requiring clarification and refinement. Across the 50 items, mean scores ranged from 3.36 to 4.55 and median values ranged from 3 to 5, indicating that responses clustered largely between "Somehow agree" and "Strongly agree". Dispersion analysis showed a mix of moderate to low consensus, with standard deviation values spanning 0.47 to 1.15, in which a small subset of items exceeded 0.90, signaling substantive variation in expert interpretation and/or contextual applicability. Items with higher dispersion were primarily associated with governance coordination and data interoperability, domains that are known to be context-sensitive and interpreted differently across organizational settings (Janssen et al., 2020; Luna-Reyes et al., 2012). Qualitative feedback highlighted overlapping concepts, ambiguous terminology, and the need to distinguish implementation-level readiness from strategic intent.

In response, several items were reworded for clarity, merged to reduce redundancy, or refined to better reflect operational readiness. This pattern of initial divergence followed by targeted refinement aligns with established instrument development practices, where early-stage variability is expected and serves as a mechanism for improving content validity (DeVellis, 2017; Boateng et al., 2018).

**Table 1: Summary of Consensus Statistics for Delphi Round 1**

| Metric | Minimum | Maximum | Interpretation |
|---|---|---|---|
| Mean | 3.36 | 4.55 | General agreement with notable variation |
| Median | 3.00 | 5.00 | Presence of somehow agree to strong agreement |
| Standard Deviation | 0.47 | 1.15 | Moderate to low consensus, refinement required |

### *Delphi Round 2: Improved Alignment And Emerging Consensus*

Following revisions informed by Round 1 feedback, the Delphi Round 2 evaluated the refined items quantitatively to determine whether clarification and consolidation improved convergence and overall consensus reliability. The results indicated a clear stabilization of expert judgement, suggesting enhanced conceptual clarity and shared understanding of the proposed readiness indicators.

As shown in Table 2, mean values clustered between 3 ("Somehow agree") and 4 ("Agree"), while median values were consistently 4.00 across all items, reflecting strong central alignment among experts. Dispersion analysis further demonstrated improved consensus, with standard deviation values narrowing to a range of 0.30 to 0.65, indicating predominantly moderate to high agreement. These patterns suggested that the refinements introduced after Round 1 were effective in reducing interpretive ambiguity and enhancing item interpretability, consistent with established instrument development practices.

Nevertheless, a small subset of indicators continued to exhibit moderate variability, as reflected by comparatively higher standard deviation values within the accepted consensus range. Rather than removing these items prematurely, they were retained for further evaluation in the final

round, in line with Delphi best practices that recommend reassessment of the exposure to aggregated group feedback (Okoli & Pawlowski, 2004). Overall, the Round 2 results provide empirical support for the effectiveness of iterative expert feedback in stabilizing judgements for multidimensional constructs such as digital implementation readiness (Vial, 2021; Pereira et al., 2018).

**Table 2: Consensus Statistics for Delphi Round 2**

| Metric | Minimum | Maximum | Interpretation |
|---|---|---|---|
| Mean | 3.82 | 4.55 | Improved agreement across items |
| Median | 4.00 | 4.77 | Central tendency stabilised |
| Standard Deviation | 0.30 | 0.65 | Reduced dispersion, moderate consensus |

***Delphi Round 3: Final Consensus And Instrument Stability***

Delphi Round 3 was conducted to confirm the stability of expert consensus following the convergence observed in Round 2. In this final iteration, experts re-evaluated items with visibility of aggregated Round 2 results, enabling reflection while preserving independent judgment. The results indicated strong and stable consensus across the instrument.

As shown in Table 3, mean values ranged from 4.18 to 4.91, indicating a high level of agreement regarding item relevance and clarity of readiness indicator. Median values clustered between 4 ("Agree") and 5 ("Strongly Agree"), demonstrating consistent endorsement across the expert panel. Dispersion analysis further showed that standard deviation values narrowed to a range of 0.30 to 0.87, with the majority of items achieving high consensus thresholds and only a small number remaining within the moderate consensus range.

Importantly, no items exhibited extreme divergence at this stage, indicating that earlier sources of ambiguity had been effectively addressed through iterative refinement. The overall reduction in variability across three Delphi rounds provides clear empirical evidence of convergence and supports the reliability of the final instrument (Hsu & Sandford, 2007; Linstone & Turoff, 2011). This outcome is consistent with prior Delphi research, which demonstrated that controlled feedback and repeated evaluation are effective mechanisms for achieving reliable expert consensus in complex, multidimensional domains.

**Table 3: Final Consensus Statistics for Delphi Round 3**

| Metric | Minimum | Maximum | Interpretation |
|---|---|---|---|
| Mean | 4.18 | 4.91 | Strong expert agreement |
| Median | 4.00 | 5.00 | Stable and high relevance |
| Standard Deviation | 0.30 | 0.87 | The majority of items achieved high consensus |

The convergence patterns are observed across the three Delphi rounds, where several important implications are observed. First, the initial variation in expert responses underscores the inherent complexity of assessing readiness for large-scale digital implementation, particularly in governance and interoperability domains where institutional practices vary widely (Mergel et al, 2019; Tilson et al., 2010). The subsequent convergence demonstrates that such complexity can be systematically addressed through structured expert validation.

Second, the findings provide empirical support for the Delphi method as a robust approach to instrument validation in digital governance research. The alignment of mean and median values, coupled with progressive reduction in standard deviation, illustrated how expert consensus can be cultivated through controlled feedback and iteration rather than assumption (Okoli & Pawlowski, 2004; Boateng et al., 2018).

Third, the validated instrument offers practical values by focusing on implementation-level readiness indicators rather than abstract maturity stages. This addresses a limitation identified in existing readiness frameworks and global indices, which often lack this diagnostic granularity for operational decision making (Gil-Garcia et al., 2018; Pereira et al., 2018). As such, the validated instrument provides a structured foundation for assessing preparedness to initiating complex digital initiatives.

From a methodological perspective, this study contributed to digital transformation research by demonstrating transparent consensus thresholds and explicit reporting of convergent metrics. Such reporting enhances methodological rigor and reproducibility, responding to calls for more robust validation practices in digital governance and information system studies (Bannister & Connolly, 2020; AL-Hujran et al., 2015).

## Conclusion

This study presented the validation of a digital implementation readiness instrument using a structured three-round Delphi method. By systematically eliciting and refining expert judgment across iterative rounds, the research established strong consensus on the relevance and clarity of readiness indicators for large-scale digital implementation contexts. The progressive convergence observed in mean, median, and standard deviation values provides empirical evidence of instrument stability and content validity.

The findings contribute methodologically to digital governance and information systems research by demonstrating the effectiveness of the Delphi method for validating a multidimensional instrument in complex sociotechnical ecosystems. Unlike many existing readiness frameworks that operate at an abstract or macro level, this study emphasizes implementation level assessment and provides a transparent account of consensus formation through explicit convergent metrics. This strengthens the reliability and reproducibility of readiness measurement practices in digital transformation studies.

From a practical perspective, the validated instrument offers a structured foundation for assessing preparedness prior to the deployment of large-scale digital initiatives. By encompassing governance alignment, data interoperability readiness, stakeholder capability, and sustainability considerations, the instrument supports more informed decision-making, risk identification, and capacity planning. The expert-driven validation process ensures that the indicators reflect shared professional understanding rather than isolated theoretical assumptions.

Several limitations should be acknowledged. First, while the Delphi panel was composed of experienced experts from diverse sectors, the findings remain grounded in expert judgment rather than empirical deployment outcomes. Second, the study focused on content validation and consensus reliability, while additional psychometric testing was beyond its scope. Future research may extend this work through pilot implementation, exploratory and confirmatory

factor analysis, and longitudinal evaluation to assess predictive validity and practical effectiveness. Integration of the instrument into broader digital governance of digital maturity assessment frameworks also represents A promising avenue for further study.

In conclusion, this research demonstrates that structured expert consensus, achieved through a rigorous applied Delphi process, provides a robust and empirically defensible approach to validating digital implementation readiness instruments. The study advances methodological practice in digital transformation research and offers a validated foundation for assessing readiness in a complex digital ecosystem.

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# INTEGRATING BEHAVIORAL SCIENCE AND DATA VISUALIZATION IN A CONCEPTUAL FRAMEWORK FOR DAO ADOPTION IN COOPERATIVES

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***Abstract:*** *Blockchain-based decentralized autonomous organizations present opportunities for transparent and participatory governance within cooperatives. However, adoption remains limited due to behavioral, technological, and organizational challenges. This study develops A conceptual framework grounded in behavioral science to explain cooperative members' intention to adopt those systems. The framework integrates the technology acceptance model (TAM), trust theory, cognitive fit theory (CFT), and the technology organizational environment (TOE) framework, combining cognitive, affective, and contextual determinants. Key constructs include perceived transparency, perceived usefulness, perceived ease of use, trash visual decision support, and organizational readiness. An initial conceptual framework aims to explain how visualization-driven decision support can enhance trust and adoption intention in blockchain governance systems. Discharge equal integration contributes to the ICT body of knowledge by extending behavioral adoption models into the blockchain governance domain and providing a foundation for future empirical validation and design of visualization-enhanced style systems to support cooperative digital transformation.*

***Keywords:*** *Blockchain*, *Digital Governance, Organizational Readiness, Technology Adoption, Visualization Interfaces*

## Introduction

Cooperatives are founded on principles of democratic participation, transparency and equitable distribution of resources. As these organizations grow in scale and complexity, sustaining effective governance, maintaining member trust, and ensuring accountability has become increasingly challenging (Silva et al., 2022; Saadan et al., 2024). Digital transformation efforts within cooperatives remain uneven, particularly in governance-related processes that require high levels of coordination, transparency, and timely decision-making . In this context, blockchain technology, specifically in the form of Decentralized Autonomous Organizations (DAOs), has been recognized as a promising mechanism to automate governance rules, enhance transparency, and foster participatory decision-making (Lustenberger et al., 2025; Almaher et al., 2024).

DAOs encode governance logic in smart contracts, enabling inevitable records, automated decision workflows, and on-chain voting system that align with cooperatives values such as democratic participation and collective accountability (Merk, 2024; Lustenberger et al., 2025).

Despite this alignment, empirical evidence shows that adoption of blockchain-based governance models remains slow within traditional membership organizations, including cooperatives (Polcumpally et al., 2024; Al-Ashmori et al., 2023). Resistances arise not only from technological unfamiliarity but also from behavioral and cognitive barriers such as low trust in algorithmically mediated decisions, perceived complexity of blockchain interfaces, and anxiety related to digital accountability (Polites & Karahanna, 2012; Obidallah et al., 2024). These barriers indicate that DAO adoption is shaped by more than technological attributes, as it is also influenced by psychological, cognitive, and organizational readiness factors (Almaher et al., 2024).

Existing literature in information systems has demonstrated that behavioral science theories, such as perceived ease of use, perceived usefulness, cognitive load, and trust formation, play critical roles in determining acceptance of the emerging technologies (Venkatesh et al., 2022; Musa et al., 2024). For blockchain applications, initial trust remains a decisive factor, despite alteration as a "trust-enhancing" technology (Polcumpally et al., 2024). Users often rely on heuristics, familiarity, and perceived transparency to evaluate system reliability, especially when they lack technological knowledge (Polites & Karahanna, 2012). Similarly, cognitive factors play a prominent role. Blockchain interfaces are known to impose substantial cognitive load due to unfamiliar terminologies, cryptographic structures, and information density (Lindner et al., 2025; Neri et al., 2025).

Data visualization is increasingly recognized as a mechanism to reduce cognitive load, improve comprehension of complex digital processes, and facilitate high-quality decision-making (Neri et al., 2025; Lindner et al., 2025). Within blockchain governance, visualization can transform opaque transaction logs and smart contract rules into intuitive dashboard, thereby enhancing clarity, user confidence, and trust in automated governance processes. However, the role of visualization in DAO adoption, especially in cooperative contexts, remains underexplored in the scholarly literature (Cabello & Mikalef, 2024).

To address these gaps, this study focuses on integrating a conceptual framework grounded in four theoretical pillars; the Technology Acceptance Model (TAM), Trust Theory, Cognitive Fit Theory (CFT) and the Technology-Organization-Environment (TOE) framework (Davis, 1989; Goodhue & Thompson, 1995; Tornatzky et al., 1990). Integrating these perspectives provides a multi-level understanding of the behavioral, cognitive, and organizational conditions underpinning DAO adoption in cooperatives. A key novelty of the proposed framework is the theorization of visualization-driven decision as a mechanism that enhances trust formation, reduces cognitive barriers, and improves adoption intention among cooperative members (Neri et al., 2025; Lindner et al., 2025).

This paper contributes to the IT and blockchain governance literature in two-folds. First, it advances conceptual understanding by synthesizing behavioral science and information visualization theory to explain DAO adoption in membership-based organizations (Cabello & Mikalef, 2024; Polcumpally et al., 2024). Second, it offers a theoretically grounded model that can inform future empirical studies, particularly those examining digital governance innovation in cooperatives and similar member-driven institutions (Al-Ashmori et al., 2023). The framework also provides initial design considerations for visualization-enhanced DAO platforms aimed at improving transparency, usability and member engagement (Neri et al., 2025).

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## Literature Review

### *Decentralized Autonomous Organization in Cooperative Governance*

Decentralized Autonomous Organizations (DAOs) are blockchain-based governance structures in which rules, decision workflows, and voting mechanisms are encoded in smart contracts, enabling transparent and tamper-resistant coordination (Lusterberger et al., 2025). DAOs have gained prominence in digital-natives' communities and decentralized finance ecosystems; however, their application in traditional membership-based organizations, particularly cooperatives, remains limited (Cabello & Mikalef, 2024).

Cooperatives continue to face governance challenges such as information asymmetry, inconsistent oversight, manual decision-making processes, and limited transparency in resource allocation (Silva et al., 2022). In principle, DAOs can alleviate these issues by automating compliance, enabling immutable governance records, and ensuring equitable voting rights for members (Lusterberger et al., 2025). Yet, despite this alignment between DAO characteristics and cooperative principles, adoption has been slow. Empirical studies attribute this hesitation to the perceived complexity of blockchain interactions, the unfamiliarity of cryptographic processes, and concerns about delegating governance authority to automated systems (Obidallah et al., 2024; Polcumpally et al., 2024).

The emerging literature indicates a critical research gap in which DAO adoption in cooperatives has been examined mainly from a technological or governance design perspective, with limited attention to behavioral, cognitive, and organizational readiness factors (Almaher et al., 2024). Addressing these gaps requires a multidisciplinary framework that captures how cooperative members perceive, understand, and trust DAO-enabled governance systems.

### *Behavioral Science Perspective in Digital Technology Adoption*

Behavioral science provides essential insight into how individuals form attitudes, interpret risk, and develop trust in unfamiliar digital technologies. Recent studies showed that perceived fairness, sense of control, cognitive burden, and anxiety towards irreversible blockchain transactions strongly influenced acceptance (Musa et al., 2024).

Cooperative members also represent diverse demographic groups with varying digital competencies; thus, behavioral determinants are amplified in this context. Users with limited technological familiarity rely more heavily on cognitive heuristics, interface clarity, and perceived transparency when judging system reliability (Polites & Karahanna, 2012; Silva et al, 2022). Blockchain systems, especially those involving smart contracts and on-chain voting, can impose a high cognitive load, which in turn negatively affects trust and willingness to adopt (Obidallah et al., 2024; Lindner et al., 2025). These behavioral factors reveal limitations in purely technical production models and underscore the need for frameworks integrating psychological and cognitive dimensions.

### *Technology Acceptance Model (TAM)*

The Technology Acceptance Model (TAM) remains one of the most influential models for predicting user acceptance of digital technologies. Recent extensions confirmed that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) continue to shape technology adoption

across emerging systems, including blockchain applications (Venkatesh et al, 2022; Musa et al., 2024).

In DAO-based cooperative governance, PU reflects the belief that DAO systems enhance transparency, reduce administrative workload, prevent manipulation, and streamline governance processes. Meanwhile, PEOU concerns the accessibility of DAO interfaces, whether members can navigate dashboards, interpret smart-contract outputs, and participate in voting processes without technical expertise.

Although TAM captures utilitarian and usability-related beliefs effectively, it does not account for trust formation, a critical factor influencing interactions with systems perceived as opaque, decentralized, or high risk. This limitation necessitates complementing TAM with theories that explain how individuals develop trust in algorithmic and decentralized systems.

***Trust Theory in Blockchain Adoption***

Trust Theory provides a multi-dimensional lens for understanding how users evaluate the reliability and legitimacy of blockchain-based governance. Recent research distinguishes between trust in technology (system reliability, security), trust in the institution (cooperative leadership and governance), and trust in information (accuracy, transparency of blockchain data (Polcumpally et al., 2024).

Despite blockchain's reputation as a "trust-enhancing technology", empirical findings consistently showed that initial trust remains essential for adoption, particularly among non-expert users (Merk, 2024; Polites & Karahanna, 2012). The technical opacity of blockchain processes, the irreversibility of transactions, and the algorithmic automation of decisions can create psychological uncertainty, making trust a central predictor of behavioral intention.

Importantly, trust is influenced not only by inherent properties of blockchain, but also by the clarity and interpretability of information presented to users in linking transformation to visualization and cognitive processing, which existing DAO adoption studies seldom addressed.

***Cognitive Fit Theory and The Role of Data Visualization***

Cognitive Fit Theory (CFT*)* highlighted that decision performance improves when the presentation of information aligns with the cognitive needs of the user (Goodhue & Thompson, 1995). Recent research emphasized that data visualization reduces cognitive load, enhances comprehension of complex systems, and facilitates more accurate decision making (Lindner et al., 2025; Neri et al., 2025).

Blockchain interfaces typically present unfamiliar and cognitively dense information (for example, long transaction hashes, cryptographic outputs, raw ledger data). For cooperative membership with varied technological literacy, this complexity can hinder meaningful participation in governance processes. Visualization, therefore, becomes a critical mechanism for (i) transforming opaque blockchain data into an intuitive dashboard, (ii) conveying smart contract rules transparently, (iii) presenting voting outcomes or fund flows accessibly, and (iv) reducing perceived risk by improving clarity.

Yet, no existing DAO adoption framework systematically integrates visualization as a cognitive-enabling mechanism, revealing a significant theoretical gap that this study addresses by embedding CFT within an adoption model.

### *Technology Organization Environment (TOE) Framework*

The Technology-Organization-Environment (TOE) framework offers a macro-level perspective that incorporates organizational capability, structural readiness, and environmental pressures. Previous studies affirmed TOE's suitability for assessing blockchain adoption across sectors (Almaher et al., 2024; Al-Ashmori et al., 2023). For cooperatives, organizational readiness includes availability of digital infrastructure, leadership commitment to digital governance, alignment between cooperative values and DAO automation, training and capacity-building for members, and regulatory considerations and sector norms. Given the heterogeneity among cooperatives in size, structure, and digital maturity, TOE provides a robust foundation for explaining why some cooperatives are better positioned than others to adopt blockchain-based governance.

From the literature study, three (3) critical gaps were highlighted. First, DAO adoption studies have insufficiently addressed behavioral and qualitative challenges faced by cooperative members. Second, visualization has not been integrated theoretically as a mechanism to reduce cognitive load and enhance trust in blockchain governance. Lastly, existing models lack a multi-level integration of individual, cognitive, affective, and organizational factors. These gaps justify the development of the integrated conceptual framework presented in this paper.

## Methodology

### *Research Design*

This study adopted a conceptual development design, which is appropriate when the objective is to integrate multiple theoretical perspectives and propose a new framework for understanding emerging technological phenomena. Because DAO adoption in cooperatives remains underexplored, particularly from behavioral and cognitive perspectives, a conceptual approach enables systematic theorization before empirical validation.

This study employed an integrative literature synthesis method, which allowed for the combination of diverse theories, empirical insights, and interdisciplinary findings into a coherent conceptual model. Integrative synthesis is widely used for developing new theoretical explanations in information systems and organizational research, especially in fields where empirical studies are still growing.

### *Literature Search Strategy*

A structured literature search was conducted across major academic databases, including Scopus, Web of Science (WoS), and Google Scholar. The search focused on studies published between 2020 and 2025, consistent with the rapid evolution of blockchain governance research.

The keywords used included "DAO governance", "decentralized autonomous organizations", "blockchain adoption", "cooperative governance", "technology acceptance model", "trust in technology", "cognitive feed", "data realization", "organization readiness", and "TOE framework".

The inclusion criteria include:

- peer-reviewed journal articles or reputable conference proceedings from Scopus or WoS-indexed
- publications addressing blockchain adoption, digital governance, organizational technology adoption, or behavioral theories
- studies examining cognitive load, visualization, or human-technology interaction
- papers that focus on cooperative member organizations, or decentralized governance models all within the time range limited to 2019 to 2025 for relevant new

The exclusion criteria comprise:

- technical blockchain engineering papers without behavioral or organizational focus
- studies unrelated to governance or user adoption
- non-academic sources or preprints lacking peer review

This process ensured that only high-quality, theoretically relevant literature informed the development of the conceptual model.

***Framework Development Process***

To guide the development of the conceptual framework, this study followed a structured multi-stage analytical process grounded in theoretical integration and systematic literature synthesis. The process involves identifying cooperative governance challenges, mapping relevant behavior and organizational theories to these challenges, analyzing cognitive barriers associated with blockchain interfaces, applying Cognitive Fit Theory to the role of visualization, and finally synthesizing this insight into a unified framework for DAO adoption. Figure 1 illustrated the five-step framework development process that informed the construction of the proposed construction framework.

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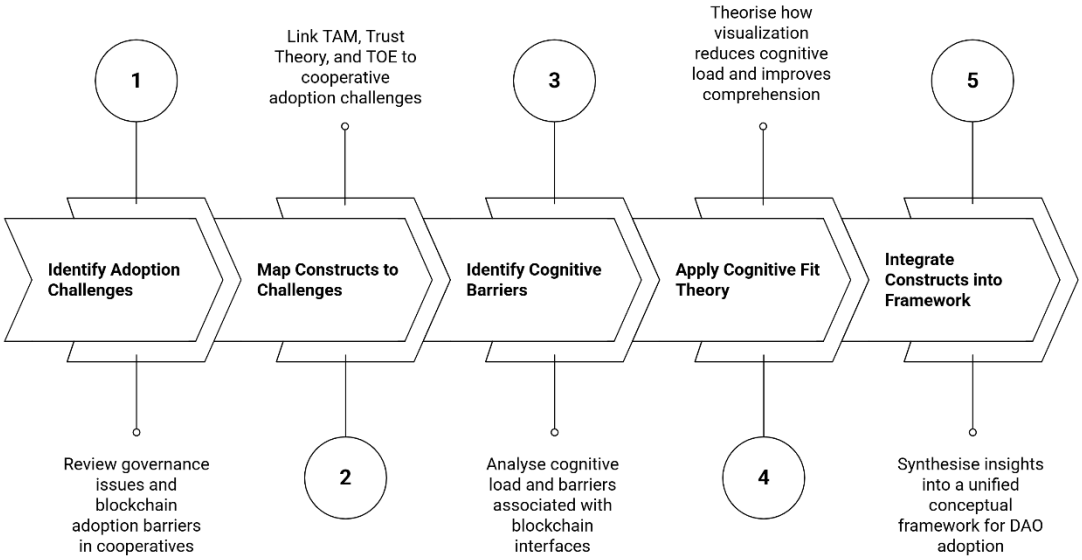



**Figure 1: Framework Development Process**

**Identify adoption challenges in cooperatives**- The initial review examining governance issues commonly reported in cooperatives, including information asymmetry, low transparency, limited digital literacy, and administrative inefficiencies (Silva et al., 2022). Literature on blockchain adoption barriers, such as cognitive complexity, trust deficits, and perceived risk, was also analyzed (Obidallah et al., 2024; Polcumpally et al., 2024).

**Map constructs from TAM, Trust Theory, and TOE to cooperative challenges**- TAM was used to link cooperative members' perception of usefulness and ease of use to adoption intention (Venkatesh et al., 2022; Musa et al., 2024). Trust Theory informed how confidence in blockchain systems, organizational governance, and data integrity influenced willingness to adopt (Polites & Karahanna, 2012). While TOE framework was applied to situate adoption within organizational readiness, technology capabilities, and contextual pressures (Almaher et al., 2024; Al-Ashmori et al., 2023).

**Identify cognitive barriers associated with blockchain systems**- Blockchain interfaces frequently impose high cognitive load due to unfamiliar terminology, complex processes, and dense information presentation (Lindner et al., 2025; Neri et al., 2025). These cognitive barriers were analyzed to theorize how they inhibit perceived ease of use, transparency, and trust.

**Apply Cognitive Fit Theory to explain the role of visualization -** CFT was used to theorize how visualization reduces cognitive load and improves comprehension when system information matches cognitive processing requirements (Goodhue & Thompson, 1995; Lindner et al., 2025; Neri et al., 2025). Visualization emerged as a theoretically grounded mechanism for enhancing perceived transparency, strengthening trust, improving perceived ease of use, and supporting decision-making in DAO environments.

**Integrate all constructs into a unified conceptual framework**- Insights from Steps 1-4 were synthesized to identify the relationship between perceived transparency, ease of use, usefulness, organizational readiness, trust, and visualization-based decision support. This resulted in the formulation of a multi-level conceptual framework that captures cognitive, affective, and organizational factors driving DAO adoption intention.

### *Conceptual Model Development*

The development of the conceptual model followed a structured process of theoretical integration based on the analytical steps outlined earlier. After identifying current themes and determinants from the literature, the constructs from TAM, Trust Theory, Cognitive Fit Theory, and the TOE framework were examined for conceptual alignment with the adoption challenges identified in cooperative settings.

TAM constructs were incorporated to represent individual-level perceptions of system usefulness and ease of use (David, 1989; Venkatesh et al., 2022). Trust Theory was included to account for user evaluations of system reliability and perceived risk, given the centrality of trust in decentralized and algorithm-driven governance environments (Polites & Karahanna, 2012).

Cognitive Fit Theory was used to conceptualize visualization as a cognitive support mechanism capable of addressing the interpretive complexity of blockchain-based processes (Goodhue & Thompson, 1995; Lindner et al., 2025). The TOE framework was used to capture organizational-level determinants such as digital capability, leadership support, and structural readiness (Almaher et al., 2024; Al-Ashmori et al., 2023)

Through iterative comparison, mapping, and synthesis, these constructs were integrated to form a coherent model that reflects the multi-level conditions influencing DAO adoption intention. The integration was based on conceptual complementarity between theories rather than empirical correlation, consistent with standard procedures for conceptual framework development. The resulting model presents theoretically derived relationships that form the basis for future empirical validation.

## Results and Discussion

The integrative synthesis conducted in this study produced a conceptual framework that explains cooperative members' intention to adopt DAO-based governance systems. As this research adopts a conceptual design rather than an empirical one, the results refer to the theoretical relationships emerging from the literature integration and the structure of the proposed model. The discussion that follows interpreted these relationships and positions within broader scholarly debates on digital governance, behavioral adoption, and collective support systems (see Figure 2).

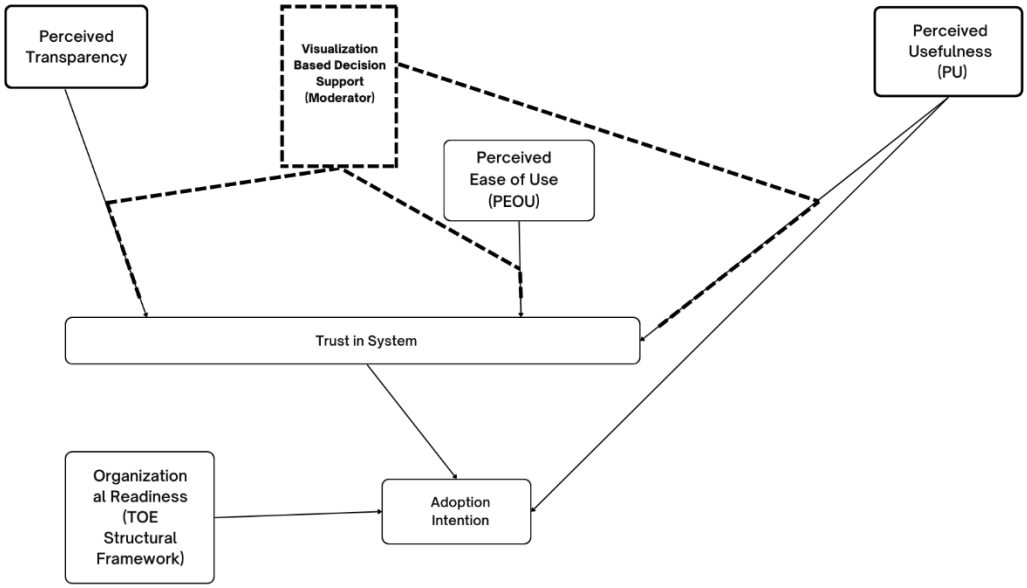



**Figure 2. Proposed Conceptual Model for DAO Adoption in Cooperatives**

The synthesis revealed six (6) interrelated determinants that collectively shaped DAO option intention in cooperatives, which include perceived transparency, perceived usefulness, perceived ease of use, trust in the system, visualization-based decision support, and organizational readiness. Taken together, they reflected the multi-dimensional nature of technological adoption in cooperative settings, where decisions are influenced not only by functional evaluations but also by cognitive accessibility, affective confidence, and structural readiness.

A central outcome of this analysis is the recognition that DAO adoption cannot be understood through traditional technology acceptance models alone. Although perceived usefulness and ease of use remain important predictors under the TAM, blockchain-based governance introduced interpretive complexity that fundamentally alters the user experience. Smart contract logic, cryptographic records, and immutable transaction histories present information that is difficult for non-technical users to process. As such, the decision to participate in DAO governance requires not only an assessment of efficiency or convenience but also an evaluation of understandability, interpretability, and trustworthiness.

Accordingly, trust emerged as a pivotal mediator in the proposed framework. While blockchain systems are often described as inherently trust-promoting, prior studies showed that non-expert users rely on psychological cues and perceived clarity, rather than cryptographic assurance, when forming trust judgments (Polcumpally et al., 2024; Merk, 2024). In cooperatives, where governance has historically been relational, social, and face-to-face, transitioning to algorithmic governance heightens the need for members to trust system outputs. The model therefore positions trust as the mechanism through which transparency, usability, and interpretability translate into adoption intention.

The inclusion of visualization-based decision support (VBDS) represents an important theoretical advancement. Drawing on the Cognitive Fit Theory, the framework conceptualizes

visualization as a cognitive enabler that addresses a fundamental barrier in blockchain adoption, which is the mismatch between technically dense information and users' cognitive processing abilities. Visualization reduces cognitive load by presenting blockchain data, such as voting results, governance records, and financial flows, in formats that align with how users naturally interpret patterns and relationships (Lindner et al., 2025; Neri et al., 2025). In this way, visualization strengthens perceived transparency, enhances ease of use, and reinforces trust in system outputs. The framework further proposed that visualization moderates the relationship between system perceptions and trust, amplifying positive effects when visualization quality is high. This contribution fills a significant gap in existing DAO adoption models, which have not explicitly accounted for cognitive support mechanisms.

The final determinant, organizational readiness, reflects the structural foundation for DAO implementation. Consistent with the TOE framework, adoption intention is influenced by the extent to which cooperatives possess adequate digital infrastructure, governance alignment, leadership support, and member training systems (Almaher et al., 2024; Al-Ashmori et al., 2023). The model emphasizes that even when individual members express willingness to adopt DAO systems, adoption remains unlikely without adequate institutional capacity to support and sustain such technology.

Overall, the interactions among the constructs form a coherent, multi-level explanation of the DAO adoption intention. At the individual level, members assess usefulness, ease of use, and interpretability, while at the cognitive level, visualization assists in understanding complex blockchain processes. At the affective level, trust determines whether members are willing to engage with algorithmically mediated governance, and at the organizational level, readiness conditions the feasibility of adoption. Together, these dimensions reflect the layered decision-making processes present in cooperative environments, where governance innovations require both individual acceptance and structural support.

Beyond theoretical integration, the conceptual framework contributes practical implications. For DAO designers, the findings underscore the importance of visualization tools that simplify system interactions and promote transparent decision-making (Neri et al., 2025; Lindner et al., 2025). For cooperative leaders, the framework highlights the need to invest in organizational readiness, particularly through training initiatives and digital infrastructure, to support member adoption (Al-Ashmori et al., 2023). For researchers, the proposition derived from the framework offers a set of testable hypotheses that can guide empirical studies using structural equation modeling (SEM) or other quantitative approaches.

Hence, the resulting conceptual model advances understanding of how cooperative members interpret trust, and ultimately accept DAO governance systems. By introducing visualization as a cognitive mechanism and situating adoption decisions within behavioral and organizational contexts, the framework provides a foundation for future empirical work and a roadmap for designing inclusive, transparent, and trustworthy decentralized governance platforms (Cabello & Mikalef, 2024).

## Conclusion

This study developed an integrated conceptual framework that is cooperative members' intention to adopt DAO-based governance systems by synthesizing the TAM, Trust Theory, Cognitive Fit Theory, and TOE framework (Davis, 1989; Goodhue & Thompson, 1995;

Tornatzky et al., 1990; Venkatesh et al., 2022). The framework brings together cognitive, affective, and organizational determinants while introducing visualization-based decision support as a novel construct to address the interpretive complexity of blockchain systems. By positioning visualization as a mechanism for reducing cognitive load and enhancing perceived transparency and trust, this study advances theoretical understanding of how cooperative members engage with decentralized digital governance tools (Lindner et al., 2025; Neri et al., 2025).

The proposed framework extends existing adoption literature by emphasizing that DAO implementation requires more than technological capacity, as it depends equally on members' ability to comprehend governance information, their confidence in system behavior, and the cooperative organizational readiness (Al-Ashmori et al., 2023; Almaher et al., 2024). These insights offer practical relevance for system designers seeking to build user-centered DAO interfaces, and for cooperative leaders planning digital transformation strategies that uphold principles of transparency and democratic participation (Cabello & Mikalef, 2024; Polcumpally et al., 2024).

As a conceptual contribution, this framework provides a foundation for future empirical validation. Subsequent research should operationalize the construct and test the proposed relationships using structural equation modeling (SEM), experiments, or mixed method approaches across varied cooperative contexts. Further studies may also explore the design of effective visualization techniques, differences in adoption across demographic groups, and comparative analysis between cooperatives with differing levels of digital maturity (Neri et al., 2025; Lindner et al., 2025). Such empirical work will refine and strengthen the model, supporting the development of more accessible, trustworthy, and cognitive-aligned DAO governance systems.

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# USABILITY TESTING OF THE CONFERENCE ALERT (CONLERT) MOBILE APPLICATION WITH ARTIFICIAL INTELLIGENCE INTEGRATION

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***Abstract***: *This study aims to develop a prototype of a mobile application called Conference Alert (CONLERT) integrated with Artificial Intelligence (AI) to facilitate academics, researchers, and students in obtaining up-to-date information on academic events such as conferences, seminars, and workshops. The study employed the Design and Development Research (DDR) approach, which systematically emphasizes the design, development, and evaluation of a product through three main phases: Needs Analysis, Design and Development, and Evaluation. This research is currently at the second phase, which focuses on prototype development and evaluation, following the completion of the needs analysis phase under a previous research grant. The application was developed using the React Native framework to support cross-platform functionality (Android and iOS), while Firebase Hosting served as a real-time cloud database. The AI component, implemented through Browse.ai, automated the process of collecting academic event information from various online portals. This study adopted a quantitative research design, and usability testing was conducted using the System Usability Scale (SUS). A total of 10 respondents, comprising lecturers, researchers, postgraduate students, and event organizers, were selected through purposive sampling to evaluate the usability and functionality of the application. The findings revealed that CONLERT achieved an average SUS score of 84.0, indicating a high level of usability and strong user acceptance in terms of ease of use, functionality, and system efficiency. Overall, the development of CONLERT demonstrates the potential of AI-based mobile applications in enhancing the dissemination of academic information and supporting the digital transformation agenda in higher education. This study also provides a foundation for future development of more user-centered, inclusive, and effective smart academic applications.*

***Keywords:*** *Academic events, Artificial Inttelligence, Conference alert, mobile apps, system usability scale (SUS)*

## 1.0 Introduction

Academic events such as seminars, conferences, workshops, academic talks, and others are important elements within the education and research ecosystem. These events provide a platform for knowledge sharing, discussion of ideas, and the discovery of new research (Nurul Ibtisam et al, 2025). They also play a key role in building professional networks and encouraging collaboration among students, researchers, and academics from various disciplines.In an increasingly global and technologically advanced world, academic events have evolved from physical gatherings to virtual events that can be accessed by participants from around the globe. Information and communication technology has made it easier to access information and participate in these events without geographical limitations. This has opened new opportunities for more individuals to engage in academic discussions and knowledge development. However, with the increasing number of academic events organized each year, there is a growing need for a more efficient system to manage and disseminate information about these events. The use of mobile applications specifically designed for this purpose can offer an effective solution. Such applications can collect, organize, and deliver up-to-date information on academic events to users, making it easier for them while ensuring they always receive the latest information.

This research is conducted with the aim of developing a design framework and prototype of a mobile application called CONLERT. The CONLERT mobile application, derived from the term “Conference Alert,” is designed not only to deliver conference notification information but also to function as a ‘one-stop centre’. This means that the application will provide various types of academic event information within a single comprehensive platform, including conferences, seminars, workshops, and others.CONLERT aims to simplify access to essential information for academics without requiring them to search across multiple different sources. By integrating a wide range of events into one platform, the application is expected to address the inefficiencies in information dissemination that academics often encounter. In addition, CONLERT is enhanced with artificial intelligence (AI)-based notification features to maximise the user experience.Therefore, the objectives of this study are to develop a prototype of the CONLERT mobile application based on needs analysis and user design, and to conduct usability testing on the developed CONLERT application prototype.

## 2.0 Literature review

Academic conferences serve as crucial platforms within the scholarly community, bringing together lecturers, researchers, and professionals to present their work, exchange ideas, and establish collaborative networks (Nurul Ibtisam et al, 2025). Often referred to as congresses, symposia, workshops, or academic meetings, these events play a vital role in advancing knowledge and supporting the growth of academia (Lestari & Jaya, 2021).For lecturers, academic conferences provide meaningful opportunities to showcase their research to peers and experts in their field. Beyond sharing new findings, presenters benefit from constructive feedback that can strengthen their ongoing studies (Chen & Zhang, 2020). In addition, conferences facilitate the development of professional networks that may lead to future research collaborations, co-publication prospects, and access to broader academic resources.Various studies have been conducted to evaluate the effectiveness of mobile applications in delivering academic notifications. A study by Zhang et al. (2022) found that applications providing real-time academic notification systems can increase student attendance

at extracurricular academic activities, including seminars and scholarly talks. Personalised notifications based on user interests were found to be more effective than general notifications.

In addition, a study by Lopez and Martinez (2020) reported that mobile applications integrated with artificial intelligence (AI) are able to deliver more relevant notifications, thereby increasing user interaction with the information provided. AI-generated notifications tailored to user profiles demonstrated improved effectiveness in encouraging student participation in academic activities. Meanwhile, in the context of academic event management, a study by Chen and Li (2021) proposed the use of integrated applications as a primary platform for information dissemination to address issues of resource fragmentation. They suggested that consolidating all information into a single application could enhance academic productivity and reduce instances of missed important information among academics.

An artificial intelligence notification system is an advanced software application that uses artificial intelligence algorithms to deliver personalised and timely notifications to users across various platforms and devices. AI notification systems analyse user behaviour, preferences, and contextual data to determine the most relevant and appropriate notifications to send, thereby enhancing user engagement and user experience.A key feature of AI notification systems is their ability to provide personalised notifications based on user preferences and behaviour (Hosseini et al., 2019). These platforms use AI algorithms to assess user interactions, historical data, and contextual information to generate notifications tailored to the specific interests and needs of each user (Xiao et al., 2020).

## 3.0 Methodology

### *Research design*

This study employs the Design and Development Research (DDR) approach introduced by Richey and Klein (2007). The DDR research design is an approach that focuses on systematically designing, developing, and evaluating a product, model, system, or learning module to solve a specific problem while contributing new knowledge to the field. Generally, the DDR research design consists of three main phases:

**1. Needs Analysis Phase**

This phase aims to identify the problem, user needs, and development objectives. Activities carried out include a literature review to understand theories and previous research; interviews, surveys, or observations to determine the needs of target users; and the determination of specifications and expected outcomes of the product or model to be developed.

**2. Design and Development Phase**

In this phase, the researcher designs and develops the product prototype based on findings from the needs analysis. Typical steps include producing an initial design, expert or user review for feedback, and usability, effectiveness, and content suitability testing.

**3. Evaluation Phase**

This phase assesses the effectiveness of the developed product or model from various aspects such as usability, effectiveness, and user acceptance. Evaluation may be conducted through pilot testing, surveys, interviews, or user performance analysis.

The current research is in Phase 2, which involves the development of the Conference Alert (CONLERT) mobile application prototype. Phase 1 of this study was completed in a previous research project funded by the Universiti Islam Selangor Research and Innovation Grant 2023 (GPIU 2023).In addition, this study adopts a quantitative approach, as it involves using numerical data to understand phenomena, test hypotheses, and make predictions. Quantitative research typically involves data collection through surveys, experiments, or statistical analysis. It relies on objective measurement to produce numerical data that can be analysed statistically and emphasises measurement and the identification of relationships or correlations between variables. The data obtained may be presented in the form of statistics, tables, graphs, or charts (Zulkifley & Sazelli, 2013). Therefore, the quantitative approach is appropriate for this study.

***Study sample***

According to Nielsen (2000), a well-known usability expert, five users are sufficient to identify 80% to 90% of the major usability problems in a system or application. This indicates that when more respondents are added beyond this number, the information collected tends to be repetitive (known as data saturation). The selection of respondents in this study was carried out using purposive sampling, a sampling technique based on specific criteria determined by the researcher. In the context of this study, the selection criteria included individuals with experience participating in academic events, individuals familiar with using mobile applications, and individuals capable of providing critical feedback on the application prototype.The study sample for the prototype evaluation phase consisted of a group of target users who were specifically selected to assess the usability and initial effectiveness of the CONLERT mobile application prototype. A total of five respondents were chosen from among academics, including lecturers, postgraduate students, and researchers from both public and private higher education institutions. This sample was selected because they are the group most frequently involved in academic events such as conferences, seminars, workshops, and symposiums, and therefore have the potential to be the primary users of the CONLERT application.

***Instrument***

The usability evaluation questionnaire is the instrument used in this study to obtain user feedback on the application prototype. The researcher employed the System Usability Scale (SUS), developed by Brooke (1996), to quantitatively measure the usability of the application from the users' perspective.SUS was selected because it is easy to use, standardised, and widely accepted in usability evaluation research. The SUS questionnaire consists of 10 statement-based items rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). The aspects assessed in SUS include ease of use, user confidence while using the application, the need for technical assistance, and overall user satisfaction. Each respondent is required to provide a score for each item, which is then calculated to produce an overall score ranging from 0 to 100. Higher scores indicate better usability. Additionally, the SUS form includes an open-ended section that allows respondents to provide qualitative comments or suggestions regarding the application's design, interface, or functionality. Both instruments are used complementarily to ensure that the information obtained is comprehensive, relevant, and

suitable as a basis for improving the CONLERT prototype before advancing to the final development stage.

## 4.0 CONLERT Mobile Application Prototype

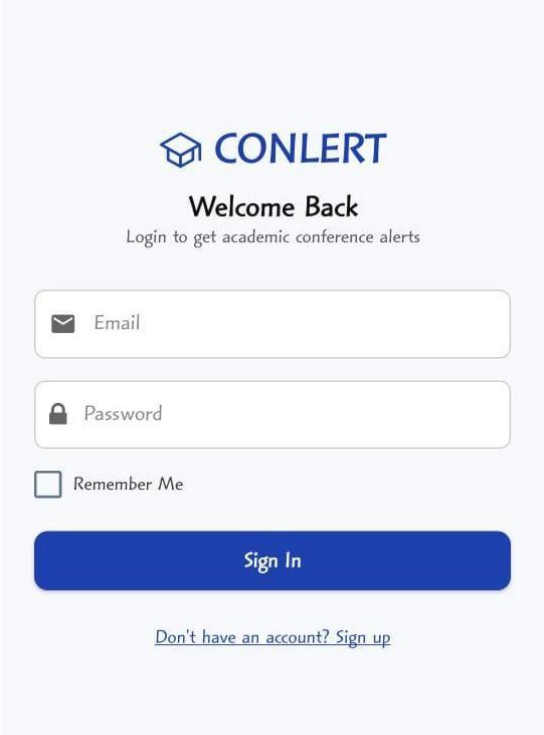



**Figure 1: Sign In Interface**

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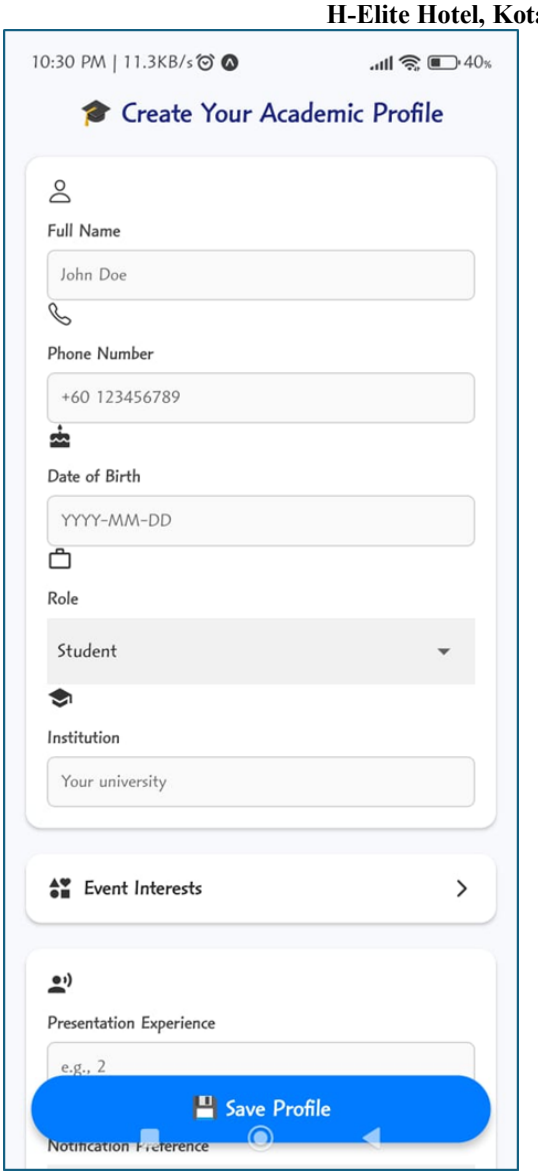



**Figure 2: Academic Profile Creation Interface**

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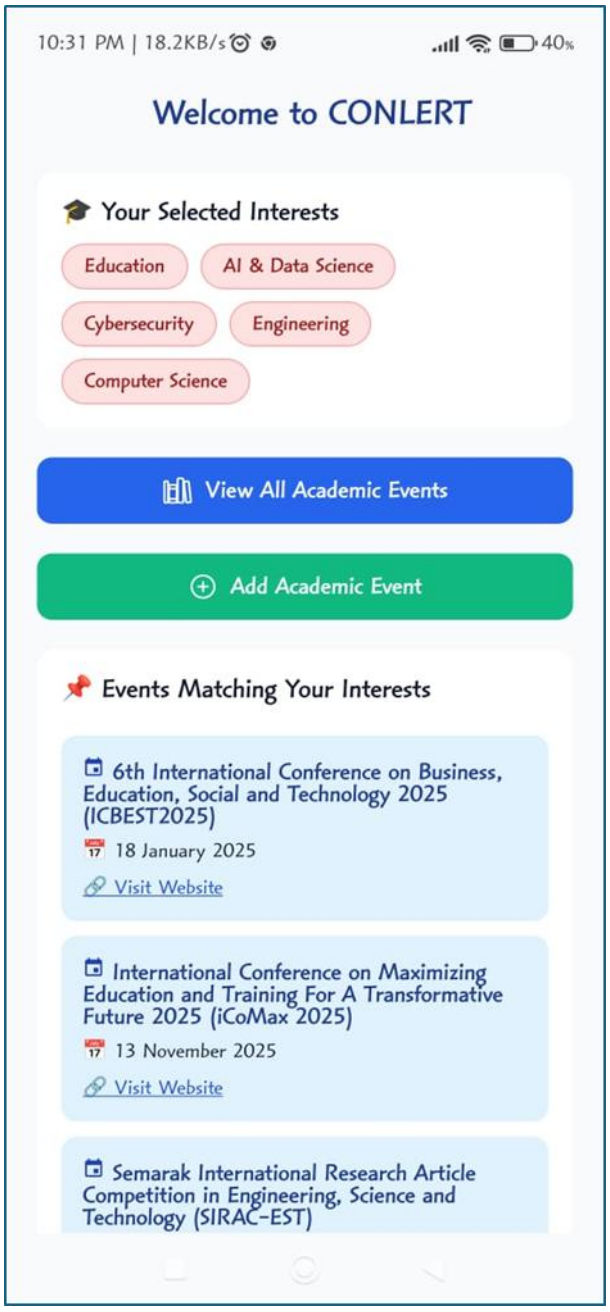



**Figure 3: Main Page Interface**

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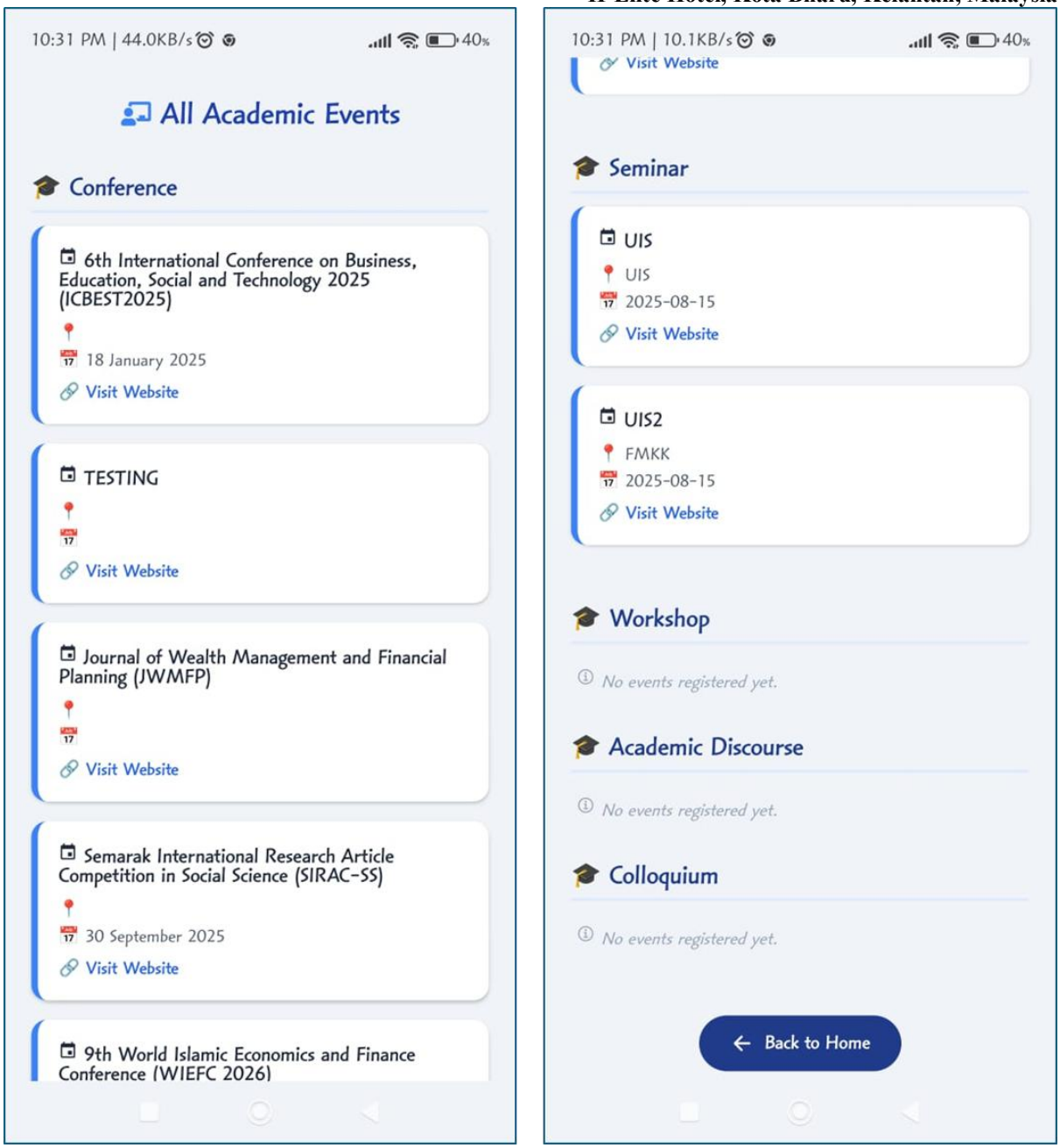



**Figure 4: All Academic Events Main Interface**

## 5.0 Analysis and Result

The demographic analysis was conducted based on data obtained from Section A of the questionnaire, which includes information regarding the respondents' roles in relation to the application's use. The purpose of this analysis is to understand the background of the users who participated in the usability testing and to identify how their roles influenced their perceptions and feedback on the application. A total of 10 respondents participated in this study, comprising three main categories of users: Academics, Event Organisers, and System Developers. The distribution of respondent roles is shown in Table 1.0 below.

**Table 1 : Distribution of Respondent Roles**

| Respondent role | Number (n) | Percentage (%) |
|---|---|---|
| Academician | 3 | 30 |
| Post-Graduated Student | 1 | 10 |
| Event organizer | 3 | 30 |
| System developer | 3 | 30 |
| | **10** | **100** |

The demographic distribution shows that the respondents consist of academics (30%), postgraduate students (10%), event organisers (30%), and system developers (30%). This composition was intentionally selected to ensure representation from different user groups who are likely to use or support the CONLERT application. Academics make up the primary user group, as CONLERT is designed to support their needs in accessing information on academic activities and university events. They serve as direct end-users who rely on the system for receiving updates, registering for events, and organising their activity schedules.

Event organisers, on the other hand, represent the group responsible for managing and publishing event-related content within the application. Their insights help evaluate how effectively the system supports information dissemination, event coordination, and communication. System developers were also included because they possess technical expertise related to the application's design, interface, and functionality. Their feedback is crucial for assessing whether the prototype aligns with principles of user-centred design and whether the interface and system behaviour are consistent from a technical standpoint.

***System Usability Scale Analysis***

The SUS instrument consists of 10 items using a 1 to 5 Likert scale. Each respondent answers alternating positive and negative statements. The SUS score is calculated based on the original formula:

SUS Score = (Total Adjusted Item Score) × 2.5

Based on the data from this study, the SUS scores were calculated as follows:

**Table 2 : SUS Score for Each Respondent**

| Respondent | Skor SUS |
|---|---|
| 1 | 72.5 |
| 2 | 87.5 |
| 3 | 90.0 |
| 4 | 92.5 |

| | |
|---|---|
| 5 | 80.0 |
| 6 | 82.5 |
| 7 | 97.5 |
| 8 | 67.5 |
| 9 | 80.0 |
| 10 | 80.0 |

**Table 3: Mean and Range of SUS Scores**

| **Statistic** | **Value** |
|---|---|
| Overall mean SUS score | 84.0 |
| Score range | 67.5-97.5 |
| Median | 82.5 |
| Number of respondent | 10 |

*Interpretation of SUS Scores Based on Acceptability Scale*

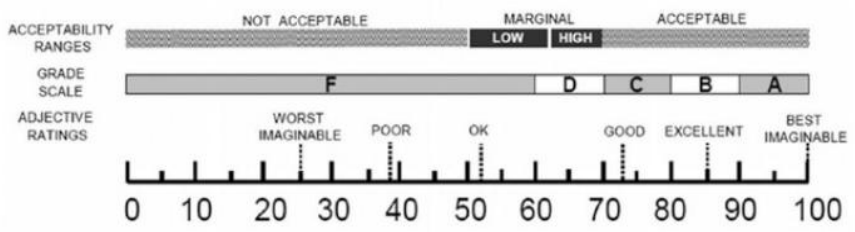



**Figure 4: Determination of Evaluation Results Using Acceptability, Grade Scale, and Adjective Rating (Bangor, Kortum & Miller, 2009)**

Figure 4 illustrates the acceptability scale used to interpret the System Usability Scale (SUS). The scale developed by Bangor, Kortum, and Miller (2009) combines three evaluation dimensions: the user acceptability range, the grade scale, and the adjective rating. This scale enables researchers to understand the quality of system usability from a more holistic psychological perspective.

The overall mean SUS score for the CONLERT application is 84.0. Based on Figure 4 above, this score falls within the 70–84 range, which corresponds to the Acceptable category with a grade of B and the adjective rating "Excellent." This indicates that CONLERT achieves a high level of usability, where users find the system easy to understand and operate, functionally well-structured, non-burdensome, and capable of providing a pleasant and consistent user experience. Several respondents recorded scores above 90 (Respondents 3, 4, and 7), which fall under Category A  Best Imaginable, indicating that the application not only functions well

but also leaves a remarkably strong positive impression on the user experience. No respondent scored below 67.5, indicating that none of the evaluations fall within the Not Acceptable or Marginal categories. This shows that all users agree that CONLERT is easy to use and meets their expectations.Overall, 100% of respondents rated the application as Acceptable, with 60% providing ratings from Excellent to Best Imaginable and 40% rating it between Good and

Excellent. These findings indicate that CONLERT has reached a mature level of design and functionality, making it suitable for real-world application. Minor improvements suggested in user feedback (such as the addition of a “back” function, “bookmark,” and “filter” features) could elevate the SUS score to the highest category (A+), placing it within the Best Imaginable level according to the Bangor et al. (2009) model.

## 6.0 Discussion and conclusion

The findings of the study indicate that the CONLERT application obtained an average SUS score of 84.0, categorised as “Acceptable” with a grade of B (Excellent) according to Bangor, Kortum, and Miller (2009). This result reflects a high level of user satisfaction with the application's usability, consistent with previous studies which emphasise that applications scoring above 80 are considered to have achieved an optimal level of usability (Kortum & Bangor, 2013).These findings demonstrate that the design of CONLERT aligns with the principles of User-Centered Design (UCD) as outlined by Norman (2013), where priority is given to user needs, understanding, and goals. The application has proven to be easy to use, user-friendly, and capable of delivering an enjoyable interaction experience. This is consistent with Tullis and Stetson (2004), who found that high SUS scores are often associated with systems that feature clear navigation and low cognitive load.Recent research by Lewis (2018) also emphasises that SUS not only measures perceptions of usability but also serves as an indicator of overall user experience (UX). Therefore, the score of 84.0 for CONLERT suggests that the application is not only easy to use but also provides positive psychological value to academic users who rely on it for professional purposes.

In conclusion, the development of the CONLERT application has successfully achieved the objectives of the study by producing an efficient and user-friendly mobile application prototype with strong potential for widespread adoption within the academic environment. The application not only enhances the effectiveness of communication and the management of academic events but also serves as a supportive tool in advancing the digital transformation of higher education.Overall, this study affirms that usability-based design is a relevant and effective approach for developing academic systems that are inclusive, responsive, and sustainable. With this success, CONLERT holds significant potential for further enhancement into a more intelligent version through the integration of emerging technologies such as artificial intelligence and data analytics, thereby strengthening the role of mobile applications in improving the efficiency, engagement, and accessibility of academic information in the future.

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# BIM EDUCATION IN POLYTECHNIC: MEASURING STUDENT ENGAGEMENT AND CONFIDENCE IN USING BIM TOOLS FOR CONSTRUCTION PROJECTS

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***Abstract:*** *Building Information Modeling (BIM) is fundamentally transforming the Architecture, Engineering, and Construction (AEC) industry, creating an urgent demand for a workforce proficient in its methodologies. As pivotal Technical and Vocational Education and Training (TVET) providers, polytechnics are critical to fulfilling this demand. A successful BIM curriculum integration hinges on understanding student engagement and confidence, which are established predictors of learning efficacy and skill acquisition. This quantitative study measured the levels of student engagement and self-confidence in using BIM tools among final-year polytechnic civil engineering students. Data were collected from 120 students across three polytechnics using a validated 25-item questionnaire. Descriptive and inferential statistics were analyzed using IBM SPSS Statistics 29.0. The findings revealed a high level of overall engagement (M = 4.15, SD = 0.62) and a moderate level of overall confidence (M = 3.58, SD = 0.79). Engagement was highest in collaborative, project-based activities (M = 4.32), while confidence was most deficient in performing advanced model simulations and analyses (M = 3.12). A Pearson correlation analysis unveiled a strong, positive relationship between engagement and confidence (*r*(118) = .78, *p* < .01). This study concludes that while the project-based pedagogical approach successfully fosters engagement, a significant "confidence gap" exists for advanced BIM competencies. Recommendations include implementing a tiered learning model to scaffold complex skills, enhancing hands-on simulation exercises with industry-derived data, and formalizing industry mentorship programs to bridge academic training with professional practice.*

*Keywords: BIM, Polytechnic Education, Student Engagement, Self-confidence, Construction Education*

## Introduction

The global Architecture, Engineering, and Construction (AEC) industry is in the throes of a digital paradigm shift, propelled by the widespread adoption of Building Information Modeling (BIM). BIM transcends mere 3D visualization; it is an intelligent model-based process that furnishes stakeholders with actionable insight to plan, design, construct, and manage buildings and infrastructure more efficiently (Azhar, 2011). In alignment with global trends and its own Construction Industry Transformation Programme (CITP), the Malaysian government has championed BIM adoption, making it mandatory for major public projects to drive productivity, sustainability, and collaboration (CIDB, 2020).

Technical and Vocational Education and Training (TVET) institutions, particularly polytechnics, constitute the backbone of Malaysia's strategy to develop an intermediate skilled

workforce capable of supporting national initiatives like Industry 4.0 and the BIM mandate. The civil engineering departments within these institutions are thus entrusted with the crucial task of equipping graduates with practical, industry-relevant BIM competencies (Ismail, Salleh, & Haron, 2021). However, integrating a complex process like BIM into established curricula presents profound pedagogical challenges that extend beyond software training.

A pivotal challenge lies in cultivating not only technical proficiency but also ensuring students are deeply engaged and possess high self-confidence in their ability to apply BIM tools. Student engagement—encompassing behavioral, emotional, and cognitive investment in learning activities—is a robust meta-construct strongly linked to academic achievement and persistence (Fredricks, Blumenfeld, & Paris, 2004). In technical domains, this is often activated through hands-on, problem-based learning. Concurrently, confidence, or self-efficacy, defined as an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments (Bandura, 1997), is critical for mastering challenging software and complex workflows. Low self-efficacy can lead to anxiety and avoidance, severely hindering skill acquisition.

While existing scholarship has productively focused on BIM curriculum frameworks, software comparisons, and industry requirements (Barison & Santos, 2010; Sacks & Pikas, 2013), there is a conspicuous scarcity of empirical research investigating the student perspective within the Malaysian polytechnic context. Specifically, the levels of engagement and confidence, and the dynamic interplay between them, remain significantly underexplored. This study aims to address this gap by quantitatively measuring these constructs to derive evidence-based insights for refining BIM pedagogy, ultimately producing more competent and confident graduates ready to contribute to the modernized construction industry.

Therefore, this study is guided by the following research objectives:

1. To examine the level of student engagement including behavioral, emotional, and cognitive aspects in BIM-related learning activities within Malaysian polytechnic civil engineering programs.
2. To assess students' confidence (self-efficacy) in using BIM tools and processes, particularly in handling complex software and workflows.
3. To analyze the relationship between student engagement and confidence in the context of BIM learning to understand how these factors influence one another.

## Literature Review

### *The Imperative of BIM Integration in TVET*

The integration of BIM into AEC education has evolved from teaching isolated software commands to embracing a holistic pedagogical approach that emphasizes process management, interdisciplinary collaboration, and information lifecycle management (Barison & Santos, 2010). For polytechnics, which are inherently oriented towards applied, hands-on learning, BIM presents an unparalleled opportunity to simulate authentic construction project environments. Students can engage in clash detection, quantity take-off, 4D scheduling, and

other processes that mirror professional practice, thereby effectively bridging the theory-practice gap and enhancing graduate employability (Ismail et al., 2021). This alignment is

essential for TVET institutions to remain relevant and meet the human capital needs of the industry (World Bank, 2020).

### *Student Engagement in Project-Based Technical Learning*

In engineering and technology education, student engagement is profoundly influenced by active learning strategies. Project-Based Learning (PBL) is particularly effective, as it situates learning within complex, authentic, and problem-oriented tasks that require sustained inquiry (Prince, 2004). BIM education is inherently suited to PBL, as it often involves collaborative projects where students assume different professional roles (e.g., architect, structural engineer, MEP engineer) and work within a Common Data Environment (CDE). This collaborative and authentic context is a significant driver of deep cognitive and behavioral engagement, moving students beyond passive reception of knowledge to active construction of meaning (Kolari, Savander-Ranne, & Viskari, 2008).

### *Building Self-Confidence and Software Self-Efficacy*

Learning sophisticated digital tools like Autodesk Revit, Navisworks, or Bentley Systems can be intimidating for students. According to social cognitive theory, self-efficacy is built through four primary sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological states (Bandura, 1997). The most effective is *mastery experience*—successfully completing a task. Therefore, a structured learning progression that ensures success with foundational skills (e.g., basic modeling) is crucial before introducing more advanced, complex tasks (e.g., simulation, automation). Studies specific to BIM education confirm that a lack of this structured progression can lead to low self-efficacy, which negatively impacts learning outcomes and future application intentions (Suwal & Singh, 2018).

### *Research Gap*

Despite a growing body of literature on BIM in education, a distinct gap exists. Previous research has largely been top-down, focusing on curriculum design, educator readiness, or industry perspectives. There is a paucity of bottom-up, empirical studies that quantitatively measure the student experience—specifically their engagement and self-confidence—within the distinctive hands-on, industry-focused context of Malaysian polytechnics. Understanding this dynamic is not merely an academic exercise; it is a practical necessity for designing interventions that maximize learning effectiveness and graduate readiness. This study seeks to fill this gap by investigating the following research questions:

1. What are the levels of student engagement and self-confidence in using BIM tools among polytechnic civil engineering students?
2. What is the relationship between student engagement and self-confidence in the context of BIM learning?

## Methodology

This study employed a quantitative cross-sectional survey design to measure the perceptions of polytechnic students regarding their engagement and confidence. A self-administered questionnaire was developed based on an extensive review of literature and adapted from

established scales for engagement (Fredricks et al., 2004) and self-efficacy (Bandura, 2006). The instrument consisted of two main sections:

1. Section A: Captured demographic information including gender, polytechnic, and prior BIM experience.
2. Section B: Comprised 25 items measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). This section was divided into two sub-constructs: *Engagement* (15 items, e.g., "I am excited to attend BIM lab sessions") and *Confidence* (10 items, e.g., "I am confident in creating a structural model for a 2-storey building").

The instrument underwent a validation process through review by three experts in BIM education and quantitative research. It was then pilot-tested with a sample of 30 students who were not part of the main study. Reliability analysis of the pilot data yielded a Cronbach's alpha value of 0.91 for the engagement scale and 0.88 for the confidence scale, indicating excellent internal consistency and reliability for both constructs (Tavakol & Dennick, 2011).

A purposive sampling technique was used to select 120 final-year Diploma in Civil Engineering students from three polytechnics known for their active BIM curriculum integration. This sample size is deemed adequate for survey research aiming for generalizability (Bartlett, Kotrlik, & Higgins, 2001). All participants had completed at least one full semester of dedicated, mandatory BIM coursework, ensuring a common baseline of exposure. Data collection was administered online immediately following a scheduled BIM lab session to ensure contextual relevance. All 120 distributed questionnaires were fully completed and deemed usable for analysis.

Data were analyzed using IBM SPSS Statistics version 29.0. Descriptive statistics (mean, standard deviation) were computed for all items and for the overall engagement and confidence constructs. To interpret the mean scores, the guidelines adapted from Suebwongsuwan and Nomnian (2020) were applied, as presented in Table 1. Furthermore, the Pearson product-moment correlation coefficient was calculated to examine the strength and direction of the relationship between the overall engagement and confidence scores.

**Table 1: Interpretation of Mean Score for 5-point Likert Scale**

| Respondent Perception | Value | Mean Score | Interpretation of Mean |
|---|---|---|---|
| Strongly Agree | 5 | 4.21–5.00 | Very High |
| Agree | 4 | 3.41–4.20 | High |
| Neutral | 3 | 2.61–3.40 | Moderate |
| Disagree | 2 | 1.81–2.60 | Low |
| Strongly Disagree | 1 | 1.00–1.80 | Very Low |

*Note.* Adapted from "A development of training curriculum to enhance English communicative competence for non-native English speaking tour guides," by W. Suebwongsuwan and S. Nomnian, 2020, *Journal of Education and Learning*, *9*(4), p. 125.

## Results

### *Demographic Characteristics of Respondents*

All 120 respondents were final-year Diploma in Civil Engineering students. The demographic profile of the participants is summarized in Table 2. The sample was predominantly male

(78.3%), which is representative of the gender distribution typically found in civil engineering programs across Malaysian polytechnics. Crucially, all participants had successfully completed a mandatory BIM course, ensuring a standardized foundational understanding of the subject matter before responding to the survey.

**Table 2: Participant Demographics (N=120)**

| Characteristic | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 94 | 78.3% |
| | Female | 26 | 21.7% |
| Polytechnic | Polytechnic A | 50 | 41.7% |
| | Polytechnic B | 40 | 33.3% |
| | Polytechnic C | 30 | 25.0% |
| Prior BIM Experience | Yes (before polytechnic) | 18 | 15.0% |
| | No (learned at polytechnic) | 102 | 85.0% |

### *Overall Levels of Engagement and Confidence*

The overall mean scores for the key constructs of engagement and confidence are presented in Table 3. The analysis revealed that the overall mean score for student engagement was 4.15 (*SD* = 0.62), which falls within the "High" interpretation range according to the scale in Table 1. In contrast, the overall mean for student confidence was 3.58 (*SD* = 0.79), which falls within the "Moderate" interpretation range. This indicates a clear disparity: while students report being highly engaged with the BIM learning process and activities, their confidence in their own abilities to perform specific BIM-related tasks is noticeably lower.

**Table 3: Overall Mean Scores for Engagement and Confidence**

| Construct | Mean (M) | Standard Deviation (SD) | Interpretation |
|---|---|---|---|
| Engagement | 4.15 | 0.62 | High |
| Confidence | 3.58 | 0.79 | Moderate |

### *Analysis of Engagement and Confidence Items*

A more granular analysis of individual survey items provides deeper insight into the strengths and weaknesses within each construct. Table 4 below displays the top three and bottom three items for both engagement and confidence, based on their mean scores.

**Table 4: Key Items for Engagement and Confidence**

| Construct | Item Description | Mean (M) | Interpretation |
|---|---|---|---|
| Engagement | E1: I enjoy working on BIM team projects. | 4.32 | Very High |
| | E2: BIM lab activities are interesting and stimulating. | 4.28 | Very High |
| | E3: I actively participate in BIM class discussions. | 3.89 | High |
| | E15: I often do extra BIM practice outside of class hours. | 3.41 | High (Lowest) |

| | | | |
|---|---|---|---|
| Confidence | C1: I am confident in creating basic architectural elements (walls, doors, floors). | 4.18 | High |
| | C2: I am confident in extracting basic schedules and quantities from a model. | 3.85 | High |
| | C3: I am confident in collaborating on a shared model with peers. | 3.55 | Moderate |
| | C10: I am confident in running advanced simulations (e.g., energy analysis, structural analysis). | 3.12 | Moderate (Lowest) |

As illustrated in Table 4, engagement was highest for items related to collaborative and hands-on activities (Items E1 and E2), scoring in the "Very High" range. The lowest engagement item, though still "High," pertained to self-directed learning outside of formal class hours (Item E15). For confidence, students reported the highest confidence ("High") in performing basic modeling and documentation tasks (Items C1 and C2). The lowest confidence scores ("Moderate") were associated with advanced technical applications, particularly running sophisticated simulations and analyses (Item C10), and collaborating on shared models (Item C3).

***Relationship Between Engagement and Confidence***

To address the second research question, a Pearson correlation analysis was conducted to determine the relationship between the overall engagement score and the overall confidence score. The analysis revealed a strong, positive correlation between the two variables, *r*(118) = .78, *p* < .01. This statistically significant result indicates that students who reported higher levels of engagement in BIM learning activities also consistently reported higher levels of confidence in their ability to use BIM tools.

**Discussion**

The primary aim of this study was to quantitatively measure the levels of engagement and confidence among polytechnic students learning BIM and to explore the relationship between these two constructs. The high level of overall engagement ($M = 4.15$) can be directly attributed to the project-based and collaborative pedagogical approach that is a hallmark of effective BIM instruction (Prince, 2004). The highest-rated engagement items involved teamwork and interesting lab activities, confirming that students are motivated by learning environments that mimic real-world industry practice and provide opportunities for active participation.

However, the moderate level of overall confidence ($M = 3.58$) reveals a critical area for pedagogical improvement. This "confidence gap" is particularly pronounced for advanced competencies such as running simulations and analyses. This finding aligns perfectly with Bandura's (1997) theory of self-efficacy, which posits that confidence is built through successful "mastery experiences." It appears the current curriculum may provide sufficient mastery experiences for basic and intermediate skills but falls short in scaffolding the learning to ensure similar success with more complex, advanced tasks. This gap is concerning as these advanced skills are increasingly demanded by the industry (CIDB, 2020).

The strong, positive correlation between engagement and confidence (*r* = .78, *p* < .01) is a highly significant finding. It suggests that the engaging, project-based learning environment does not only make learning enjoyable but is also a powerful mechanism for building self-efficacy. This creates a virtuous cycle: engaging activities boost confidence through successful experiences, and increased confidence, in turn, motivates students to engage more deeply with subsequent challenges. This underscores the importance of designing learning activities that are not only interesting but are also structured to ensure students can succeed at them, thereby building confidence incrementally.

## Conclusion

This study concludes that final-year civil engineering students in Malaysian polytechnics are highly engaged in BIM learning, primarily due to the collaborative and project-based nature of the instruction. However, they exhibit only a moderate level of confidence, especially in applying advanced BIM functionalities. The strong interdependence between engagement and confidence highlights that the learning environment is a key determinant in developing self-assured competencies.

Bridging this confidence gap is not an optional enhancement but an essential step for polytechnics to achieve their mandate. The goal must be to produce graduates who are not merely familiar with BIM software but are proficient, confident, and capable of innovating within the modern digital construction environment. Therefore, pedagogical strategies must be intentionally designed to translate high engagement into robust confidence across the full spectrum of BIM competencies.

## Recommendations

Based on the findings of this study, the following evidence-based recommendations are proposed for educators, curriculum developers, and polytechnic administrators:

1. Implement a Tiered, Scaffolded Learning Model: Structure the BIM curriculum into distinct, sequential tiers (e.g., Fundamentals, Application, Advanced Simulation). Each tier should be designed to ensure mastery before progression, providing the necessary "mastery experiences" to build confidence for complex tasks (Bandura, 1997).
2. Augment Advanced Hands-on Training: Develop dedicated lab modules and exercises focused specifically on advanced simulations (energy, structural, clash detection) using real-world, industry-provided project data. This reduces the abstraction of these tasks and grounds them in practical application.
3. Formalize Industry Mentorship and Collaboration: Establish a structured program where industry practitioners or recent alumni mentor student teams on capstone projects. This provides "vicarious experiences" and "verbal persuasion," other key sources of self-efficacy, directly from the profession (Bandura, 1997).
4. Incentivize Self-Directed Learning: To address the lower engagement in self-paced practice, create online badge systems or micro-credentials for completing advanced tutorials or modules outside of class, making independent learning more goal-oriented and rewarding.
5. Conduct Longitudinal and Qualitative Follow-up Research: Future studies should track students into the workplace to correlate their educational engagement and confidence levels with job performance. Complementary qualitative interviews could provide rich, nuanced data on the specific experiences that build or hinder confidence.

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# STUDY OF TURMERIC DRYING AT DIFFERENT THICKNESSES OF MODULAR THERMAL ENERGY STORAGE

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***Abstract:*** *The research investigates the turmeric drying at different thicknesses of silica sand using experimentation for the extension of drying hours. Drying is a method that uses thermal energy to remove moisture from a material. Direct sunlight or specialised electrical equipment can facilitate drying. The process for drying materials is influenced by several aspects, including the product's surface characteristics, drying temperature, airflow, steam pressure, energy supply, and the specific type of material involved. Drying rates accelerate with increased temperatures and reduced relative humidity. Regulating these parameters requires diligent supervision via the installation of numerous sensors at different positions within the dryer. Conversely, thermal energy storage applications have comparatively underutilised solid-state thermal energy storage (TES) materials like sand. Consequently, the use of silica sand is essential for thermal energy storage, mitigating the constraints of solar dryers that function exclusively during daylight hours. The highest thickness of sand has a higher drying rate compared to the lowest thickness of sand for thermal energy storage. Additionally, the previously mentioned amount of sand retains more heat storage compared to the lowest thickness. Therefore, it can be concluded that as the thickness of silica sand increases, the temperature of thermal energy storage also increases, which accelerates the drying process.*

***Keywords:*** *drying, solar dryer, experimentation, thermal energy storage.*

## Introduction

Drying is one of the most ancient techniques for preserving agricultural products like fruit, vegetables, and cotton by removing enough moisture to prevent decay and spoilage. This technique may inhibit cellular processes, including both enzymatic and non-enzymatic browning, while ensuring the optimal preservation of macronutrients (proteins, carbohydrates, and fibres), small-molecule nutrients (antioxidants and elements), and natural substances (chemical mixtures, antioxidants, and derived antioxidants) (Menon et al., 2020). Moreover, dehydration diminishes shipping and storage expenses while extending product shelf life. Despite the potential benefits of reducing product moisture content, we must address challenges like high energy requirements and extended drying times.

The drying process is energy-intensive, accounting for up to 20% of overall energy consumption in the industrial sector. It may account for as much as 90% of the processing expenses (Simo-Tagne et al., 2020). Researchers have dedicated considerable effort to explore

and execute more effective drying methods. A study was performed to demonstrate the impact of intermittency on wood drying (Phonetip et al., 2019). The authors assert that intermittent drying enhances the quality of the finished product and yields energy savings throughout the process. Further research assessed the impacts of various drying protocols (Berrocal et al., 2017). The authors evaluated three distinct schedules to minimise drying time and energy usage. The authors found that the dry-bulb temperature and wet-bulb depression had the greatest influence on drying rate; however, an inflection point was found in the relationship between drying rate and moisture content at a 40% moisture content for all three drying schedules. The inflection point indicates when diffusion becomes the primary driving force of moisture movement, thereby limiting the drying rate, and indicates when the kiln conditions should be accelerated to minimise the total drying time. The drying rate in hours should remain more than 0.5%/hour (a high value for tropical species) for the first 72 hours (3 days), until the lumber reaches 40% moisture content, and then be lowered to 0.5%/hour until drying is completed.

The swift advancement of industry has resulted in a persistent increase in worldwide energy requirements across various forms. Fossil fuels remain the primary source for fulfilling most global energy needs (Sawin, 2017), particularly for the thermal energy essential in drying processes. However, the environmental consequences associated with the use of these fuels and the progressive exhaustion of their supplies impose significant constraints on their utilisation. Given the heightened awareness of environmental concerns and advancements in sustainable energy policies, renewable energy sources are crucial for attaining a more eco-friendly and safe energy future (Achkari & El Fadar, 2020). Solar dryers are an excellent example of technology that aligns with several Sustainable Development Goals (SDGs), which include goal 1, which is no poverty, where solar dryers can help alleviate poverty by enabling smallholder farmers to increase the value of their crops. By preserving produce with solar dryers, farmers can avoid post-harvest losses and fetch better prices for their goods. Goal 2 is zero hunger, where solar dryers contribute to food security by extending the shelf life of perishable foods. This helps ensure a more stable food supply, especially in regions prone to food shortages or with limited access to conventional preservation methods. Goal 3 is beneficial health and well-being, where solar drying reduces the need for chemical preservatives and pesticides, leading to healthier food products. Additionally, by reducing food waste, solar dryers can help combat malnutrition and related health issues.

Solar energy stands out as the most potent among renewable sources, characterised by its free, inexhaustible nature, widespread accessibility, and versatility, which has led to increased interest. Improving drying methods is crucial for economic and environmental reasons. Many countries continue to maintain a primarily non-renewable energy framework, making the investigation of solar energy-based drying technologies increasingly pertinent in contemporary discourse. It was emphasised that conventional dryers and kilns, reliant on fossil fuels, remain prevalent despite their impending adverse environmental impacts (Bekkioui et al., 2020). The benefits of solar dryers exceed those of conventional kilns and dryers, extending well beyond their environmental effects. Solar dryers can potentially decrease drying expenses by as much as 80% (Jain et al., 2023). They enhance the quality of the final product, eradicate greenhouse gas emissions, and are simple to construct and operate (Jain et al., 2023). Considering the acknowledged economic and environmental benefits of solar dryers, it is imperative to undertake research aimed at enhancing the collection, conversion, and use of available solar energy. Improving solar energy dryers facilitates expedited drying and augments the capability

for processing greater quantities of items while conserving the same energy consumption (Barbosa et al., 2023).

A significant challenge linked to solar energy is its immediate fluctuation. Solar energy's dependence on weather conditions implies that it is only applicable on sunny days unless integrated with conventional energy-based technology. Therefore, the effectiveness of solar energy systems depends on various factors in addition to the energy harvesting device itself. The linkage between the storage of gathered energy for extended durations and its conversion into the requisite usable energy form is intricate. Recent major publications on renewable energies emphasise that the enhancement of concentrated collectors should focus on augmenting their capacity to meet thermal demand over days, weeks, or seasons (Mehos et al., 2017; Power, 2010; U.S. Department of Energy, 2012). Consequently, thermal energy storage technologies are essential for the future advancement of solar technology. In this context, the development of solar thermal systems linked with thermal energy storage can achieve sustainable, efficient, and cost-effective applications.

Current research aims to optimise solar drying systems to provide high-quality final goods while minimising time and energy expenditures. A study was performed to assess the impact of various factors on the efficacy of a solar oven for wood drying (Khouya, 2020). The research assessed the impact of a heat exchanger and a latent heat storage system on the thermal efficiency of the solar oven. The study's results were encouraging. The researchers determined that employing an air heater to reclaim energy dissipated into the atmosphere (the heater utilises heat from the humid air to prepare the air entering the thermal storage) might decrease the drying time by as much as 62.4%. The deployment of the heat storage technology decreases drying time by as much as 40%. The amalgamation of these technologies led to a decrease in energy use by as much as 54%. A previous investigation documented similar findings (Khouya & Draoui, 2019). The authors noted that heat recovery and thermal storage systems could decrease drying time by as much as 47% and 26.5%, respectively. The authors achieved a peak drying efficiency of 85% with these systems.

Extensive research has been conducted over the years to gather data on developments in solar drying and heat storage systems, reflecting the subject's significance. Researchers conducted a thorough assessment of solar dryers combined with thermal energy storage systems for the dehydration of agricultural products (Bal et al., 2010). The authors analysed various storage modes and their applications for solar drying technologies. Figure 1 presents different types of solar thermal energy storage (Baylin, 1979). The authors examined similar objectives and provided a concise analysis of how computational methods can enhance solar drying systems (Kant et al., 2016). Other researchers have conducted recent assessments of indirect solar dryers for agricultural products, as illustrated in Figure 2 (Lingayat et al., 2020).

The authors employed a methodology that included a range of dryer configurations and the integration of thermal energy storage materials into these systems. The existing literature indicates that, although there are investigations into solar dryers and thermal energy storage, there is a notable gap in comprehensive studies regarding their integrated application, performance, and numerical modelling. This renewable energy application can be adopted by both small and large-scale enterprises, as well as agricultural producers, indicating significant potential for interest in this area. This investigation outlines the drying process, classifies different types of dryers and their efficiencies, explores thermal energy storage systems, and analyses the numerical modelling associated with these processes. This investigation focuses

on a relatively neglected aspect of drying studies: the role of turbulence within porous materials.

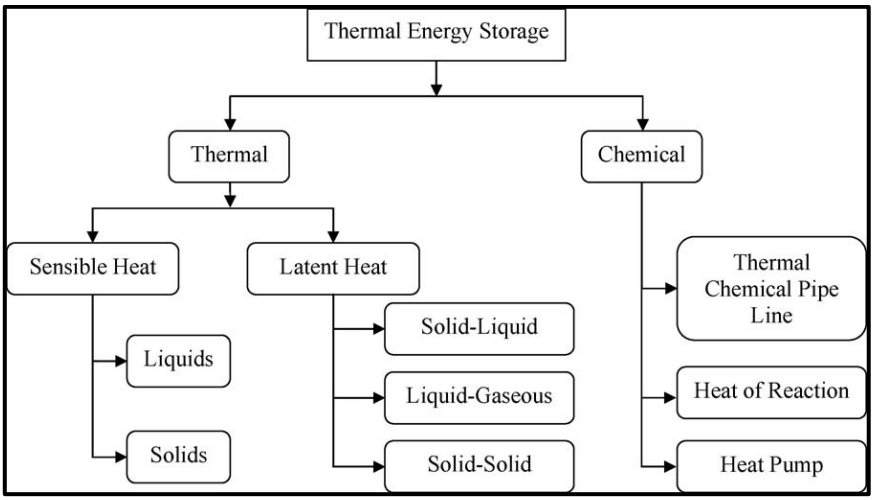



**Figure 1: Different Types Of Thermal Energy Storage** (Baylin, 1979).

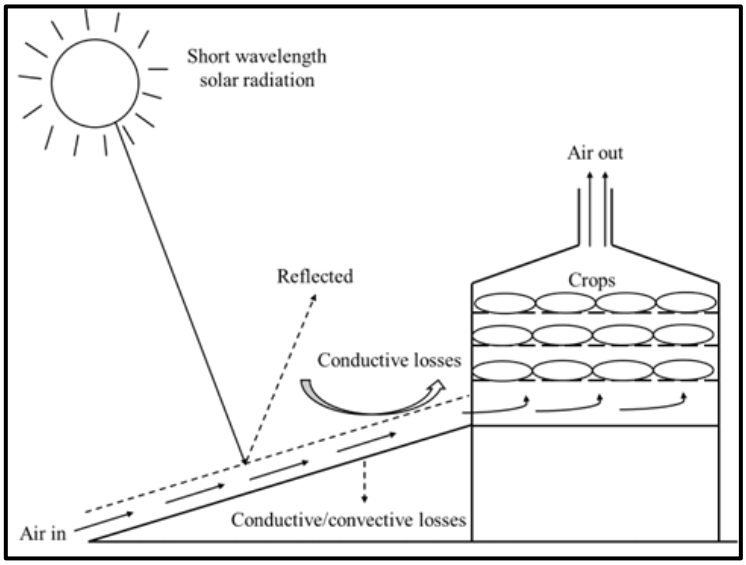



**Figure 2: A Schematic Representation Of The Indirect Solar Dryer** (Lingayat Et Al., 2020).

The development and evolution of solar dryers from 2010 to 2025 have been marked by significant advancements in technology, efficiency, and application, driven by the growing need for sustainable energy solutions and improved food preservation methods. Table 1 represents an overview of the key revolutions and milestones in solar dryer technology over this period.

From 2010 until 2020, the development of solar dryers focused on sustainable design and integration with Internet of Things (IoT) systems. In the 2010s, smart technology began to be integrated into solar dryers, especially with the advent of the Internet of Things (IoT) (Deokar, 2022). This made it possible to remotely monitor and control solar dryers using smartphones or computers. Automation became more prevalent, with systems adjusting airflow, temperature, and moisture content based on real-time data collected from sensors. Data-driven

designs led to more personalised solutions, allowing farmers and industries to optimise the drying process based on specific environmental conditions. The integration of energy storage systems, such as solar batteries or thermal storage materials (like molten salts), allowed solar dryers to operate 24 hours, making them suitable for industrial-scale applications. Additionally, there was a significant push towards more eco-friendly materials and hybrid systems that combined solar drying with other renewable energy sources (wind, biomass) for greater energy reliability. Solar-powered refrigeration and solar-powered dryers were developed to address both the drying and storage needs of agricultural products.

Lastly, the future with smart, modular, and highly efficient solar dryers begins from 2020 until 2025 (Gunawan et al., 2022). Recently, there has been a focus on modular solar dryers that can be easily scaled up or down depending on the needs of farmers or industrial users. A wider audience, particularly in developing countries, can access these systems due to their affordability and ease of installation and maintenance. Prefabricated modular solar dryers have emerged as cost-effective solutions for smallholder farmers and rural entrepreneurs. Artificial intelligence (AI) and machine learning algorithms are being integrated into solar dryers to optimise drying processes, predict weather conditions, and improve energy usage. For example, AI can adjust parameters in real-time to maintain ideal drying conditions based on changing weather patterns. Moreover, the advanced phase-change materials (PCMs) and nano-structured materials are being explored for improving the thermal storage and heat retention capabilities of solar dryers, enabling them to be more energy-efficient and weather-resistant.

New heat transfer fluids and solar collector designs are being tested for greater energy capture and faster drying times. The latest solar dryers are designed with a focus on reducing carbon emissions, enhancing the efficiency of agricultural value chains, and improving the economic prospects of rural communities. These dryers are aligned with global sustainability goals, like the United Nations' Sustainable Development Goals (SDG), particularly SDG 7, 2, and 13, which are affordable and clean energy, zero hunger, and climate action, respectively.

**Table 1: Key Milestones in Solar Dryer Evolution (2010-2025).**

| Year | Milestone |
|---|---|
| 2010 - 2020 | IoT and AI-enabled smart solar dryers integrate thermal storage for continuous drying. |
| 2020 - 2025 | Modular, scalable, AI-driven, highly efficient solar dryers with eco-friendly designs and advanced storage. |

Advancements in materials, energy efficiency, automation, and smart technologies have driven the solar dryer revolution from 2010 to 2025. Over the years, solar dryers have evolved from simple, passive systems into highly efficient, AI-enabled, scalable technologies that offer solutions to climate change, food security, and economic development, particularly in rural and agricultural communities. The future promises even greater advancements, including autonomous operations, innovative materials, and enhanced energy storage to make solar drying an even more powerful tool for sustainable agricultural.

The process of drying involves the movement of heat and mass between the products and the surrounding air. Therefore, favourable environmental conditions, particularly the temperature and relative humidity of the air, significantly influence the effectiveness of sun drying. The drying rate increases with higher temperatures and lower relative humidity. To ensure optimal

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regulation of temperature and humidity, it is essential to implement thorough monitoring by strategically placing various sensors in multiple locations within the dryer. However, solar dryers are significant only during daylight and have limited working hours (Rahman et al., 2025). Therefore, thermal energy storage systems were introduced to extend the capacity of the drying process during nighttime. On the other hand, solid-state TES materials, like sand, have not been extensively investigated for TES applications (Tetteh et al., 2024). Consequently, the utilisation of silica sand is essential for thermal energy storage, tackling the constraints of solar dryers that function exclusively during daylight hours. To the best of the authors' knowledge, there has been insufficient investigation into the silica sand as a thermal energy storage medium. This research aims to study the ability of silica sand with an average diameter of 10 mm for different thicknesses of thermal energy storage to store the heat energy during the turmeric drying process.

## Methodology

The aluminium sandbox has been constructed with dimensions of 111 cm (length) x 50 cm (width) x 5 cm (height) and was placed above the solar dryer under natural convection as depicted in The weight of the turmeric was measured for every 30-minute time interval. The aforementioned procedure was repeated for the 1pm to 5pm and 5pm to 9pm time intervals to study different durations of turmeric drying.

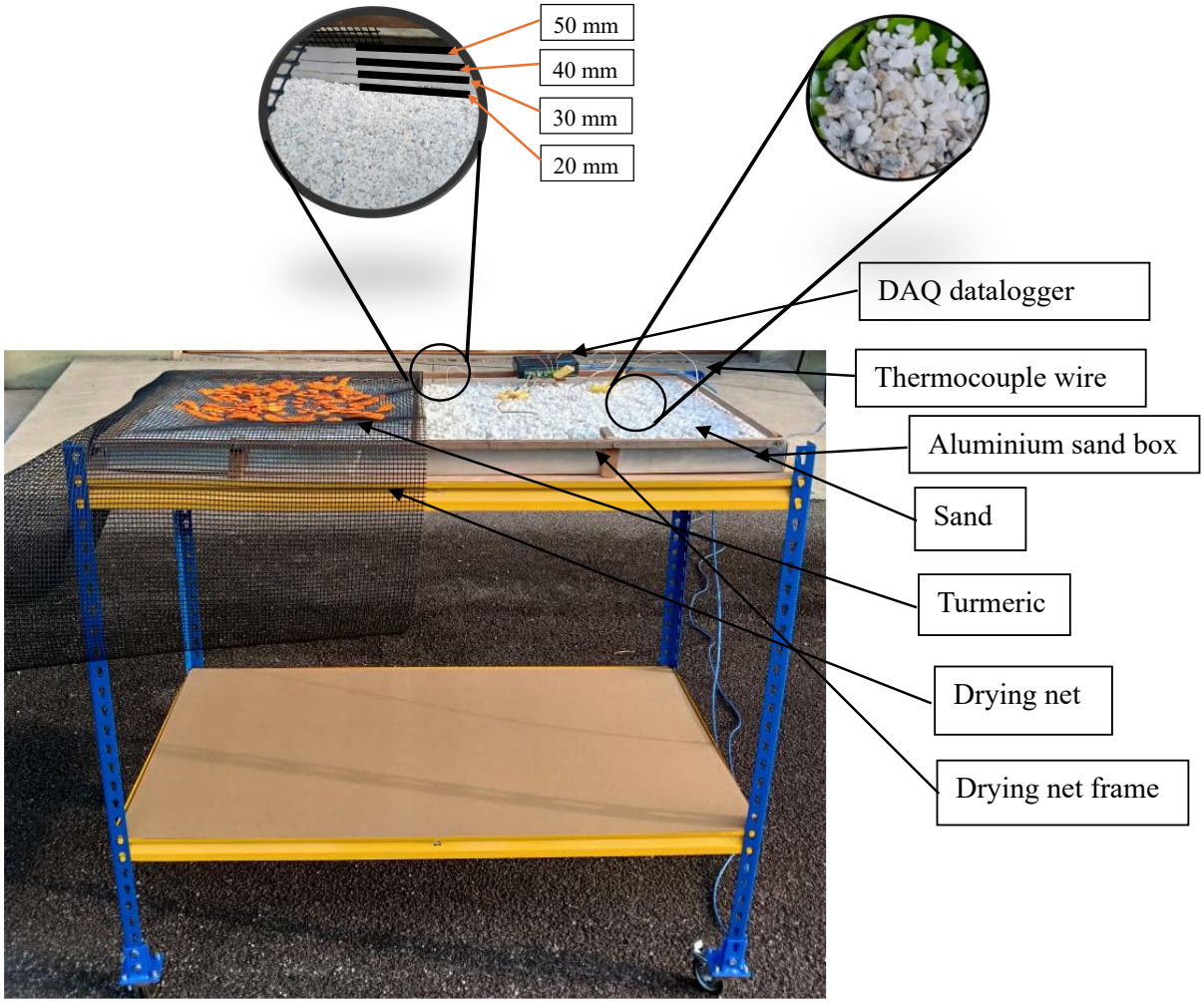



**Figure 3**. The size of the sandbox plays a critical role in the performance of solar dryers with thermal energy storage systems. It affects the energy storage capacity, efficiency, temperature stability, and overall system cost (Shahul et al., 2023). While larger sandbox provides greater storage, they come with increased costs, space requirements, and potential efficiency trade-offs. Therefore, it is important to carefully design the system to optimise the size based on energy needs, cost considerations, and space availability to achieve the best results for the drying process. Aluminium is frequently used due to its effective heat transfer properties and cost-effectiveness compared to alternative materials (Choudhuri, 2024). Silica sand was utilised in the present study. Silica sand consists of a blend of coarse fragments, typically made up of different minerals and rocks. Common minerals encompass quartz ($SiO_2$), feldspar, and occasionally calcareous materials such as limestone.

Table **2** displays the material characteristics of silica sand (Baghbani et al., 2023; Chen et al., 2021; Gu et al., 2023; Jin et al., 2024; Khalifa & Mzali, 2024; Momeni et al., 2023; Naveen & Bhat, 2024; Wang, Gong, et al., 2024; Wang, Shi, et al., 2024; Ziccarelli, 2024).

**Table 2: Materials Properties Of Silica Sand (Baghbani Et Al., 2023; Chen Et Al., 2021; Gu Et Al., 2023; Jin Et Al., 2024; Khalifa & Mzali, 2024; Momeni Et Al., 2023; Naveen & Bhat, 2024; Wang, Gong, Et Al., 2024; Wang, Shi, Et Al., 2024; Ziccarelli, 2024).**

| Properties | Silica sand |
|---|---|
| Density (kg/m3) | Bulk density = 1800 |

| | |
|---|---|
| Young's Modulus (MPa) | 47 |
| Poisson's ratio (ν) | 0.31 |
| Thermal Conductivity (k) | 0.2-0.4 |
| Thermal Expansion (CTE) | 10-20× $10^{-6}$ |
| Specific heat (C) | 800-830 |
| Melting point | Primary component, quart = 1650°C |
| Reference temperature | 20-25°C |

Thermocouple connector cables are positioned at middle points inside the sandbox and outside the sandbox for ambient temperature data collection to collect accurate heat variation information through the data acquisition device (DAQ). The location of thermocouples inside the sandbox was decided by considering the sand layer thickness (Yamaguchi et al., 2023). The data-collecting system was used to record the temperature readings from the sand. Thermocouples operate as temperature sensors at their junction points. The capacity of K-type thermocouples to function across an extensive temperature spectrum necessitated their use. The DAQ data logger software sets the acquisition frequency at 10 Hz. The frequency calculation utilised in the data acquisition (DAQ) data logger software is outlined as follows, i.e.,

$$f = \frac{1}{T}. \quad (1)$$

In this context, $f$ represents the frequency measured in hertz, while $T$ denotes the duration required to complete a single cycle, expressed in seconds. Consequently, temperature data will be gathered at intervals of 0.1 seconds. The technique will be executed for particle sizes with diameters of an average of 10 mm, as depicted in
Figure **3**. The experiment will be repeated with different thicknesses of silica sand, ranging from 50 mm to 10 mm, to analyse the temperature variations of the sand. The thermocouple-type cables linked to the gathering information section will gather and store the sand temperature. The information that results will be presented as well as portrayed on a laptop. The experiment is set to last for 12 hours, corresponding to the approximately 12 hours of everyday daylight in Malaysia (Ray et al., 2024). Upon acquiring the temperature data, the period of heat retention from the sand will be monitored and documented.

This setup was used for turmeric drying to measure the weight losses of the turmeric. Turmeric is a favourable crop choice because it is readily available, and a study would help local farmers. Furthermore, turmeric (*Curcuma longa*) are rhizomatous plants; their derivative products are widely used for food additives and folk medicines. The fresh turmeric is dried to prepare its derivatives, such as turmeric oil. The turmeric was sliced into small diameters with an initial weight of 100 g and placed above the thermal energy storage from 8 am to 12 pm, as shown in Figure 3. The weight of the turmeric was measured for every 30-minute time interval. The aforementioned procedure was repeated for the 1pm to 5pm and 5pm to 9pm time intervals to study different durations of turmeric drying.

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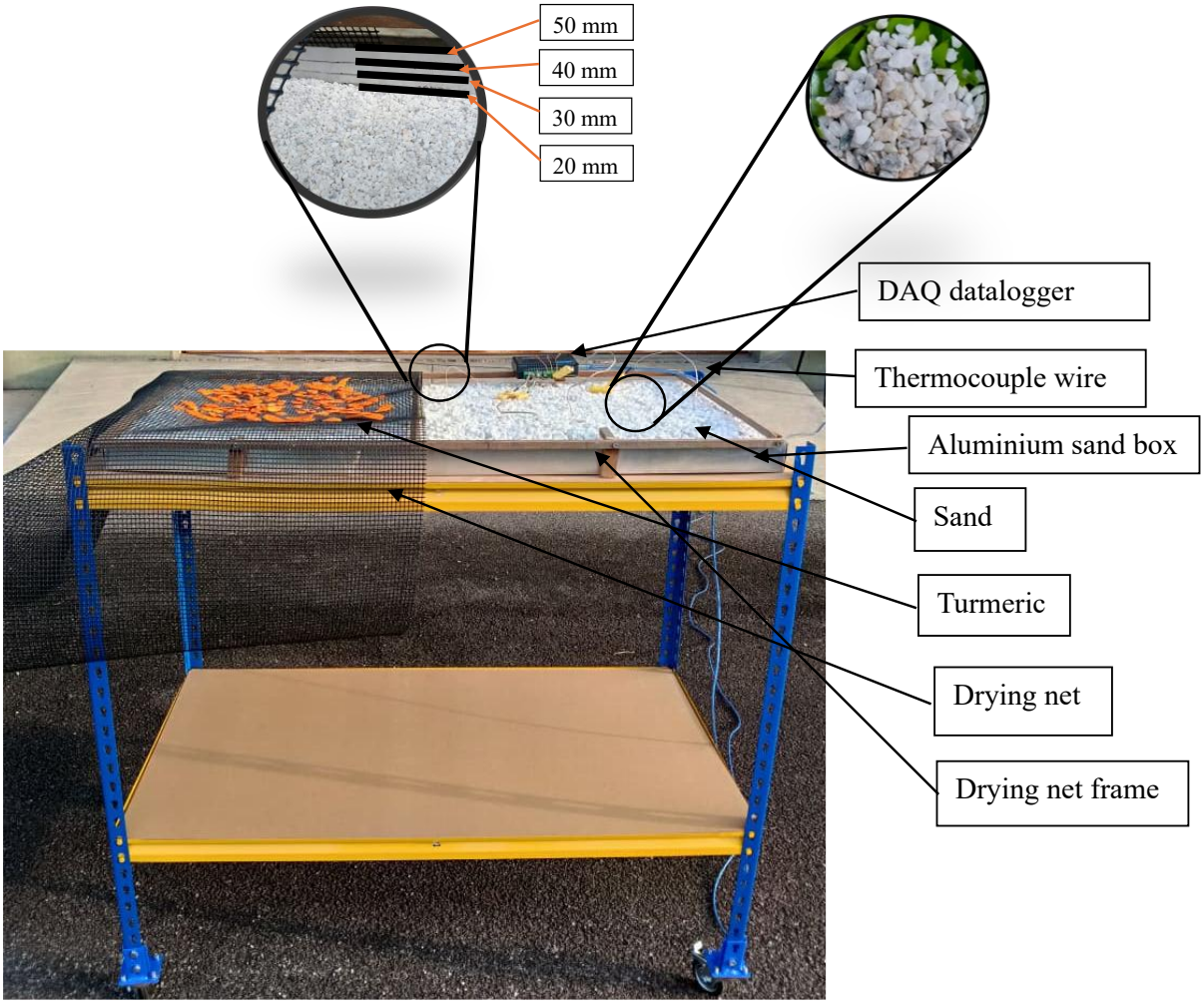



**Figure 3: A Depiction Illustrating The Full Image Of Turmeric Drying.**

## Result and Discussion

Figure 4 represents the weight (g) against time graph of turmeric drying utilising different thicknesses of silica sand as thermal energy storage with the sand diameter of an average of 10 mm through natural convection drying. The weight of the turmeric decreases linearly with the drying time in hours. This phenomenon is because the moisture content inside the turmeric decreases as the drying time decreases due to the evaporation process. The environment temperature increases with the increase of time, thus increasing the drying rate of the turmeric drying process.

The greater the thickness of silica sand, the greater the losses of moisture content inside the turmeric. The turmeric drying time from 8 a.m. to 12 p.m. is slower than from 1 p.m. to 5 p.m. due to the heat energy not being absorbed enough in the sand yet. The turmeric drying time of 1 p.m. until 5 p.m. is faster compared to other time intervals. This trend is due to the high temperature inside the sandbox that absorbs heat from the sun. From 5pm until 9pm, the drying becomes slower than at other time intervals because the sand loses heat, and there isn't enough heat energy to remove the moisture from the turmeric.

The 50-mm thickness has a slow drying rate from 8 a.m. until 12 p.m. compared to other drying conditions. This slowdown is due to the larger area of silica sand needed to store the heat energy. However, the drying rate of 50mm becomes faster than others from 1pm to 5pm since the conduction process between silica sand and turmeric drying has occurred rapidly. Furthermore, heat is transferred from the air to the turmeric, while simultaneously transporting moisture from the interior of the solid turmeric to its surface, where it is removed by the moving air stream through the convection process.

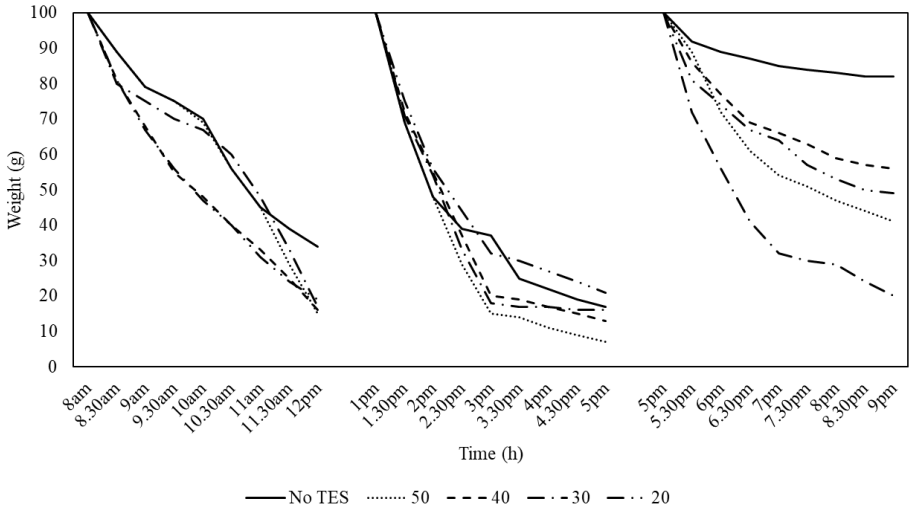



**Figure 4: Weight (G) Against Time Graph. The Legend Represents The Thickness Of Silica Sand (Mm).**

Figure 5 displays the graph of the temperature ratio (temperature sand/temperature ambient) plotted against time for the current experiment. The reason to divide both temperatures is to obtain the dimensionless value. The temperature ratio of the no thermal energy storage (TES) turmeric drying process remains constant at the value of 1 since only the ambient temperature was recorded.

Overall, the temperature ratio is increasing from 8am to 12pm, and the highest temperature is expected to be at 2pm and begin to decrease until 9pm. This increase is due to the highest amount of heat energy from the sun. The 50mm thickness received a lower temperature ratio from 8am until 12pm since it has a larger area and needs to store the heat from the sun. However, from 1pm to 9pm, the temperature ratio becomes the highest among all time intervals because the heat has been fully stored in the thermal energy storage. Higher temperatures inside the sandbox can expedite the drying process as compared to the outside temperature (Fauzan & Kartika, 2023). This study indicates that the drying process above the sandbox would be significantly more effective than drying the turmeric under normal outside conditions. This finding is further supported by recent research, which demonstrated that the temperature within the solar dryer exceeded that of the external environment (Halim Ghafar, Hamid Yusoff, Sh Mohd Firdaus Sh Abdul Nasir, Kay Dora Abdul Ghani, 2025). This indicates that the temperature inside the sandbox is elevated relative to the outside temperature, which is attributable to the sand's capacity to retain heat energy as a sensible heat- solid thermal energy storage material.

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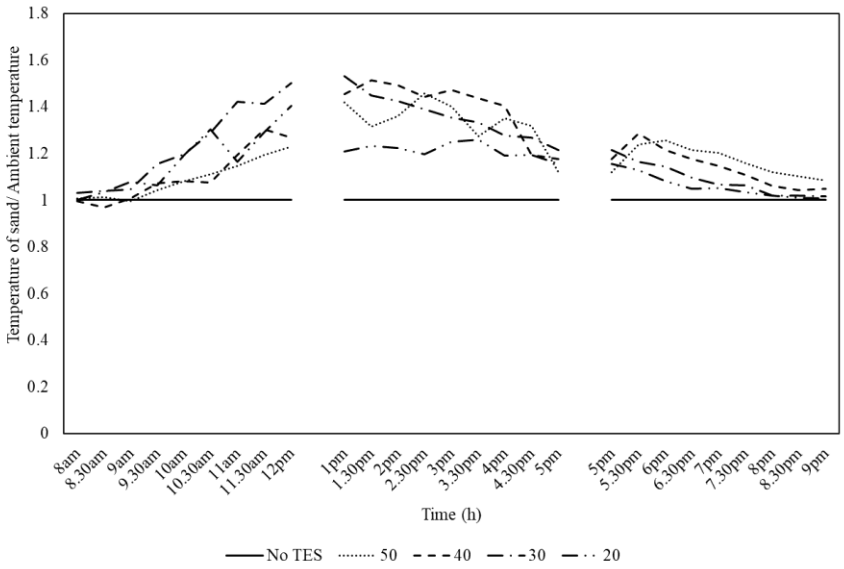



**Figure 5: Temperature Of Sand/ Ambient Temperature Against Time Graph. The Legend Represents The Thickness Of Silica Sand (Mm).**

## Conclusion

The value of the temperature ratio and weight for different thicknesses of silica sand has been obtained through experimental studies of the turmeric drying process. The data has been compared for no thermal energy storage condition, and different thicknesses of silica sand vary from 50 mm to 20 mm. It can be concluded that silica sand with an average diameter of 10 mm, when used in different thicknesses for thermal energy storage, can effectively store heat energy, thereby accelerating the turmeric drying process compared to a condition without thermal energy storage. However, modifications can be made to the existing solar dryer to create a more efficient system by combining it with sands of different compositions for thermal energy storage.

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# EFFECT OF PEDAGOGY SUPPORT ON STUDENT'S LEARNING MOTIVATION IN INNER MONGOLIA UNIVERSITY, CHINA

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***Abstract:*** *Pedagogy support has been identified as an essential predictor of student's academic engagement and long-term learning motivation. In culturally diverse higher education environments such as Inner Mongolia University, China, teacher care, classroom interaction, and learning resource support play critical roles in shaping student's motivational outcomes. This study examines the extent to which pedagogy support effects learning motivation among undergraduate students. Guided by Self-Determination Theory, Social Support Theory, and Vygotsky's Sociocultural Theory, a quantitative research design was done using survey questionnaires distributed to 450 students. Data were analysed through descriptive statistics and multiple regression. The findings show that all three dimensions of pedagogy support significantly contribute to intrinsic and extrinsic learning motivation [teacher care ($t=9.40$, $p < .001$; classroom interaction ($t=6.12$, $p < .01$); and learning resource support ($t=4.73$, $p < .05$]. Teacher care emerged as the strongest predictor, followed by classroom interaction and learning resource support. The study underscores the importance of supportive pedagogy to enhance student's cognitive, emotional, and behavioural engagement. Recommendations for improving teaching practice, institutional support structures, and future research directions are presented.*

***Keywords:*** *pedagogy support, learning motivation, teacher care, classroom interaction, learning resources*

## Introduction

Learning motivation is considered a central component of academic achievement and persistence in higher education (Ryan & Deci, 2020). In China's expanding higher education landscape, understanding the factors that influence student's motivation has become increasingly important. Inner Mongolia University is unique due to its multiethnic student population, which includes Mongolian, Han, and other minority groups. These diverse students often experience different levels of academic preparedness, linguistic competence, and social support, all of which can influence learning motivation.

Pedagogy support which refers to instructional practices, emotional responsiveness, and resource facilitation offered by teachers plays an instrumental role in shaping student's motivational attitudes (Wentzel, 2016). Supportive pedagogical practices help students build resilience, strengthen self-regulation, and develop interest in learning tasks. This study investigates how pedagogy support affects learning motivation among students enrolled at Inner Mongolia University. Specifically, it examines the roles of teacher care, classroom

interaction, and learning resource availability. Pedagogy is crucial as a transformative element to promote knowledge. In sustainable education, transformative pedagogy provides student's learning experiences by blending theoretical knowledge (Siyam Ul Alam *et al*., 2025).

## Research Background

### *Learning Motivation in Higher Education*

Learning motivation refers to the internal and external processes that stimulate student's desire to engage in academic tasks (Schunk *et al.,* 2022). Intrinsic motivation arises from interest, curiosity, and enjoyment, whereas extrinsic motivation driven by rewards, recognition, or external expectations. In Chinese universities, student's motivation s affected by exam-driven educational culture, institutional expectations, and teacher guidance. This makes teacher support a particularly significant determinant of motivational outcomes.

In Inner Mongolia, many undergraduate students must adjust to Mandarin or Mongolian-medium instruction and new academic expectations. These adjustments can influence their willingness to engage or persist in learning activities. Consequently, motivational support through pedagogy becomes a key mechanism for improving student engagement.

### *Pedagogy Support in the University Context*

Pedagogy support includes teaching behaviours and institutional conditions that promote student's cognitive, emotional, and behavioural engagement (Xie & Derakhshan, 2021). It typically includes teacher care, interactive classroom environments, and access to adequate learning resources.

Teacher care involves empathy, responsiveness, and personalized support that build student's sense of belonging and competence (Wentzel, 2016). Classroom interaction includes participation in discussions, questioning, group work, and collaborative learning activities. Learning resource support includes both physical materials (books, labs, classrooms) and digital tools (learning management systems, online libraries).

### *Higher Education Context in Inner Mongolia*

Inner Mongolia is distinct due to its cultural, linguistic, and demographic diversity. Students from rural or nomadic backgrounds often enter university with limited digital literacy, fewer learning resources, or weaker academic foundations. In addition, some students must transition between Mongolian and Mandarin in academic settings, which can affect comprehension and confidence.

Given these challenges, pedagogy support becomes crucial for maintaining and enhancing learning motivation. Yet, there is limited empirical research on how pedagogy support influences motivation in this region.

## Research Problem

Despite ongoing national reforms aimed at improving teaching quality in China, many universities including those in Inner Mongolia continue to struggle with uneven pedagogical practices. Students frequently report passive learning environments, limited teacher-student

interactions, and inadequate access to learning materials. These circumstances may weaken student's learning motivation, reduce engagement, and affect overall academic performance. The fact that student's motivation is very crucial in the new era of education. According to P. Kamalesh Kumar and C. Vairavan (2025), student's or learner's motivation is a common challenge facing educators, but it is serious to be studied.

The central problem addressed in this study is a lack of empirical evidence on how pedagogy support effect the learning motivation of university students in Inner Mongolia. This study aims to fill this gap by examining the effect between pedagogy support and learning motivation in a multicultural academic context.

**Research Objectives**

This research objectives are to:

i. Identify the effects of teacher care, classroom interaction, and learning resource support on student's learning motivation.
ii. Examine the significant effects teacher care, classroom interaction, and learning resource support on student's learning motivation.

**Research Questions**

The study addresses the following questions:

i. Identify the effects of teacher care, classroom interaction, and learning resource support on student's learning motivation.
ii. Are there any significant effects teacher care, classroom interaction, and learning resource support on student's learning motivation.

**Hypothesis**

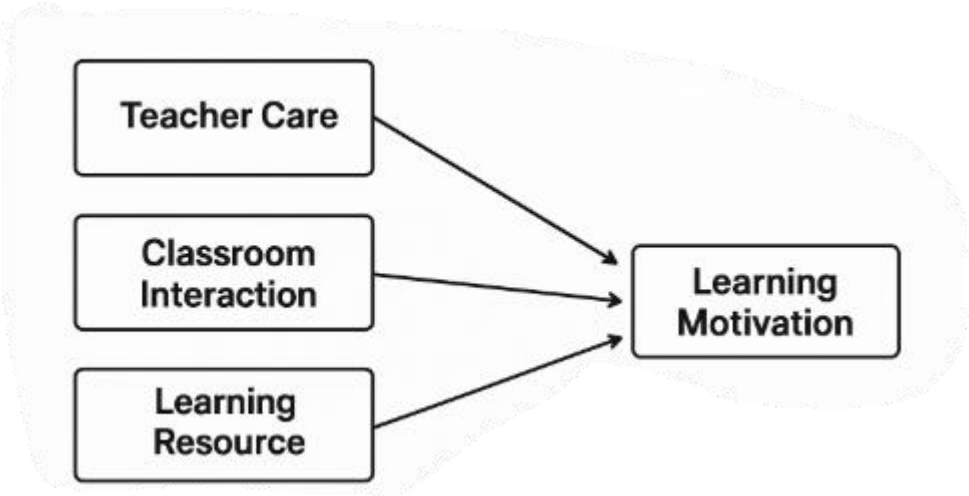
Ho1: There any no significant effects of teacher care, classroom interaction, and learning resource support on student's learning motivation.

**Conceptual Framework**

The conceptual model guiding this study proposes that pedagogy support (teacher care, classroom interaction, learning resource support) directly influences student's learning motivation.

The diagram below illustrates the conceptual framework:

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**Theoretical Framework**

***Self-Determination Theory (SDT)***

Motivation is shaped by individual's needs for autonomy, competence, and relatedness (Ryan & Deci, 2020). Teacher care contributes to relatedness, classroom interaction strengthens competence, and learning resource support enhances autonomy in learning.

Teacher care directly addresses the need for relatedness. When students perceive their teachers as caring, supportive, and genuinely concerned about their well-being, they feel emotionally connected and valued. This sense of belonging strengthens student's trust and encourages them to participate actively in the learning process. A strong teacher-student relationship has been consistently associated with higher motivation and academic engagement.

Classroom interaction supports the need for competence, as frequent and meaningful interactions, whether through discussions, feedback, questioning, or collaborative activities to enable students to feel capable and confident in their learning. Constructive interactions help students understand content more deeply, receive timely guidance, and experience mastery, all of which reinforce their belief in their ability to succeed.

Learning resource support enhances autonomy, as access to adequate and diverse learning materials empowers students to explore content independently, make choices in their learning pathways, and regulate their own pace. When students are provided with flexible and supportive resources such as digital tools, reference materials, and structured learning guides to gain greater control over their learning, which directly contributes to higher intrinsic motivation.

When these three psychological needs are simultaneously fulfilled through teacher care, classroom interaction, and resource support, students are more likely to experience increased learning motivation. Thus, SDT provides a strong theoretical foundation for understanding how the learning environment shapes student's motivational outcomes.

**Operational Definitions**

i. Teacher Care

Supportive teaching behaviours that demonstrate empathy, guidance, and respect.

ii. Classroom Interaction

Engagement between students and teachers through questioning, discussion, and collaboration.

iii. Learning Resource Support

Availability of digital and physical learning materials that facilitate academic engagement.

iv. Learning Motivation:

Student's intrinsic and extrinsic desire to participate in and persist with learning.

## Literature Review

### *Teacher Care and Learning Motivation*

Teacher care has been widely recognized as an essential component of student motivation. Supportive teachers strengthen student's sense of belonging and promote deeper academic engagement (Wentzel, 2016). When students perceive teachers as caring and responsive, they are more likely to participate actively in class, seek help, and feel confident in their academic abilities. Research shows that teacher–student relationships significantly influence intrinsic motivation (Roorda et al., 2017).

Teacher care also has long been recognized as a powerful predictor of student's academic behaviours, emotional adjustment, and overall motivation to learn. In educational psychology, teacher care refers to the behaviours through which teachers demonstrate empathy, warmth, respect, and support toward student's personal and academic growth (Noddings, 2013). Teacher care establishes a relational context in which students feel valued and secure, which is foundational to their willingness to participate, persist, and excel in learning tasks. Wentzel (2016) notes that supportive teachers strengthen student's sense of belonging, which is a critical component of motivation, particularly for adolescents navigating social and academic transitions.

i. Theoretical Foundations of Teacher Care

The relationship between teacher care and learning motivation can be understood through several theoretical perspectives. Self-Determination Theory (SDT) posits that motivation is fostered when individual's basic psychological needs autonomy, competence, and relatedness are supported (Deci & Ryan, 2000). Teacher care plays a crucial role in fulfilling the need for relatedness, which directly nurtures intrinsic motivation. When students feel connected to their teachers, they are more likely to internalize academic goals and engage deeply with learning tasks.

Attachment Theory also offers insights into the significance of teacher care. While originally developed for parent-child relationships, attachment theory has been extended to school

environments, suggesting that teachers who provide emotional support help children develop secure school-based attachments (Bergin & Bergin, 2009). Such attachments enhance motivation by reducing anxiety, fostering trust, and encouraging exploration and risk-taking in learning.

ii. Impact of Teacher-student Relationships on Motivation

Empirical research strongly supports the notion that positive teacher-student relationships enhance student motivation. Roorda et al. (2017), in a large-scale meta-analysis involving over 95,000 students, found that positive teacher–student relationships were significantly associated with higher levels of engagement, intrinsic motivation, and academic achievement. Similarly, Hughes (2020) reports that students who perceive their teachers as caring and responsive demonstrate greater task persistence, improved self-efficacy, and stronger intrinsic interest in learning activities.

Teacher care also reduces negative behaviours such as anxiety, disengagement, and avoidance of academic tasks. For example, Klem and Connell (2004) found that students who perceived strong teacher emotional support were more likely to report positive attitudes toward school and higher academic effort. This suggests that teacher care functions as both a motivational catalyst and an emotional safeguard.

iii. Classroom Practices that Reflect Teacher Care

Teacher care is demonstrated through instructional practices such as active listening, encouragement, feedback, and individualized support. According to Pianta et al. (2012), teacher behaviours such as showing interest in student's experiences, providing constructive feedback, and offering emotional reassurance contribute to a classroom climate that supports motivation. Teachers who display warmth and respect not only foster emotional well-being but also model pro-social behaviours, thereby cultivating a classroom environment conducive to learning.

In addition, caring teachers set high academic expectations while providing the necessary support for students to meet those expectations. This balance of warmth and structure, sometimes referred to as 'authoritative teaching', has been found to predict higher motivation and engagement (Brophy, 2010).

iv. Cultural Dimensions of Teacher Care

Teacher care is not interpreted uniformly across cultures. In collectivist societies such as China, Malaysia, and other parts of Asia, teacher care is often expressed through structured guidance, discipline, and academic monitoring rather than overt emotional expressions (Chen & Wong, 2020). Students in these contexts may perceive rigorous instruction and consistent feedback as indicators of teacher commitment and care. Understanding cultural nuances is important for interpreting the relationship between teacher care and motivation in diverse educational settings.

v. Synthesis

In summary, extensive literature demonstrates that teacher care is foundational to student's learning motivation. Through supportive relationships, culturally responsive practices, and psychologically informed instructional strategies, teacher care enhances student's sense of belonging, competence, and autonomy key drivers of intrinsic and sustained motivation.

***Classroom Interaction and Learning Motivation***

Interactive classrooms create learning environments where students are encouraged to think critically, communicate their ideas, and collaborate with peers. Research shows that higher levels of classroom interaction led to increased engagement and motivation (Zhou & Hwang, 2021a). Participatory activities such as discussions, presentations, and group work promote deeper learning and intrinsic interest.

Classroom interaction, defined as the verbal and non-verbal exchanges between teachers and students and among students themselves, is a central component of effective teaching and learning (Walsh, 2011). It is through these interactions that knowledge is constructed, skills are developed, and motivation is fostered. Interactive classrooms are characterized by dialogue, collaboration, feedback, questioning, and active participation, all of which contribute to meaningful learning experiences.

i. Constructivist and Sociocultural Perspectives

Constructivist theories highlight the role of interaction in knowledge construction. Vygotsky's (1978) sociocultural theory posits that learning occurs through social exchange and guided participation within the learner's Zone of Proximal Development. In this view, classroom interaction is not merely communication but a learning mechanism that helps students internalize new concepts.

Interactive learning environments support intrinsic motivation by providing opportunities for exploration, inquiry, and autonomy (Skinner & Pitzer, 2012). When students engage in discussions, collaborative tasks, and problem-solving activities, they develop a deeper understanding of the subject matter and a stronger interest in academic tasks.

ii. Teacher-student Interaction and Motivational Outcomes

Teacher-student interaction is a major determinant of classroom motivation. The frequency, quality, and nature of teacher responses influence student's academic behaviours and attitudes. Zhou and Hwang (2021b) found that higher levels of classroom interaction predicted stronger learning motivation among secondary school students. Interactive teaching strategies, such as open-ended questioning, dialogic exchanges, and immediate feedback, promote cognitive engagement and persistence.

Feedback is a powerful motivational tool. Hattie and Timperley (2007) emphasize that feedback enhances student's sense of competence, especially when it is specific, timely, and focused on task improvement. Students who receive supportive feedback are more likely to persist through challenges and maintain high levels of motivation.

iii. Peer Interaction and Collaborative Learning

Peer interaction is also essential in building learning motivation. Collaborative learning structures, such as cooperative group activities, peer tutoring, and project-based learning, allow students to share knowledge, negotiate ideas, and reflect together. Johnson and Johnson (2019) report that cooperative learning improves motivation, academic achievement, and interpersonal skills.

Moreover, peer interaction promotes a sense of community and emotional support. Students who feel accepted and supported by their classmates demonstrate higher levels of engagement and intrinsic motivation (Wentzel, 2016a). Through collaboration, students not only develop academic competencies but also build confidence, communication skills, and social responsibility.

iv. Technology-Mediated Classroom Interaction

With the expansion of digital learning environments, interaction now extends beyond traditional face-to-face settings. Technology-mediated interactions, such as online discussions, interactive simulations, and real-time response systems, enhance student's engagement and motivation. Tseng and Walsh (2020) highlight that digital tools foster active learning by providing immediate feedback, personalized learning pathways, and opportunities for collaboration across time and space.

v. Synthesis

Overall, classroom interaction, whether teacher-led, peer-driven, or digitally mediated plays a central role in shaping student's learning motivation. Interactive classrooms promote active engagement, autonomy, and relatedness, which are essential components of sustained academic motivation.

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***Learning Resource and Learning Motivation***

Access to high-quality learning resources such as digital platforms, textbooks, laboratory equipment, and library facilities during the learning process significantly influences motivation (Kim & Lee, 2019). Students with sufficient resources are more likely to feel prepared, competent, and confident in their learning activities.

Learning resources are integral to the instructional process and significantly influence student's motivation and academic success. These resources include physical materials such as textbooks and laboratory equipment, digital resources such as learning management systems and online libraries, and institutional support structures such as tutoring centres and library services.

i. Resource Availability and Perceived Competence

Access to high-quality learning resources enhances students perceived competence, a core factor in learning motivation according to SDT (Deci & Ryan, 2000). Students who have adequate resources feel more prepared, capable, and confident in their academic tasks. Kim and Lee (2019), for instance, found that students with access to digital learning materials demonstrated higher motivation, better time management, and stronger academic outcomes.

ii. Digital Learning Resources and Technology Integration

The integration of digital learning resources has transformed the educational landscape. E-books, online courses, virtual laboratories, and multimedia content provide students with flexible and interactive learning opportunities. Martin and Sunley (2020) note that digital resources promote intrinsic motivation by making learning more engaging and allowing students to learn at their own pace.

Digital resources also support differentiated instruction, enabling teachers to tailor learning materials to student's needs. This personalization enhances motivation by increasing relevance and reducing frustration, especially for learners with diverse abilities.

iii. Physical Resources and Learning Motivation

Physical learning resources such as well-equipped libraries, science laboratories, and classroom facilities also play an important role in motivation. Adequate lighting, seating, ventilation, and access to learning materials contribute to a positive learning environment, which has been linked to improved motivation and academic engagement (Barrett et al., 2015).

iv. Resource Accessibility and Educational Equity

Resource inequity is a significant barrier to motivation. Students who lack access to textbooks, internet services, or academic support centres often experience academic stress, disengagement, and reduced self-efficacy (UNESCO, 2021). Ensuring equitable resource distribution is therefore essential in promoting learning motivation for all students.

v. Synthesis

Learning resource support strengthens student's motivation by enhancing preparedness, promoting autonomy, and supporting competence. As educational settings increasingly adopt digital tools and blended learning models, equitable access to learning resources remains a key determinant of student motivation.

## Methodology

### *Research Design*

This study employed a quantitative, cross-sectional survey design to examine the effect of pedagogy support on student's learning motivation at Inner Mongolia University. The design was chosen because it allows for the systematic collection of numerical data from many respondents and enables the application of inferential statistical analyses to identify relationships among variables (Creswell & Creswell, 2018). A survey method was considered

appropriate as it captures student perceptions of pedagogy support and learning motivation at a single point in time.

***Population and Sample***

The target population consisted of undergraduate students enrolled at Inner Mongolia University in the 2024/2025 academic year. A sample size of 450 students was determined using Krejcie and Morgan's (1970) sample size estimation table, which is suitable for populations exceeding 10,000. Stratified random sampling was applied to ensure adequate representation across faculties, academic levels, and student ethnicities (Mongolian, Han, and others). This sampling approach minimized selection bias and improved the generalizability of the findings.

***Research Instrument***

Data were collected using a structured questionnaire consisting of four sections:

i. Teacher Care Scale (10 items)

   Adapted from the Teacher Support Questionnaire developed by Torsheim et al. (2000).

ii. Classroom Interaction Scale (10 items)

   Based on the Classroom Engagement Scale by Skinner *et al.* (2009).

iii. Learning Resource Support Scale (8 items)

   Adapted from the Academic Resource Adequacy Inventory (Kim & Lee, 2019).

iv. Learning Motivation Scale (12 items)

   Based on the Academic Motivation Scale (Vallerand et al., 1992).

All items were measured on a 5-Point Likert Scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Higher scores indicated a higher level of perceived pedagogy support or learning motivation.

***Validity and Reliability***

Content validity was established through expert review by three scholars in educational psychology and pedagogy. Minor adjustments were made to item wording to suit the Inner Mongolia University context. Reliability analysis showed strong internal consistency across all scales. Cronbach's alpha coefficients were shown in Table 1:

**Table 1: Reliability Analysis**

| | |
|---|---|
| Teacher Care | α = .91 |

| | |
|---|---|
| Classroom Interaction | α = .89 |
| Learning Resource Support | α = .87 |
| Learning Motivation | α = .93 |

These values indicate high reliability, meeting the recommended threshold of 0.70 (Nunnally & Bernstein, 1994).

***Data Collection Procedure***

Data collection took place over a four-week period. Participants were approached after lectures and provided a brief explanation of the research purpose. They completed the questionnaire voluntarily and anonymously. Completed questionnaires were checked for completeness before data entry.

***Data Analysis***

Data were analysed using SPSS version 27. Descriptive statistics [mean (M) and standard deviation (SD)] were computed to summarize the level of pedagogy support and learning motivation. Multiple regression was used to determine the predictive power of teacher care, classroom interaction, and learning resource support on learning motivation.

**Results**

***Descriptive Statistics***

Overall, students reported moderately high levels of pedagogy support. Table 2 shows the descriptive statistics.

**Table 2: Descriptive Statistics**

| | | |
|---|---|---|
| Teacher Care | Mean = 4.12 | SD = 0.52 |
| | | |

| | | |
|---|---|---|
| Classroom Interaction | Mean = 3.95 | SD = 0.58 |
| Learning Resource Support | Mean = 4.05 | SD = 0.49 |
| Learning Motivation | Mean = 4.18 | SD = 0.54 |

These results suggest that students generally perceive their lecturers as supportive, experience reasonable levels of classroom interaction, and have access to adequate learning resources.

**Multiple Regression Analysis**

To examine the data for predictor variable, Multiple Regression Analysis was tested. Table 3 shows the analysis.

**Table 3: Multiple Regression Analysis of pedagogy support on learning motivation**

| **Predictor Variable** | **B** | **SE B** | **β** | **t** | **p** |
|---|---|---|---|---|---|
| Teacher Care | 0.47 | 0.05 | .47 | 9.40 | < .001 |
| Classroom Interaction | 0.31 | 0.06 | .31 | 6.12 | < .01 |
| Learning Resource Support | 0.21 | 0.05 | .26 | 4.73 | < .05 |

Note: Learning motivation served as the dependent variable.

Multiple regression analysis was done to examine the significant effects of pedagogy support dimensions on learning motivation. From the Table 3, teacher care ($t=9.40$, $p < .001$; classroom interaction ($t=6.12$, $p < .01$); and learning resource support ($t=4.73$, $p < .05$). It shows that there

is significant effects of teacher care, classroom interaction, and learning resource support on student's learning motivation.

Therefore, the hypothesis below is rejected.

Ho1: There any no significant effects of teacher care, classroom interaction, and learning resource support on student's learning motivation.

## Discussion

The purpose of this study was to examine the effects of pedagogy support on learning motivation among undergraduate students in Inner Mongolia University. The results confirm that all three dimensions teacher care, classroom interaction, and learning resource support significantly predict learning motivation.

### *Teacher Care as the Strongest Predictor*

Teacher care emerged as the strongest predictor of learning motivation, consistent with previous research emphasizing the role of teacher–student relationships in academic engagement (Wentzel, 2016b; Roorda et al., 2017). Students who perceive teachers as caring, respectful, and supportive are more likely to feel competent and valued, leading to stronger intrinsic and extrinsic motivation. This is particularly important in multicultural contexts such as Inner Mongolia, where students from minority groups may require additional emotional support.

### *Classroom Interaction and Engagement*

Classroom interaction also demonstrated a significant positive effect on learning motivation. Interactive learning environments promote deeper understanding, encourage active participation, and reduce feelings of isolation (Zhou & Hwang, 2021a). When instructors incorporate discussions, group work, questioning strategies, and collaborative learning, students engage more deeply and sustain interest in academic tasks.

### *Learning Resource Support and Self-Regulation*

Although learning resource support was the weakest predictor among the three, it still had a significant influence. Adequate resources such as textbooks, digital platforms, and laboratory tools enable students to study independently and efficiently. Students who can access essential learning materials experience less stress and greater motivation (Kim & Lee, 2019a).

## Overall Model Strength

The regression model explained 48% of the variance in learning motivation, indicating that pedagogy support is a substantial contributor. These findings reinforce theoretical explanations such as Self-Determination Theory, which posits that supportive environments enhance autonomy, competence, and relatedness (Ryan & Deci, 2020).

## Implications

### *Theoretical Implications*

This study contributes to the understanding of how pedagogy support functions in multicultural higher education contexts. It supports Self-Determination Theory and Sociocultural Theory by demonstrating that socially supportive teaching environments enhance student motivation.

***Practical Implications***

Teachers should prioritize relationship-building, interactive teaching, and personalized feedback. Universities must invest in professional development programs that enhance culturally responsive pedagogy.

***Policy Implications***

Institutions should allocate funding to improve digital learning environments, upgrade libraries, and reduce disparities in resource access between students from different socioeconomic backgrounds.

**Recommendations**

i. Enhance Teacher Care

Encourage lecturers to use empathetic communication, provide timely feedback, and establish mentorship systems.

ii. Increase Classroom Interaction

Incorporate blended learning, project-based learning, and collaborative group activities to boost engagement.

iii. Strengthen Learning Resources

Expand access to e-libraries, improve laboratory equipment, and develop multilingual learning materials.

iv. Provide Pedagogical Training

Offer workshops on student-centred teaching, cultural sensitivity, and motivational strategies.

v. Develop Motivation Support Programs

Facilitate academic counselling and peer mentoring programs targeting first-year and minority students.

## CONCLUSION

This study examined the effects of pedagogy support on student's learning motivation at Inner Mongolia University. The results demonstrated that teacher care, classroom interaction, and

learning resource support each significantly affect learning motivation, with teacher care emerging as the strongest predictor. These findings highlight the importance of supportive and interactive pedagogy in multicultural university contexts. Strengthening pedagogy support can enhance student engagement, improve academic performance, and contribute to long-term educational success. Future studies may expand the scope to include comparative analyses across universities, qualitative interviews, or longitudinal tracking of student motivation over time.

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# PERFORMANCE INDICATORS FOR MALAYSIAN FAMILY TAKAFUL OPERATORS

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***Abstract:*** *This study examines the determinants of business performance among Malaysian family takaful operators, focusing on both firm-specific factors (Fee & Commission Income, Zakat Paid, Underwriting Risk, Liquidity, and Firm Size) and macroeconomic indicators (GDP Growth and Inflation Rate). Using an 11-year panel dataset (2013– 2022) from nine family takaful operators, this study employs multiple regression models, including Ordinary Least Squares (OLS), Robust OLS, Cluster Robust OLS, and Feasible Generalized Least Squares (FGLS), to ensure the robustness of the findings. The results indicate that Fee & Commission Income (FCI) and Zakat Paid (ZP) positively influence business performance, highlighting their role as key revenue streams and ethical financial indicators in Islamic finance. Conversely, Underwriting Risk (UWR) and Liquidity (LQ) negatively impact performance, suggesting that excessive claims, risk mismanagement, and inefficient liquidity allocation hinder profitability. Interestingly, Firm Size (FS) was found to be insignificant, challenging the assumption that larger operators achieve better financial outcomes. Additionally, Inflation significantly affects business performance, while GDP Growth was found to be insignificant, implying that family takaful participation is more influenced by inflationary pressures than broad economic expansion. This study contributes to theoretical, methodological, and practical advancements in Islamic finance, particularly in understanding the financial sustainability and risk management strategies of takaful operators. The findings provide valuable insights for policymakers, regulators, and industry practitioners, emphasizing the need for effective pricing strategies, investment diversification, and enhanced risk governance. Future research should explore comparative studies across different jurisdictions and incorporate qualitative insights into takaful consumer behavior and operational challenges.*

***Keywords:*** *Business performance, Family takaful operators, Econometric, Fee & commission income, Zakat paid*

## 1.0 Introduction

The takaful industry in Malaysia was established to provide a Shariah-compliant alternative to conventional insurance, catering to the needs of the Muslim community. Rooted in the principles of mutual cooperation (ta'awun) and shared responsibility (tabarru'), takaful aligns with Islamic financial ethics by offering risk-sharing mechanisms instead of conventional risk-transfer models (Bank Negara Malaysia, 2005). This unique structure ensures that policyholders contribute to a common fund, which is then used to provide financial protection to members facing unexpected losses.

Currently, Malaysia hosts 11 family takaful operators and four general takaful operators, all regulated under the purview of the Central Bank of Malaysia (Bank Negara Malaysia, 2023). This regulatory oversight ensures that takaful operations adhere to both financial and Shariah governance, maintaining consumer trust and industry stability.

The Malaysian family takaful sector has demonstrated impressive growth, reinforcing its position as a key player in the broader Islamic finance industry. In 2023, the market penetration rate for family takaful stood at 19.58% (Alam, 2023), reflecting the increasing acceptance and adoption of takaful products among consumers. Additionally, data from the Malaysian Takaful Association (MTA) reported that new business contributions reached RM 10.06 billion in 2022, representing a 15.6% year on-year increase, with 1.31 million new certificates issued.

Despite this robust growth, the industry continues to face several challenges that threaten its long-term sustainability. The COVID-19 pandemic significantly impacted the financial sector, including takaful, as economic uncertainties led to reduced consumer spending and policy cancellations. Additionally, recurring natural disasters such as floods and landslides have further stressed the industry by increasing claim payouts, affecting liquidity management and overall market stability (Eldaia et al., 2021; Mahadi & Ismail, 2022). Market competition from conventional insurance providers, regulatory compliance costs, and evolving customer expectations also pose hurdles that family takaful operators must navigate.

Although the Malaysian takaful industry has received considerable academic attention, much of the existing literature focuses on overall takaful performance rather than specifically addressing the family takaful segment. Previous studies have examined the operational efficiency, financial stability, and market growth of takaful operators, but few have provided an in-depth analysis of the factors influencing the performance of family takaful businesses.

Furthermore, while traditional financial indicators such as Return on Assets (ROA) and Return on Equity (ROE) have been widely used to assess business performance, they may not fully capture the distinct characteristics of family takaful operations. These conventional metrics primarily measure profitability and asset utilization efficiency but overlook the role of alternative revenue sources and social obligations that are integral to takaful businesses. To address this gap, this study introduces Fee and Commission Income (FCI) and Zakat Paid as novel proxies for measuring performance.

Additionally, previous studies have largely examined the broader financial health of Islamic financial institutions, yet limited research has explored how internal and external factors influence the specific operational success of family takaful businesses. Understanding these dynamics is crucial, especially as family takaful continues to expand in response to growing consumer demand and regulatory advancements.

Understanding the key performance drivers enables takaful operators to refine their strategic and financial management practices. By analyzing the impact of fee & commission income (FCI), zakat paid, underwriting risk, liquidity, and firm size, operators can identify strengths and weaknesses in their revenue models and risk exposure. The study also highlights how FCI, a crucial income source under the *wakalah* model, differentiates family takaful from conventional life insurance, reinforcing the need for optimizing management fees and service charges. Additionally, the inclusion of zakat paid as a performance indicator offers insights into how corporate social responsibility in Islamic finance contributes to both financial

sustainability and consumer trust. Ultimately, this research plays a pivotal role in shaping the future growth and sustainability of the family takaful industry in Malaysia.

## 2.0 Literature Review

### *2.1 Performance Indicators for Family Takaful Operators*

Evaluating a company's business performance is crucial, as it reflects its ability to manage finances effectively and sustain long-term growth. Business performance measurement is essential for stakeholders, including investors, regulators, and management, to assess financial health, operational efficiency, and strategic direction. Several indicators can be used to measure company performance, with return on assets (ROA) being one of the most widely used, particularly in financial institutions (Che Arshad et al., 2020). ROA measures how efficiently a company utilizes its assets to generate income, making it a reliable indicator of profitability and resource efficiency. Several studies have extensively scrutinized the use of ROA as a performance metric for Islamic banks. Notable researchers such as Kamarulzaman & Mahshar (2018), Nugroho et al. (2022).

Apart from ROA, other financial performance indicators are also widely used to assess business efficiency in takaful and Islamic finance industries. Return on Equity (ROE) is another key profitability ratio that evaluates a company's ability to generate profits from shareholders' equity. ROE is particularly relevant for assessing investor returns, as higher values indicate better profitability and effective capital utilization. Studies such as Nugroho et al. (2022) and Ur Rehman et al. (2022) have employed ROE in Islamic banking and takaful research, highlighting its significance in financial performance evaluation.

Overall, while ROA remains a critical financial performance measure, incorporating additional indicators such as ROE, ROI, UPR, and solvency ratio provides a more comprehensive evaluation of family takaful operators. These metrics collectively offer a multidimensional assessment of financial health, risk management effectiveness, and business sustainability. Given the increasing complexity of the takaful industry, a diversified approach to performance measurement is essential for ensuring long-term stability and growth.

### *2.2 Operator's Specific*

#### *2.2.1 Fee & Commission Income*

Fee and commission income (FCI), or non-interest income, refers to the charges a bank imposes for its services. In the takaful business industry, FCI is the primary source of income for operators, as outlined in the Malaysia Takaful Operational Framework 16 (TOF) in Section 16 (16.1) (Bank Negara Malaysia, 2019). Unlike conventional insurance, where earnings largely depend on underwriting surplus and investment returns, takaful operators derive a substantial portion of their revenue from management fees collected under *wakalah* contracts.

Furthermore, a significant empirical gap exists, as previous studies have predominantly treated FCI as a dependent variable rather than an independent predictor of business performance (Damankah et al., 2014; Shahimi et al., 2006). For instance, Shahimi et al. (2006) investigated the relationship between portfolio diversification and fee-based income in Australian banks. Their study revealed that while fee-based income presents higher risks than traditional margin income, it also offers diversification benefits for shareholders.

Similarly, Muhammad Zuki (2024) explored the determinants of non-financing income in Malaysian Islamic banks, including total fee and commission income. His findings indicated that bank-specific factors such as ROA, bank size, total deposits, and loan loss provisions significantly influence non-financing income, reinforcing the notion that FCI plays a crucial role in financial performance.

### *2.2.2 Zakat Paid*

Zakat (Islamic tax) is the third pillar of Islam and holds both spiritual and economic significance in the Islamic faith. Linguistically, zakat means to cleanse or purify oneself from dirt and to grow, praise, and increase. Theologically, it refers to the purification of one's wealth and spiritual self through the fulfillment of zakat obligations (Abd Samad et al., 2017). According to Al-Qaradawi (2011), zakat is as specific portion of one's wealth prescribed by God to be distributed among designated categories of recipients, including the poor, needy, zakat administrators, those whose hearts are inclined toward Islam, slaves seeking freedom, debtors in genuine need, those striving in the path of Allah, and stranded travellers.

One of these distinctions is the obligation to pay zakat, specifically business or corporate zakat, which aligns financial performance with ethical and social responsibility (Ali et al., 2020). In Malaysia, the Malaysian Accounting Standards Board (2006) outlines zakat payment mechanisms based on the Adjusted Working Capital and Adjusted Growth methods, ensuring systematic zakat calculations (Malaysian Accounting Standards Board, 2006). Business zakat, therefore, is an essential component of Islamic finance, reinforcing the ethical foundations of IFIs and contributing to socio-economic development.

In financial analysis, zakat is increasingly recognized as a key indicator of profitability and corporate responsibility within Islamic financial institutions. Shiu & Haron (2022) argue that zakat payments effectively reflect the financial health and profitability of IFIs, justifying the selection of zakat ratio as a measurement of performance. Their study suggests that IFIs with larger total assets are obligated to pay higher amounts of zakat, reinforcing the idea that financial growth should be accompanied by ethical financial obligations. The integration of zakat as a performance metric offers a unique perspective, combining financial success with social impact and ethical governance.

### *2.2.3 Underwriting Risk*

Underwriting risk is the potential loss an insurer may face due to an inaccurate assessment of risk or unforeseeable events, resulting in expenses exceeding premiums earned. When assessing underwriting performance, a signal may indicate that a takaful company is experiencing financial difficulties related to its underwriting cash flow. This suggests the company is struggling to overcome these challenges (Shiu, 2004). Effective underwriting plays a crucial role in ensuring the financial stability of takaful operators, as poor risk assessment can lead to unsustainable claims payouts, liquidity constraints, and ultimately, reduced profitability.

Ana-Maria and Ghiorghe (2014) suggest that taking on too much underwriting risk can reduce the profitability of an insurance company. This is because the company will have to spend more on managing expenses, such as loss adjustment costs and claims investigation, which can lead

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to higher insurance losses. As a result, excessive underwriting risk negatively impacts the company's operational performance, leading to higher claim handling and monitoring costs (Ana-Maria & Ghiorghe, 2014).

Many previous empirical works have indicated that underwriting risk significantly influences a firm's performance. For instance, Luqman et al. (2022) investigated the determinants of performance across Malaysian takaful companies. The study used the loss ratio as a proxy to measure underwriting risk and found that the loss ratio was significant and positively related to the return on assets of Malaysian takaful companies. The findings suggest that controlling underwriting risk through better risk selection and claims management can enhance overall profitability.

### *2.2.4 Liquidity*

One of the key measures of liquidity is the quick ratio, which indicates how much of a firm's assets can be quickly converted into cash to cover its liabilities (Alam et al., 2023). Maintaining proper liquidity is essential for takaful operators, as it ensures they can balance shortterm cash needs with long-term financial sustainability. Previous empirical works have extensively examined the relationship between liquidity and financial performance across various industries, including the takaful sector. For instance, Che Arshad et al. (2020) conducted an empirical study on takaful operators in Malaysia and found that liquidity significantly affects the financial performance of takaful operators.

Similarly, Hemrit (2020) explored the impact of liquidity on firm performance in takaful companies and found a significant positive relationship, indicating that maintaining adequate liquidity levels is crucial for business sustainability. Another study by Abdullah et al. (2022) revealed a similar positive relationship between return on assets (ROA) and liquidity in takaful performance, reinforcing the importance of maintaining sufficient liquid assets to sustain operational efficiency.

However, some studies suggest that excessive liquidity can have a negative impact on financial performance. According to Alam et al. (2023), liquidity has a negative significant relationship with financial performance in Islamic financial institutions. Their findings indicate that Islamic banks often keep large portions of their assets unused to meet liquidity demands, resulting in lower profitability.

### *2.2.5 Firm's Size*

Firm size refers to the scale or magnitude of a company's operations, often measured by assets, revenue, or market capitalization (Che Arshad et al., 2020). Theoretically, larger firms tend to have greater operational capacity, wider market reach, and enhanced financial stability, all of which contribute to better financial performance. A larger firm typically benefits from economies of scale, where increased production lowers per-unit costs, leading to higher profit margins. As sales grow, revenue increases, translating into greater profitability, which ultimately enhances returns on investments, assets, and equity. Moreover, larger firms often enjoy stronger bargaining power with suppliers, easier access to capital markets, and a more diversified portfolio, which reduces financial risk and enhances sustainability.

According to Ashraf et al. (2017), firm size is also an important determinant of market perception and investor confidence. Larger firms tend to attract more public attention and generate greater trust among stakeholders, as their size signals financial strength and stability. Larger takaful operators are likely to have better brand recognition, more extensive distribution networks, and a broader customer base, all of which contribute to their financial performance (Che Arshad et al., 2020).

### *2.3 Economic Predictors*

#### *2.3.1 Gross Domestic Product*

Gross Domestic Product (GDP) is a fundamental indicator of a country's economic health, representing the total economic output within a given period while accounting for the consumption of goods and services used in production. GDP is calculated based on various components, including personal consumption expenditures, gross domestic investment, net exports of goods and services, government consumption expenditures, and gross investment (Dynan et al., 2018).

Several empirical studies have established the link between GDP growth and company performance across various industries and regions. For instance, Surya et al. (2021) found that GDP growth boosts the productivity and financial performance of companies in Indonesia, particularly small and medium-sized enterprises (SMEs).

Similarly, Sibindi & Godi (2014) examined the relationship between economic growth and the expansion of Africa's long-term insurance and takaful sectors, concluding that higher GDP levels support the increased penetration of financial protection products, including Islamic insurance. Economic expansion creates favorable conditions foR insurance and takaful providers, as higher disposable incomes allow individuals and businesses to invest in risk management solutions such as life takaful, family takaful, and general takaful products.

#### *2.3.2 Inflation Rate*

Another essential economic predictor of business performance is the inflation rate, which reflects the percentage change in a specific price index over time (Abaidoo & Anyigba, 2020). Inflation influences the purchasing power of consumers, the cost of doing business, and the overall stability of financial markets. Additionally, Abaidoo & Anyigba (2020) suggested that inflation can introduce variability in a firm's asset holdings and operational efficiency, leading to increased costs and financial instability. This theoretical link implies that inflation may negatively affect both the financial health and operational performance of takaful firms.

Similarly, a study by O'Connell (2023) assessed the impact of inflation on UK bank profitability over two decades (1998–2018) and found a significant relationship between inflation and financial performance. The study demonstrated that higher inflation rates reduce lending margins, increase default risks, and elevate funding costs, ultimately constraining banks' ability to maintain profitability.

However, the relationship between inflation and takaful performance is not always straightforward. Sahudin et al. (2022), in their study on Malaysian takaful operators, found that inflation negatively affects business performance, contradicting previous findings. The study

suggested that higher inflation reduces consumer affordability, leading to a decline in new policy subscriptions and renewal rates.

### *2.4 Underpinning Theory of Agency*

Agency theory, first introduced by Jensen and Meckling (1976), provides a framework for understanding the relationship between principals, such as shareholders or owners, and agents, like managers, who are tasked with acting on behalf of the principals (Jensen & Meckling, 1976). This relationship inherently involves the delegation of authority and decision-making, which can lead to conflicts of interest due to differing goals or information asymmetry (Jensen & Meckling, 1976).

Such conflicts may result in agency costs, including monitoring costs by the principal and bonding costs by the agents. Reduced agency costs are associated with increased firm value and enhanced performance (Sahudin et al., 2022). Agency conflicts are particularly relevant in financial institutions, including takaful operators, where management decisions directly influence the financial well-being of both shareholders and policyholders.

In Islamic financial institutions, the role of trust, ethical governance, and mutual responsibility is paramount, making the agency-principal relationship more complex due to the emphasis on Shariah compliance. In this context, agency theory is closely related to the concept of *wakalah* (agency contract), which underpins many takaful operations (Che Arshad et al., 2020; Sahudin et al., 2022).

Overall, agency theory offers valuable insights into the governance challenges and fiduciary responsibilities of takaful operators. By integrating Islamic finance principles with modern governance mechanisms, takaful firms can achieve both financial success and ethical integrity. The *wakalah* contract not only aligns with Shariah principles but also serves as a foundation for ensuring operational transparency, accountability, and long-term sustainability within the takaful industry. Future research should explore additional agency-related factors, such as managerial incentives, regulatory effectiveness, and participant engagement, to further enhance the operational efficiency of takaful operators in Malaysia and beyond.

## 3.0 Methodology

### *3.1 Research Framework*

The research framework for this research is based on an underpinning theory, namely the Agency Theory (Jensen & Meckling, 1976). This study has incorporated five operator's specific constructs as independent variables: fee & commission income, zakat paid, underwriting risk, liquidity and firm's size. Moreover, the study also incorporates another two economic predictors; gross domestic product and inflation rate. In addition, all variables will be analyzed to examine whether there is a significant relationship between performance of family takaful operators and vice versa. Figure 1 presents the proposed framework for this study.

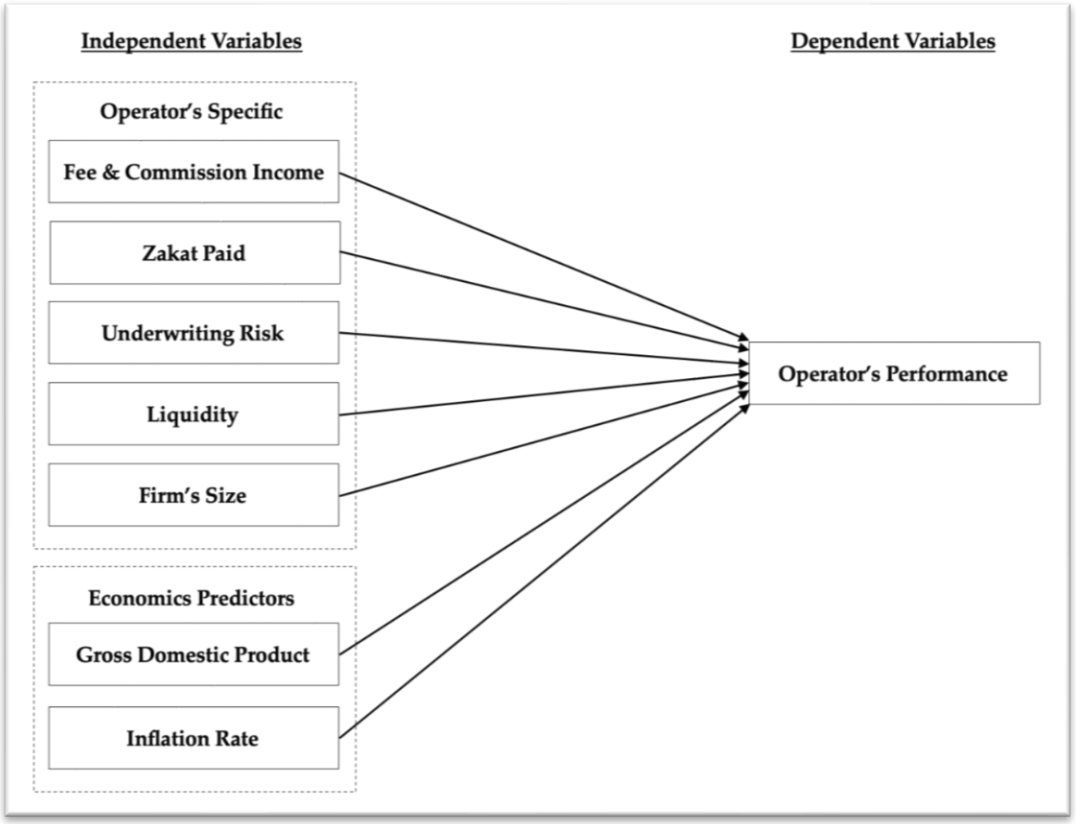



**Figure 1: Research Framework**

### *3.1 Hypotheses Development*

The conceptual model's underlying theory informs hypotheses, which are frequently relational in nature. In keeping with this definition, hypotheses can be summed up as logical relationships between two or more variables that are expressed as testable propositions.

#### *3.1.1 Performance of Family Takaful Operator*

Evaluating a company's business performance is crucial. This refers to the ability of business performance to manage finances effectively. Several indicators can be used to measure company performance, with return on the asset being one of the most used (Che Arshad et al., 2020). The study employed the ROA as a performance proxy by calculating income over total assets.

#### *3.1.2 Fee & Commission Income and Performance of Family Takaful Operator*

H1: The increase in FCI will substantially increase the business performance of the operator of the family takaful.

#### *3.1.3 Zakat Paid and Performance of Family Takaful Operator*

H2: The higher zakat paid by the operators will substantially increase the operators' performance and thus affect the performance.

#### *3.1.4 Underwriting Risk and Performance of Family Takaful Operator*

H3: Underwriting risk will stupendously increase the performance of Malaysian family takaful operators.

#### *3.1.5 Liquidity and Performance of Family Takaful Operator*

H4: The operator's lower liquidity ratio would increase profitability and, thus, the operator's performance.

#### *3.1.6 Firm's Size and Performance of Family Takaful Operator*

H5: Firm size will effectively associate with the performance of family takaful operators.

#### *3.1.7 Gross Domestic Product and Performance of Family Takaful Operator*

H6: Gross domestic product will significantly affect the family takaful operators' business performance.

#### *3.1.8 Inflation Rate and Performance of Family Takaful Operator*

H7: The inflation rate will positively affect the efficiency of family takaful operators in Malaysia.

### *3.2 Data Collection Procedures*

This study employs secondary data collection to examine the determinants of business performance for Malaysian family takaful operators. Secondary data is widely utilized in financial and economic research due to its credibility, accessibility, and ability to capture historical trends (Rubin et al., 2011). Given the quantitative nature of this study, data collection focuses on obtaining panel data covering nine Malaysian family takaful operators over an 10-year period (2013–2022).

The data for this study was sourced from two primary databases. Firm-specific variables, including fee & commission income, zakat paid, underwriting risk, liquidity, and firm size, were extracted from the Thomson Reuters database, a globally recognized financial data source widely used in empirical research on Islamic finance and takaful (Ali et al., 2020; Haniff et al., 2021). Meanwhile, macroeconomic indicators such as gross domestic product (GDP) and the inflation rate were retrieved from the World Bank database, which serves as an authoritative source for economic data in academic and policy research.

### *3.3 Model Specification*

This study employs an econometric model to examine the determinants of business performance among Malaysian family takaful operators. The model is formulated as follows:

$$BPit=\alpha 0+\beta 1FCIit+\beta 2ZPit+\beta 3UWRit+\beta 4LQit+\beta 5FZit+\beta 6GDPit+\beta 7IRit+\varepsilon it$$

BP represents business performance, measured by Return on Assets (ROA), calculated as total net profit from operating profit divided by total assets. FCI denotes fee & commission income, which serves as a primary revenue source for takaful operators under the *wakalah* (agency) model. ZP represents zakat paid, a financial obligation for Islamic financial institutions. GDP refers to gross domestic product per capita, measured in natural logarithm form to capture the broader economic environment's effect on takaful demand and overall financial stability (Remli et al., 2018). UWR denotes underwriting risk, which is calculated as net claims incurred and expenses divided by net earned contributions. LQ represents liquidity, measured as total cash and cash balance divided by total liabilities. IR stands for the inflation rate, expressed in percentage form. Inflation impacts investment returns, operational costs, and policy affordability, making it a crucial macroeconomic determinant of takaful performance. α is the constant term, representing the expected value of BP when all independent variables are zero. β denotes the beta coefficients for each independent variable, indicating the strength and direction of their influence on business performance. ε represents the error term, capturing unobserved factors that may influence business performance but are not included in the model.

### *3.4 Method of Data Analysis*

A 10-year panel dataset covering nine family takaful operators in Malaysia was analyzed using multiple regression models, including Ordinary Least Squares (OLS), Robust OLS, Cluster Robust OLS, and Feasible Generalized Least Squares (FGLS). The application of these models enhances the robustness of statistical inferences, particularly in addressing issues related to heteroscedasticity, autocorrelation, and cross-sectional dependence. To ensure the validity and reliability of the regression analysis, diagnostic tests were conducted to check for correlation, multicollinearity, and heteroscedasticity, which are crucial for avoiding biased or misleading results in panel data econometrics.

## 4.0 Results

### *4.1 Descriptive Analysis*

Table 1 illustrates the descriptive statistical analysis results. Firm size (FS) has the highest mean value at 13.787, which means that takaful operators have large asset bases. This is in line with research that links firm size to financial stability (Che Arshad et al., 2020; Sahudin et al., 2022). Return on Assets (ROA) has the lowest mean at 0.017, which means that Islamic financial institutions usually have lower ROA because they have to follow Shariah law and the takaful model structure (Abdullah et al., 2022; Nugroho et al., 2022). The highest standard deviation, 4.022, is found in Fee & Commission Income (FCI). This shows that revenue generation is very variable, probably because of different levels of market penetration and agency effectiveness (Malhotra et al., 2019). On the other hand, ROA has a low standard deviation (0.032), which means that its profitability doesn't change much, possibly because of regulatory oversight and risk-sharing mechanisms (Haniff et al., 2021).

Normality tests show that most variables don't follow a normal distribution, which is in line with what has been found before in financial data. The chi-squared test's p-values are all below 0.05, except for firm size. This non-normality, prevalent in panel datasets, is examined in previous studies regarding the use of panel regression models with generalised least squares (GLS) and robust estimators in the absence of strict normality.

A further examination of macroeconomic indicators reveals a low standard deviation (0.069) for GDP per capita, signifying stable economic conditions that facilitate the growth of the takaful industry (Remli et al., 2018). On the other hand, the inflation rate (IR) has a higher standard deviation (1.416), which means that prices are changing, which could affect how many people want to buy takaful products (Sahudin et al., 2022). Table 3 provides additional information about these descriptive results.

| Variable | Mean | Std. Dev. | Pr(skewness) | Pr(kurtosis) | Prob>chi2 |
|---|---|---|---|---|---|
| ROA | 0.017 | 0.032 | 0.000 | 0.043 | 0.000 |
| FCI | 5.975 | 4.022 | 0.194 | 0.000 | 0.000 |
| ZP | 3.460 | 2.770 | 0.332 | 0.000 | 0.000 |
| UWR | 1.055 | 0.242 | 0.002 | 0.000 | 0.000 |
| LQ | 0.068 | 0.053 | 0.005 | 0.693 | 0.025 |
| FS | 13.787 | 1.172 | 0.547 | 0.345 | 0.525 |
| GDP | 9.271 | 0.069 | 0.792 | 0.000 | 0.002 |
| IR | 1.958 | 1.416 | 0.004 | 0.838 | 0.023 |

***Table 1 Descriptive Statistic Analysis***

### *4.2 Correlation Analysis*

Table 2 shows how Return on Assets (ROA) is related to both firm-specific variables (Fee & Commission Income (LFCI/FCI), Zakat Paid (LZP/ZP), Underwriting Risk (UWR), Liquidity (LQ), Firm Size (FS), and macroeconomic indicators (Gross Domestic Product (GDP) and Inflation Rate (IR). There is a moderate positive correlation between ROA and Fee & Commission Income (LFCI) (r = 0.261), which means that higher fee and commission income may help firms' assets make more money. In the same way, Zakat Paid (LZP) has a moderate positive correlation with ROA (r = 0.306), which means that firms that make more money tend to pay more zakat. This could also mean that they are doing better financially and following governance rules.

Underwriting Risk (UWR), on the other hand, has a fairly strong negative correlation with ROA (r = –0.446), which means that higher underwriting risk is linked to lower profitability. Liquidity (LQ) has a weak negative correlation with ROA (r = –0.149), which means that holding too much liquidity may make it less efficient to use assets.

Firm Size (FS) has a weak positive correlation with ROA (r = 0.233), which means that bigger companies might be able to take advantage of economies of scale, but the link isn't very strong. When it comes to macroeconomic factors, GDP and ROA are almost completely unrelated (r = 0.005), and the Inflation Rate (IR) has a very weak negative relationship (r = –0.011). This indicates that the profitability of firms in the sample is more significantly affected by internal, firm-specific factors than by overarching macroeconomic conditions.

| Variables | ROA | FCI | ZP | UWR | LQ | FS | GDP | IR |
|---|---|---|---|---|---|---|---|---|
| ROA | 1 | | | | | | | |
| LFCI | 0.261 | 1 | | | | | | |
| LZP | 0.306 | -0.042 | 1 | | | | | |
| UWR | -0.446 | -0.121 | -0.126 | 1 | | | | |
| LQ | -0.149 | 0.14 | -0.13 | -0.191 | 1 | | | |
| FS | 0.233 | -0.245 | 0.379 | -0.13 | -0.109 | 1 | | |
| GDP | 0.005 | -0.015 | 0.074 | -0.046 | 0.107 | 0.198 | 1 | |
| IR | -0.011 | 0.064 | 0.05 | -0.226 | -0.019 | -0.093 | 0.131 | 1 |

***Table 2 Correlation Analysis Matrix***

### *4.3 Multicollinearity Check*

Multicollinearity, an issue in multiple regression models due to high correlations among independent variables, can lead to unreliable regression coefficient estimates. This study utilized the Variance Inflation Factor (VIF) test to detect multicollinearity, with a VIF value above 5 indicating a significant problem. The results showed that all VIF values were below 5, with a mean VIF of 1.163, suggesting low correlation among predictors. Individual VIF values ranged from 1.090 to 1.358, confirming that each independent variable contributes uniquely to business performance.

These findings align with previous research in Islamic finance, highlighting the necessity of assessing multicollinearity before regression analysis. A low VIF score is crucial for stable and interpretable regression coefficients, thus avoiding statistical distortions from overlapping independent variables. Prior studies indicate that multicollinearity frequently occurs with multiple financial ratios due to structural industry relationships. The lack of multicollinearity in this study supports the model's robustness, confirming that each predictor independently affects takaful performance. Moreover, it is significant for financial research to address multicollinearity when analyzing both firm-specific and macroeconomic factors, as their interactions can obscure accurate estimations of business performance impacts. Low VIF values in this study indicate minimal correlations, enhancing the precision of variable impact assessments.

| Variables | VIF | Tolerance |
|---|---|---|
| FCI | 1.358 | 0.736 |
| ZP | 1.200 | 0.833 |
| UWR | 1.166 | 0.857 |
| LQ | 1.113 | 0.898 |
| FS | 1.111 | 0.900 |
| GDP | 1.104 | 0.906 |
| IR | 1.090 | 0.918 |
| Mean VIF | 1.163 | |

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*Table 3 Variance Inflation Factor (VIF) for multicollinearity check*

### *4.4 Heteroscedasticity Test*

The study conducted Ordinary Least Squares (OLS) regression to assess heteroscedasticity, indicating variable residuals across observations and contravening the homoscedasticity assumption, following a check for multicollinearity. This results in ineffective standard errors and skewed statistical inference. The Breusch-Pagan test yielded a chi-square statistic of 6.60 and a p-value of 0.0102, signifying the rejection of the null hypothesis of constant variance and affirming heteroscedasticity. This confirmation raises concerns about unreliable standard errors and inconsistent coefficient estimates, particularly in financial contexts where firms exhibit varying performance and risk.

### *4.5 Regression Estimation Results*

Result in table 4, fee and commission income (FCI) positively correlates with return on assets (ROA) at the 1% significance level, with beta coefficients consistently between 0.002 and 0.003, indicating that wakalah-based fee structures enhance the financial viability of family takaful operators. Underwriting risk (UWR) negatively impacts ROA significantly across several models, with a beta coefficient of -0.059, highlighting the importance of effective risk management practices. Liquidity (LQ) presents a strong inverse relationship with ROA, revealed by beta coefficients indicating that excessive liquidity may hinder profitability. The analysis shows a beneficial impact of zakat paid (ZP) on ROA, affirming the role of financially stable takaful operators in Islamic corporate social responsibility, although its significance varies across models. Firm size (FS) does not significantly influence ROA, suggesting instead that management efficiency is more critical than size.

In contrast, GDP per capita demonstrates no significant relationship with ROA, challenging the notion that economic growth directly benefits takaful profitability. The inflation rate (IR) shows inconsistent significance, indicating it may affect takaful performance variably depending on the methodologies used. The overall model explains 40% of ROA variability, with various unmeasured factors accounting for the remainder. Model fit indicators,

AIC and BIC, emphasize optimized performance in explaining variations while avoiding overfitting. These findings necessitate further exploration into the effects of inflation and additional factors influencing takaful operations.

| Model | Model I (Basic OLS) | | | Model II (Robust OLS) | | | Model III (Clustered Robust OLS) | | | Model IV (Feasible GLS) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | *Coef.* | *St.Err.* | ***p-value*** | *Coef.* | *St.Err.* | ***p-value*** | *Coef.* | *St.Err.* | ***p-value*** | *Coef.* | *St.Err.* | ***p-value*** |
| FCI | 0.002 | 0.001 | **0.002*** ** | 0.002 | 0.000 | **0.000*** ** | 0.002 | 0.001 | **0.003*** ** | 0.002 | 0.001 | **0.001*** ** |
| ZP | 0.002 | 0.001 | **0.051*** | 0.002 | 0.001 | **0.023** ** | 0.002 | 0.001 | **0.105** | 0.002 | 0.001 | **0.038** ** |
| UWR | -0.059 | 0.012 | **0.000*** ** | -0.059 | 0.014 | **0.000*** ** | -0.059 | 0.024 | **0.040** ** | -0.059 | 0.012 | **0.000*** ** |
| LQ | -0.142 | 0.054 | **0.010** ** | -0.142 | 0.046 | **0.003*** ** | -0.142 | 0.075 | **0.094*** | -0.142 | 0.051 | **0.006*** ** |
| FS | 0.004 | 0.003 | **0.163** | 0.004 | 0.003 | **0.236** | 0.004 | 0.006 | **0.565** | 0.004 | 0.003 | **0.140** |
| GDP | -0.005 | 0.041 | **0.912** | -0.005 | 0.037 | **0.903** | -0.005 | 0.027 | **0.868** | -0.005 | 0.039 | **0.908** |
| IR | -0.003 | 0.002 | **0.155** | -0.003 | 0.001 | **0.049** ** | -0.003 | 0.001 | **0.049** ** | -0.003 | 0.002 | **0.133** |
| Constant | 0.063 | 0.374 | **0.867** | 0.063 | 0.323 | **0.846** | 0.063 | 0.258 | **0.814** | 0.063 | 0.357 | **0.860** |
| R-squared | | 0.400 | | | 0.400 | | | 0.400 | | | Not Applicable in GLS | |
| F-test | | 7.810 | | | 10.444 | | | 70.972 | | | Not Applicable in GLS | |
| AIC | | -395.912 | | | -395.912 | | | -395.912 | | | -395.912 | |
| BIC | | -375.914 | | | -375.914 | | | -375.914 | | | Not Applicable in GLS | |

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

***Table 4 Results for Regression Estimations***

## 5.0 Discussions

### *5.1 Fee & Commission Income and Performance of Family Takaful Operator*

The study confirms that fee & commission income (FCI) significantly and positively influences the business performance of Malaysian family takaful operators. This finding reinforces the importance of fee-based revenue streams in sustaining takaful firms' profitability, particularly given the wakalah (agency) model, which serves as the primary revenue mechanism in takaful operations. Unlike conventional insurance firms that generate income through investment returns and risk underwriting, takaful operators rely heavily on management fees and commissions from policyholders, making FCI a crucial determinant of financial success (Malhotra et al., 2019; Li, 2022).

Past studies in Islamic finance and conventional banking have demonstrated the significance of non-interest-based income in improving financial performance. Li (2022) found that FCI is a major contributor to the profitability of Chinese commercial banks, as it diversifies income sources and reduces dependence on volatile investment returns. Similarly, Malhotra et al. (2019) concluded that Indian banks with a higher proportion of fee-based income experienced improved financial stability, as such revenue streams are less sensitive to interest rate fluctuations and credit risks. In the takaful sector, Muhammad Zuki (2024) have highlighted that fee & commission income serves as a risk-free source of revenue, ensuring that takaful operators remain financially sustainable even during economic downturns.

The positive and significant relationship between fee & commission income and business performance highlights the critical role of management fees in the profitability of Malaysian family takaful operators. Given the wakalah-based revenue model, it is imperative for takaful firms to strengthen their fee-based income strategies through product innovation, market expansion, and digital transformation. These findings align with past research demonstrating that financial institutions with diversified income streams, particularly those reliant on fee-based revenues, experience greater financial resilience and stability (Li, 2022; Malhotra et al., 2019).

### *5.2 Zakat Paid and Performance of Family Takaful Operator*

The study's findings confirm that zakat paid (ZP) positively influences business performance, reinforcing the argument that Islamic financial institutions that actively contribute to zakat demonstrate stronger financial health and ethical governance. This result is consistent with previous studies that highlight the role of zakat as both a religious obligation and a financial performance indicator (Sulaeman et al., 2022; Javaid & Al-Malkawi, 2018; Abd Samad et al., 2017). Since zakat is calculated based on net assets, higher zakat payments suggest that a firm is financially stable and profitable, which in turn reflects its ability to contribute to social and economic welfare in line with Islamic financial principles.

Empirical evidence supports the positive association between zakat contributions and business performance. Javaid & Al-Malkawi (2018) found that firms in Saudi Arabia that regularly fulfill their zakat obligations experience higher levels of investor confidence and corporate transparency, which indirectly enhances financial performance. Similarly, Sulaeman et al. (2022) examined the impact of zakat payments on Indonesian Islamic banks' profitability and discovered that higher zakat contributions correlate with increased financial stability and customer retention. This suggests that zakat compliance does not merely serve as a religious duty but also functions as an ethical business practice that fosters greater public trust and institutional credibility.

The findings confirm that zakat paid positively contributes to the business performance of Malaysian family takaful operators, reinforcing the dual role of zakat as both a financial and ethical obligation. Firms that actively fulfill their zakat responsibilities tend to experience greater public trust, corporate transparency, and financial resilience, aligning with previous research that highlights zakat's impact on firm profitability and stakeholder confidence (Javaid & Al-Malkawi, 2018; Abd Samad et al., 2017).

### *5.3 Underwriting Risk and Performance of Family Takaful Operator*

The study confirms that underwriting risk (UWR) has a significant negative impact on the business performance of Malaysian family takaful operators, reinforcing the findings of past research (Luqman et al., 2022; Zainudin et al., 2018; Akotey et al., 2023; Che Arshad et al., 2020). Underwriting risk refers to the possibility of financial losses due to inaccurate risk assessment, mispriced policies, or an excessive claims ratio, which can severely affect a takaful operator's financial stability if not effectively managed. Since takaful is based on mutual cooperation and shared responsibility, underwriting inefficiencies can lead to financial distress, increased claim liabilities, and depletion of participants' funds, ultimately weakening overall business performance.

In addition, Zainudin et al. (2018) analyzed insurance firms in selected Asian countries and found that underwriting risk negatively affects return on assets (ROA) and return on equity (ROE), suggesting that insufficient risk evaluation leads to deteriorating firm performance.

Furthermore, Akotey et al. (2023) investigated the impact of underwriting losses on the Ghanaian insurance industry, reporting that companies with excessive underwriting risks experience significant financial distress due to poor claims management and inefficient risk pricing.

These findings highlight the critical importance of effective risk management in maintaining financial health and sustainability in the takaful sector. Unlike conventional insurers that operate based on fixed premium models, takaful operators rely on *tabarru'* (donation) contributions, where mispricing of risks can quickly deplete the risk fund, leading to deficits and financial instability.

### *5.4 Liquidity and Performance of Family Takaful Operator*

Liquidity plays a critical role in ensuring the financial stability of takaful operators, as it reflects the firm's ability to meet short-term obligations and maintain solvency. However, the findings of this study reveal a negative and significant relationship between liquidity (LQ) and business performance (ROA), indicating that excess liquidity may reduce profitability rather than enhance financial sustainability. While maintaining sufficient cash reserves is essential for covering claims, operational costs, and regulatory requirements, holding too much liquidity can lead to inefficient capital allocation, reduced investment opportunities, and lower financial returns (Che Arshad et al., 2020; Alam et al., 2023).

The negative impact of liquidity on profitability has been widely documented in both Islamic and conventional financial institutions. Hemrit (2020) found that Islamic banks with high liquidity ratios tend to face declining profitability, primarily due to limited investment instruments that comply with Shariah principles. Unlike conventional banks, Islamic financial institutions, including takaful operators, cannot engage in interest-based investments, restricting their ability to earn significant returns from excess cash reserves. Sahudin et al. (2022) similarly reported that excessive liquidity negatively affects takaful firms' performance, as unused cash results in opportunity costs and lost potential earnings.

### *5.5 Firm's Size and Performance of Family Takaful Operator*

Firm size (FS) has traditionally been regarded as a key determinant of business performance, with larger firms expected to benefit from economies of scale, stronger brand recognition, and market dominance. However, the findings of this study indicate that firm size has an insignificant impact on the financial performance of Malaysian family takaful operators, suggesting that scale alone does not guarantee superior profitability. These results challenge conventional assumptions and emphasize the importance of internal operational efficiency over mere expansion.

Several studies have found a positive relationship between firm size and business performance, arguing that larger firms enjoy cost efficiencies, better risk diversification, and greater market influence. Ashraf et al. (2017) highlighted that larger financial institutions tend to attract more customers, access better investment opportunities, and leverage superior risk management frameworks, leading to enhanced profitability. Similarly, Hunter & Timme (1986) suggested that banks and insurance firms with substantial asset bases experience higher efficiency and improved financial stability. The findings suggest that in the takaful industry, financial performance is driven more by operational efficiency, risk management, and revenue diversification rather than sheer size.

### *5.6 Gross Domestic Product, Inflation Rate and Performance of Family Takaful Operator*

This study found that inflation significantly influences the business performance of Malaysian family takaful operators, whereas gross domestic product (GDP) growth was found to be insignificant. These findings suggest that inflation-related cost pressures directly impact takaful firms, while overall economic growth does not necessarily translate into improved business performance.

Inflation is a key economic indicator that affects the purchasing power of consumers, cost structures of financial institutions, and investment returns. The significant negative relationship between inflation and takaful performance in this study aligns with previous research (Abaidoo & Anyigba, 2020; O'Connell, 2023; Asiamah et al., 2019; Shiu, 2004; Che Arshad et al., 2020). These studies have demonstrated that higher inflation rates lead to increased operational costs, reduced disposable income for consumers, and challenges in maintaining profitability in financial institutions.

## 6.0 Conclusion

This study examined the determinants of business performance among Malaysian family takaful operators, focusing on both firm-specific characteristics and macroeconomic influences. The findings indicate that Fee & Commission Income (FCI) and Zakat Paid (ZP) positively influence business performance, confirming their roles as significant revenue sources and ethical financial indicators in Islamic insurance operations. The study also found that Underwriting Risk (UWR) and Liquidity (LQ) negatively affect business performance, emphasizing the need for effective risk management and investment optimization strategies in the takaful sector.

Interestingly, Firm Size (FS) was found to be an insignificant determinant of business performance, challenging the assumption that larger operators necessarily achieve better financial outcomes. Furthermore, macroeconomic factors exhibited mixed results—while Inflation significantly impacted business performance, GDP Growth was found to be insignificant. This suggests that the family takaful sector is influenced more by internal operational efficiencies and inflationary pressures rather than broader economic growth trends. The study makes substantial contributions to the field of Islamic finance by introducing newly incorporated variables (FCI and ZP), applying multi-model regression techniques, and providing practical recommendations for industry stakeholders.

Despite its contributions, the study acknowledges certain limitations, such as the limited sample size, exclusive reliance on secondary data, and absence of qualitative insights. These limitations highlight the need for future research to explore broader datasets, incorporate qualitative perspectives, and adopt advanced analytical models. In conclusion, this study reinforces the critical role of revenue diversification, risk mitigation, and financial governance in ensuring the sustainability of family takaful operators. The insights provided serve as valuable guidance for takaful firms, policymakers, and researchers in strengthening the resilience, competitiveness, and ethical integrity of the takaful industry in Malaysia and beyond.

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# THE VIABILITY OF SCHOOL COUNSELING PROGRAMS FOR REFUGEE STUDENTS IN MALAYSIA

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***Abstract:*** *The aim of this paper is to explore the viability of school counseling program for refugee students' population in Malaysia. It is done by generally synthesizing information gathered from literatures on the refugee phenomenon in Malaysia, the educational provision for refugees in Malaysia, and the evolution of school counseling program in Malaysia. The viability of school counseling program for refugee students' population in Malaysia was evaluated and discussed by integrating all the information gathered from this literature review exercise. The literatures' syntheses provided baseline data to understand the possibility to establish appropriate school counseling program for refugee students in Malaysia*

***Keywords:*** *Counseling, refugee, school, Malaysia*

## Introduction

Refugees' experiences in Malaysia are complex and divergent. By the end of February 2020, there was around 178,990 refugees and asylum-seekers registered with United Nations High Commissioner for Refugees (UNHCR) in Malaysia, including around 46,520 children below the age of 18 (UNHCR, 2020). Since Malaysian government schools do not offer admission to refugee children, most of them go to UNHCR partially funded learning centers and schools or its' implementing partners. These schools provide basic education through subjects like Mathematics, English, Science and Computer skills. They are usually run by either NGOs or community organizations who charge minimal fees, and trely a lot on donations besides UNHCR funds (Koizumi & Hoffstaedter, 2015).

A number of studies have reported the positive impact of the school counseling activities, given they are facilitated by competent and professional school counselors. School counseling activities have remarkably reduced mental illness symptoms among school students (Hassan, 2015). They also helped students suffering from family problems, adjust and improve (Rose & Rose, 1992). School counseling programs do not only cater to the mental health and emotional issues of students; besides, they make sure students achieve their objectives behind going to schools which is to perform academically and intellectually well. In fact, academic issues have been the main concern of the modern trends in school counseling where counselors make sure, they are the ultimate goal of any activity they plan. That is why we find elementary students' academic achievement was positively influenced by the provision of such services (Sink & Stroh, 2003). School counselors do not merely provide remedial services, they besides play an important role in preventing the occurrence of behavioral, personal as well as social problems through direct and indirect intervention. Direct interventions are the ones provided to the students, whereas indirect interventions are the ones aimed at people around the students like

management staff, teachers, and community at large, as providing them support will result in positive impact on students.

The outcome of such efforts was the prevention of many problems, such as students drop out from school (Kaufman, Klein & Frase, 1999). Just like personal, social, and academic concerns are important to school counselor, we find that career related matters form a critical part of school counseling programs where links between student's academics and future career are established and strengthened. Many studies were carried out in this regard and found that effective career counseling helped high school students with their college choices. In general, school counseling programs are of substantial assistance to the school leadership in managing school issues and achieving school's educational goals, as it was reported that schools which implement full guidance and counseling programs have a range of privileges over other schools, their students earn higher grades, and they have more positive climate that helped students feel safe in the school and reduce classroom disruption (Lapan, Gysbers & Sun, 1997).

## Literature Review

### *Refugee Education in Malaysia*

Education plays an important role in equipping refugees with skills of peace building and conflict resolution that would definitely improve their life conditions as well as their families' ones and achieve some economic and social development (Sinclair, 2002). Similarly, Demirdjian (2012) argued that child refugees are entitled to the right of education just like any other children in their country of origin. Hence, education that is provided in such a situation is considered of high importance, it protects children well-being, creates learning opportunities, and nurtures overall child's development (Sinclair, 2002). While education is seen as a psychosocial support for children that protects them against violence and any other threats, it is difficult to guarantee education to child refugees due to lack of means and resources: building, administration, teaching materials, teachers, and funds.

In Malaysia, since refugees are denied access to public education, the UNHCR had to take care of 46,610 refugee children's education through partnering with volunteering organizations and learning centers. Yet, only 50 percent of primary aged children and 19 percent of secondary aged children are enrolled in those centers (Bailey & İnanç, 2019). While Malaysian government schools don't offer admission to refugees, the international and private school are expensive and most of them require proper documents that refugees and asylum seeker don't process. Alternatively, refugees and asylum seekers in Malaysia go to UNHCR partially funded learning centers and schools or its implementing partners. These schools provide basic education through subjects like mathematics, English, science and computer skills. They are usually run by either NGOs or community organizations who charge minimal fees, and thus they rely a lot on donations besides UNHCR funds (Koizumi & Hoffstaedter, 2015).

### *School Counseling Evolution in Malaysia*

School counseling movement in Malaysia took off in the 1960s following the similar movement in the United States of America and others such as Canada and Great Britain. Prior to that movement, and according to the Malaysian traditional practices; guidance and counseling existed even before the global movement, as classroom teachers, housemasters, and hostel masters used to provide those services to students (Othman & Bakar, 1993). It is worth

mentioning here that those practices could be tracked back to a report issued by the ministry of education in 1938 where the need to guidance services was expressed.

In 1963, a structured guidance services in Malaysian schools were introduced to the Ministry of Education, and that led to the establishment of guidance units in the Ministry of Education and in all the education departments of each state (Malaysian Ministry of Education, 1970). Acting on that, assistant supervisors from each state's education Department have to go for 6 months course on guidance, that is to allow them to train teachers in their respective states, as the ministry ruled that there should be a guidance teacher in each school, who provide guidance and counseling services besides their teaching responsibilities (Mey & Kok-Mun, 2010).

After the Educational Planning and Research Division EPRD was allocated a guidance section, it started promoting career guidance in primary and secondary school (Awang, 1969). Although all the aforementioned developments led to acceptance of guidance in schools as it helped individuals make correct choices and decisions, work on guidance faded out due to financial reasons as well manpower challenges. Soon in 1980s there were guidance and counseling units established by the Ministry of Education in schools, and the school counselors' practices were governed by a book published first in 1984 and then in 1993, titled: "Guidelines for the implementation of Guidance and Counseling Services in Schools). School counselors this time were full time officers who spend all their time providing counseling services to students.

## Discussion

### *The School Counseling*

With the growing human needs and the increasing complexity of life, counseling has become an important part of school system. School counseling has emerged over 100 years ago as a humanitarian response to the students affected by institutional changes, social and school reform, and economic circumstances such as poverty. The school counseling nowadays contributes with a great role to aspiring students and preparing the appropriate environment for them to have a successful academic achievement (Dahir & Stone, 2015). Since school counseling has been evolved as a measure to help students adapt with their surrounding circumstances, it is considered today as a necessary part of schools as it helps students adjust with their ever varying and changing lives, and thus it is an agent that facilitates growth and development of today's children.

A body of research on professional school counseling role and effectiveness has carried out that school counseling activities have a positive effect on students (Erford, 2019). School counselor is now assuming an even greater role besides the previous ones, he is now an agent of change not only in the school but in the society as well through achieving social justice in schools and closing the gap between diverse populations of students. Thus, school counselor has two important roles: school counselors are both mental health specialists and educational specialists in a school setting who focuses on the student as a learner, with school counseling services designed, delivered, and documented in an accountable manner that either directly and

indirectly advances academic achievement, enhances student development and well-being, and informs important others. Figure 1 displays the American School Counseling Association (ASCA) school counseling model that summarizes school counselor's roles and the relationship among them.

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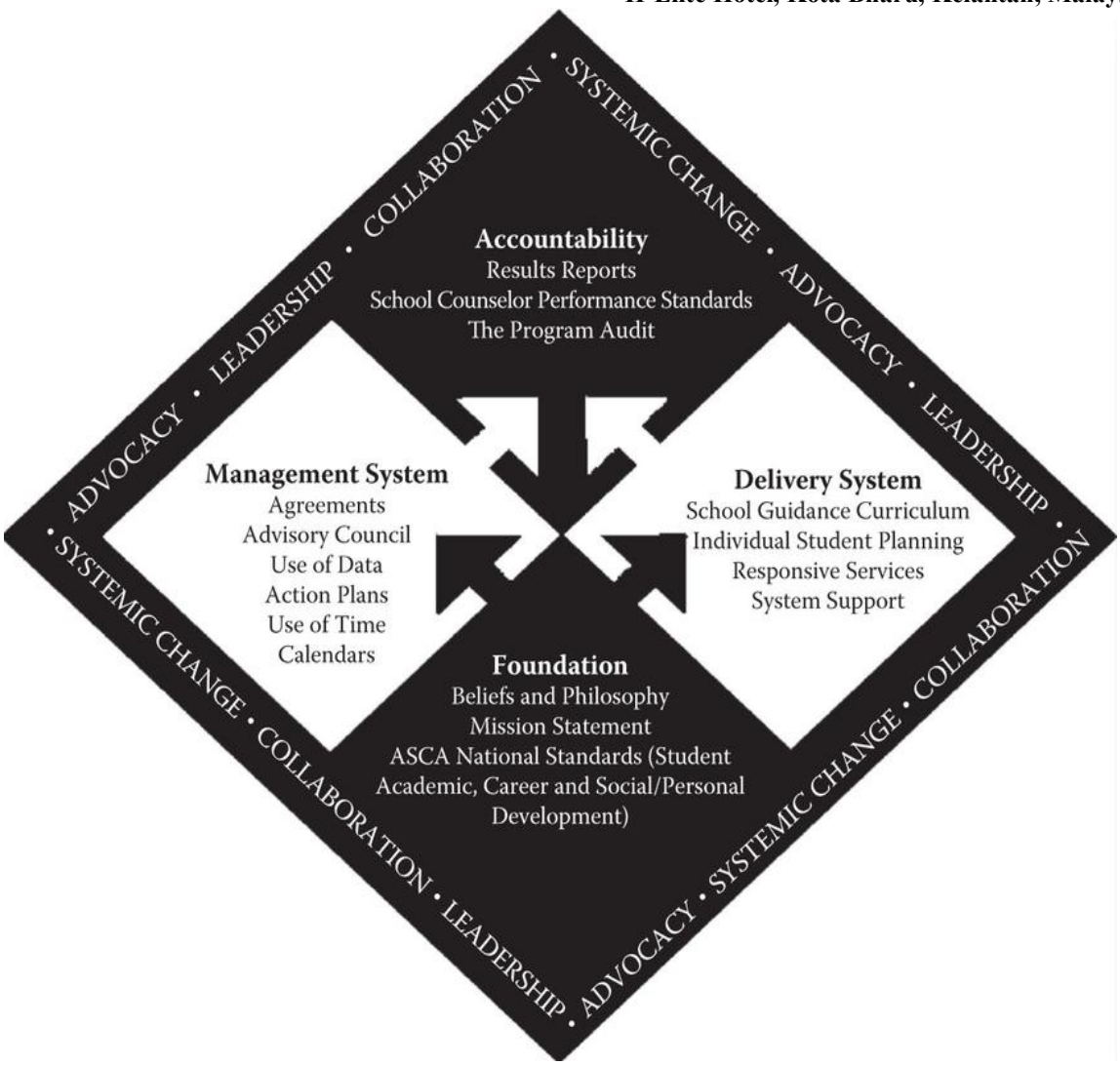



**Figure 1: The ASCA's School Counseling Model**

Source: (Kolbert et al., 2017)

Many efforts were made to position counselors in schools in a way that their contributions become significant until the 1970s when those efforts were crowned with acknowledgement by different bodies like the US department of education, University of Missouri and ASCA, where counselor's role was redefined to pay attention to all students rather than some of them, and have a program rather than position (Gysbers & Henderson, 2014). Nowadays, school counseling represents a system that has to be in line with the school educational system, and only when they function together then students may be able to achieve their goals. Therefore, Figure 2 below demonstrates the relationship between school counseling and the school educational system.

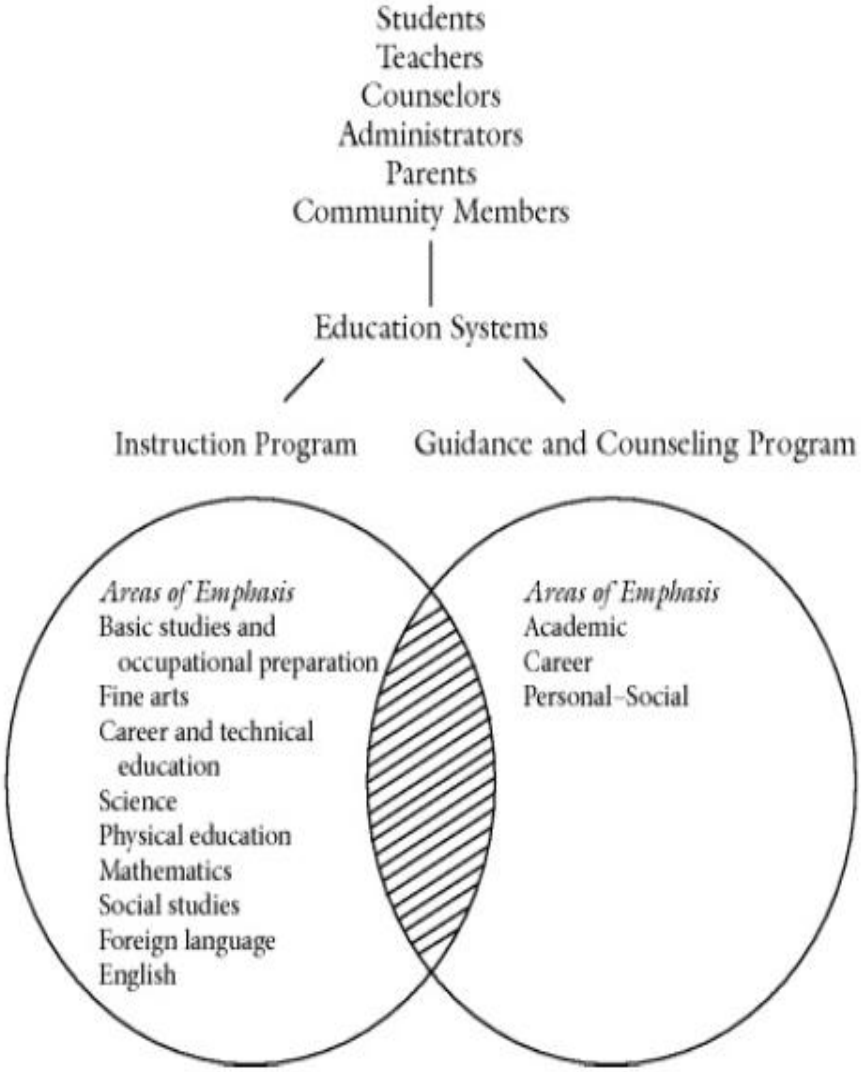



**Figure 2: Relationship between School Counseling and School Educational System**
Source: (Gysbers & Henderson, 2014)

A comprehensive counseling program is based on four essential areas: foundation, management, delivery, and accountability (ASCA, 2016). A comprehensive school counseling program has to have a foundation that contains the following essential elements: program focus, students' standards, and school counselor competencies. The program focus comprises of belief statement, vision statement, mission statement, and goals. It is important that counseling program focus is in line with the school's belief, vision, and mission statements, as well as school goals. Students' standards are the desired outcome behind the implementation of the school counseling program, that is: knowledge and skills that excerpt change in the students' life in all of its three aspects: academic, career, and social/personal. And in order for the school counseling program focus to guide and provide direction, and for the students' standards to be achieved, the school counselor has to have the essential professional competencies that are either in a form of knowledge, skills, or attitudes, without them such a program can't be properly developed, implemented, and managed (ASCA, 2016; Davis, 2014).

After curriculum foundation is laid based on the school's philosophy, then needs of students are assessed after that in all the three domains that govern students' life; academic, personal/social, and career development (Dahir & Stone, 2015). Management of the school counseling program is crucial to achieve the desired goals (Thompson, 2013), it is to ensure that all parties take place in the delivery of the program, as well as to ensure that all the program processes are monitored and evaluated for a better outcome. Management of the program also implies that there are tools that need to be used and observed throughout the progress of the program so it is run efficiently, these tools are annual agreements, school data profile, advisory council, use of data, action plans, calendars, program result data, lesson plans, and curriculum (ASCA, 2016).

Although the delivery of school counseling services are meant solely for the students, other significant parties around the students like teachers, school staff, parents, and communities are important in the delivery of quality counseling services. Stone and Dahir (2015), Gysbers and Henderson (2014), and Davis (2014) support ASCA's (2014) claim that a comprehensive school counseling program is comprised of direct and indirect services to students. While the direct services are provided to students by the counselor himself, the indirect services are provided by teachers, staff, other professionals, and parents. Direct services include individual counseling, group counseling, crisis intervention, and classroom guidance. Indirect services could appear in a form of collaboration between counselor and parents, and counselor and other professionls. Consequently, it is also found that there is a positive correlation between counselor's implementation of comprehensive school counseling program and their job satisfaction (Pyne, 2011).

***The School Counseling Programs for Refugee Students in Malaysia***

Common issues faced by refugee students all over the world, including Malaysia evolve around the environmental setting of their schools. Some of these issues include academic and social learning adjustment, language and culture integration, systemic adaptation, and communication struggle. Since it was not possible for the refugees residing Malaysia to join neither government schools nor private school which are expensive and require proper documentations recognized by the government, they had to come up with their own schools that are small learning centers under the supervision of the United Nations Higher Commission of Refuges UNHCR-Malaysia, and that is usually done with the help of Malaysian NGOs and some active Malaysian individuals who volunteered to serve refugees. Given that situation; the vast majority of the refugees' schools are not well equipped, managed, and enriched with programs like the Malaysian government and private schools due to the fact that funds are not consistently given to them, and they are not enough for providing all the school services in the first place, including the school counseling service.

Nonetheless, based on the common issues faced by refugee students at school, if a counseling provision is to be set for this student population, it should not be much different from the services provided in government schools. In 1996, when the positions of full-time counsellors were officially established in Malaysian schools, three focussed areas of these school professionals were set towards academic performance and study skills, career development and guidance, and psychological and mental health concerns. These three focussed areas generated a list of 24 new tasks for school counselors to perform including:

a. preparation of a year plan for the guidance and counseling activities

b. identification of the needs of the students
c. planning and management of the records and reports of the students
d. gathering, preparation and publicity of counseling information
e. discharging of group guidance and counseling, and instructional base activities to motivate maximum development
f. planning and discharge of individual counseling
g. planning, performance and management of study skills programs
h. planning, performance and management of programs to help students select subjects for the Government examinations
i. planning, performance and management of educational programs against drug, alcohol, and smoking abuse
j. assistance to students to continue with higher education
k. planning, performance, management and evaluation of consultation and referral services related to career and drugs
l. planning, performance, management and evaluation of conferences with parents, teachers, support staff and Government agencies, related to the process of education and development of students
m. preparation of modules, instruments and approaches to promote professionalism in the guidance and counseling services
n. planning, coordination and evaluation of guidance and counseling resources
o. setting up committees to coordinate the guidance and counseling services
p. advocating for and provision of in-house training to share understanding of the guidance and counseling services
q. provision of crisis counseling to students, teachers, staff and anyone else who needs the service
r. assumption of role as mediator between the school and outside agencies
s. assumption of a position on the Curriculum committee
t. assumption of a position on the School Planning committee
u. role as facilitator in the mentor-mentee program
v. position as facilitator in the development programs such as motivation camp, civic education etc.
w. carrying out programs related to Drug Prevention Education
x. carrying out programs related to HIV/AIDS prevention programs (Surat Pekeliling Ikhtisas Bil. 3/1996).

With the replication of this national school counseling system at refugee schools, it is believed that those refugee students' issues related to mental health, social skills, behavioral difficulties, acculturation, career guidance, resilience, and study skills. This assumption is aligned with findings of previous research works which found that students who participate in comprehensive school counseling program get high scores in their exams, have better disciplinary records, and are also ready for the transition to workforce (Gysbers & Henderson, 2014; Carey et al., 2012; Burkard, et al., 2012;).

## Conclusion

All in all, school counseling is one of the services being overlooked in the refugees' school as most of them are still struggling with their basic needs. That is why the vast majority of the refugees' schools are not able to hire counselors. Although some volunteering individuals may occasionally help with the provision of some counseling-like programs, they are not able to go

deep in holistically helping this population for long term duration. Therefore, refugee students residing in Malaysia require a proper provision of educational support system, in terms of school counseling service.

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# INSTRUCTIONAL COMPETENCY IN DIGITAL ECOSYSTEM CULTURE: A SYSTEMATIC REVIEW OF ASSISTANT HEADTEACHERS' LEADERSHIP

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***Abstract:*** *The rapid digitalisation of education has intensified the demand for leadership practices that go beyond technical adoption to shaping sustainable school cultures. This study conducted a Systematic Literature Review (SLR) guided by the PRISMA 2020 protocol and PICo framework to examine how digital ecosystem culture influences the instructional competency of Assistant Headteachers in primary education. A total of 32 peer-reviewed studies published between 2020 and 2025 in Scopus and Web of Science were systematically identified, screened, and thematically analysed. Six interrelated themes emerged: digital competence, professional learning communities, differentiated professional development, socio-technical integration, addressing barriers to digital competency, and networking and collaboration beyond school walls. Collectively, these themes highlight the evolving role of Assistant Headteachers as strategic instructional leaders who must balance technological, pedagogical, and cultural demands. The findings extend theoretical perspectives on distributed and supportive leadership while providing practical insights for leadership training and policy development. This review not only synthesises current evidence but also advances the conceptualisation of Assistant Headteachers as pivotal ecosystem builders, offering a framework that can inform both future empirical research and educational policy reform.*

***Keywords:*** *Instructional Competency, Assistant Headteachers, Digital Ecosystem Culture, Systematic Literature Review, Malaysian Primary Education*

## Introduction

Amidst the accelerating wave of digitalisation across sectors, education systems worldwide are increasingly pressured to implement technological reforms that go beyond infrastructure upgrades and classroom-level adoption. For schools, this entails embedding technology not only in pedagogical processes but also across leadership practices, teacher development, and institutional culture. In Malaysia, the urgency to cultivate a robust digital ecosystem has intensified in the post-pandemic era, aligning with national strategic agendas such as the *MyDigital* initiative and post-COVID educational recovery frameworks (Abbas et al., 2023; Hamzah et al., 2021).

Nonetheless, the establishment of this digital culture remains uneven, particularly in contexts where leadership is passive or reactive. Empirical evidence shows that when school leadership lacks a coherent digital vision, even well-resourced institutions often fail to implement meaningful technological reforms, resulting in fragmented ICT use and limited instructional transformation (Raptis et al., 2024; Wollscheid et al., 2024).

At the heart of this challenge lies the complex construct of instructional competency, which represents a multidimensional domain extending beyond subject expertise and administrative oversight. Instructional competency includes digital literacy, pedagogical adaptability in integrating emerging technologies, and a strategic vision that inspires technology driven innovation at the school level (Zakaria et al., 2021). Contemporary educational systems increasingly evaluate school leaders not merely on operational efficiency or compliance with procedures, but on their ability to foster a culture of continuous digital transformation and personalised, technology enhanced learning. Recent studies indicate that when instructional leaders actively model the use of digital tools, establish clear expectations for engagement, and mentor teachers in ICT integration, schools attain higher levels of digital ecosystem maturity, stronger collaboration, and sustained professional growth (Lau & Han, 2024; Yakob & Don, 2025).

Nevertheless, the effort to cultivate a digital ecosystem culture in schools still encounters many obstacles. A large number of schools continue to struggle with infrastructure issues such as unstable internet connections, outdated equipment, and limited technical support. These problems are even more severe in rural or less privileged schools, where the digital gap remains a significant barrier to equitable transformation. Beyond the physical shortcomings, many teachers do not receive continuous and meaningful training, which leaves them unprepared to use technology effectively in their teaching practices (Donald & Hashim, 2025; Yap et al., 2024). On the human side, fears of becoming irrelevant, resistance to change, and uncertainty about new approaches reduce the willingness of teachers to explore digital innovation. In situations where leadership guidance is weak or inconsistent, schools lose the steady support needed to maintain progress (Okunlola, 2024). The problem is further compounded by the lack of shared leadership and formal mentoring, which limits collective ownership and weakens the momentum of digital transformation (Alde, 2024).

Despite these challenges, emerging evidence suggests that Assistant Headteachers can play a pivotal role as facilitators of distributed digital leadership. Case studies demonstrate that when Assistant Headteachers act as enablers of collaboration, innovation becomes more sustainable and embedded in daily school operations. These leaders not only guide instructional practices but also nurture a culture of continuous digital growth and collaborative problem-solving (Buyukgoze et al., 2022; Lu & Chen, 2025). To explore this evolving role, this study adopts a systematic literature review (SLR) approach to critically synthesise empirical studies published between 2020 and 2025, focusing on how digital ecosystem culture contributes to the development of instructional competency among Assistant Headteachers in primary education.

Guided by the PRISMA 2020 protocol and informed by the PICo framework, this review addresses three interconnected dimensions: Population (P), referring to instructional leaders in Malaysian primary schools; Interest (I), focusing on digital ecosystem culture; and Context (Co), relating to educational leadership and technology integration within school environments (Brennan & Munn, 2021; Hernández-Cruz et al., 2024; Parums, 2021). Based on these dimensions, three research questions were developed to guide the review:

1. What are the dimensions of instructional competency among Assistant Headteachers in the context of digital transformation?

2. To what extent does digital ecosystem culture shape or enhance the instructional competency of Assistant Headteachers, particularly in the implementation of digital pedagogical practices?

3. What leadership strategies have been identified as effective in fostering a sustainable digital ecosystem culture among instructional leaders in primary education settings?

These research questions provide conceptual clarity and methodological direction for the review, ensuring that the analysis systematically identifies thematic patterns, addresses research gaps, and highlights implications for practice and policy in the context of digitally transforming schools. Beyond this, the questions serve as a conceptual lens through which fragmented evidence from multiple studies can be synthesised into coherent themes that reflect both theoretical and practical advancements. They also allow the review to critically interrogate not only the presence of digital initiatives but also their depth, sustainability, and relevance to instructional leadership. By situating the inquiry within these clearly defined dimensions, the review contributes to the development of a structured evidence base that strengthens understanding of how digital ecosystem culture interacts with instructional competency in primary education.

## Methods

### *Design*

This study adopted a Systematic Literature Review (SLR) guided by the PRISMA 2020 protocol (Page et al., 2021), ensuring transparency, rigour and reproducibility. The four phases of PRISMA which are identification, screening, eligibility and inclusion were systematically applied. The PICo framework informed the research questions and search strategy, focusing on Population (instructional leaders in Malaysian primary schools), Interest (digital ecosystem culture) and Context (educational leadership and technology integration). This combined approach ensured a comprehensive and conceptually grounded review, reducing ambiguity in study selection and strengthening alignment with research objectives. The integration of PRISMA procedures also enhanced replicability, while the use of PICo supported theoretical breadth. Together, these frameworks provided a rigorous foundation for synthesising evidence and generating meaningful implications for leadership practice in primary education. By situating the review within established methodological standards, the study strengthens its contribution to both scholarly discourse and practical application. It also highlights how structured frameworks can support the development of clearer, evidence based insights for guiding school leadership in the digital era.

***Identification***

In this study, essential steps of the systematic review process were meticulously employed to gather a comprehensive body of relevant literature. The process began with the careful selection of keywords, followed by the identification of related terms through dictionaries, thesauri, encyclopaedias and previous research. All relevant terms were consolidated, and refined search strings were formulated for both the Web of Science and Scopus databases (as presented in Table 1). This initial stage of the review yielded 306 publications deemed relevant to the study focus from the two databases. These records were subsequently subjected to systematic screening to ensure alignment with the research objectives and to eliminate duplicates. The rigorous procedures applied at this stage strengthened the validity, reliability and comprehensiveness of the review process.

In addition, the use of dual databases minimised the risk of publication bias, while the inclusion of multiple reference sources ensured that the search strategy captured both breadth and depth of existing scholarship. Furthermore, the structured and transparent search protocol enhanced the reproducibility of the review, allowing future researchers to replicate or extend the search process with consistency. Such methodological transparency is essential in systematic reviews to uphold scholarly rigour and methodological credibility. This foundation provided a strong platform for the thematic synthesis that followed and ensured that the scope of the review was sufficiently inclusive to reflect diverse perspectives across educational systems. By embedding this careful groundwork, the study established the necessary robustness to support meaningful analysis and reliable interpretation of findings.

**Table 1: Search Strategy in Scopus and Web of Science**

***Screening***

| | |
|---|---|
| **Scopus** | **TITLE-ABS-KEY ( "instructional competency" OR "instructional leadership" OR "instructional capacity" ) AND ( "digital ecosystem" OR "digital culture" ) AND ( "assistant principal" OR "school leader" ) AND ( "primary education" OR "elementary school" ) AND PUBYEAR > 2019 AND PUBYEAR < 2026 AND DOCTYPE ( ar ) AND LANGUAGE ( English )**<br>**Date of Access: May 2025** |
| **WoS** | ( "instructional competency" OR "instructional leadership" OR "instructional capacity" ) AND ( "digital ecosystem" OR "digital culture" ) AND ( "assistant principal" OR "school leader" ) AND ( "primary education" OR "elementary school" ) (Topic) AND 2020 |

OR 2021 OR 2022 OR 2023 OR 2024 OR 2025 (Publication Years)
AND Article (Document Types) AND English (Languages)

Date of Access: Jun 2025

Potentially relevant studies were screened to ensure alignment with the research questions, focusing on instructional leadership within the digital ecosystem culture in Malaysian primary schools. Duplicate articles were removed, and from the initial 306 studies, 266 were excluded, leaving 40 for further assessment (see Table 2).

The inclusion criteria emphasized peer-reviewed journal articles in English, published between 2020 and 2025, with final publication status and Malaysian affiliation. Book chapters, proceedings, reviews, and non-empirical works were excluded. After removing five additional duplicates, 35 articles remained for full review and thematic synthesis.

**Table 2: The Selection Criterion Is Searching**

| Criterion | Inclusion | Exclusion |
|---|---|---|
| **Language** | English | Non-English |
| **Publication Year** | 2020 – 2025 | < 2020 |
| **Literature type** | Journal (Article) | Conference, Book, Review |
| **Publication Stage** | Final | In Press |
| **Geographic Scope** | Any country, if aligned with PICo context | Studies unrelated to school instructional leadership |

***Eligibility***

In the eligibility phase, a total of 66 articles that had passed the initial screening were reviewed in full to determine their alignment with the objectives and scope of this study. The review process was conducted with particular emphasis on methodological rigour and conceptual clarity to ensure that only studies of strong relevance were retained. The primary aim was to identify empirical works that specifically examined how Assistant Headteachers in primary schools develop and demonstrate instructional competency within the context of digital

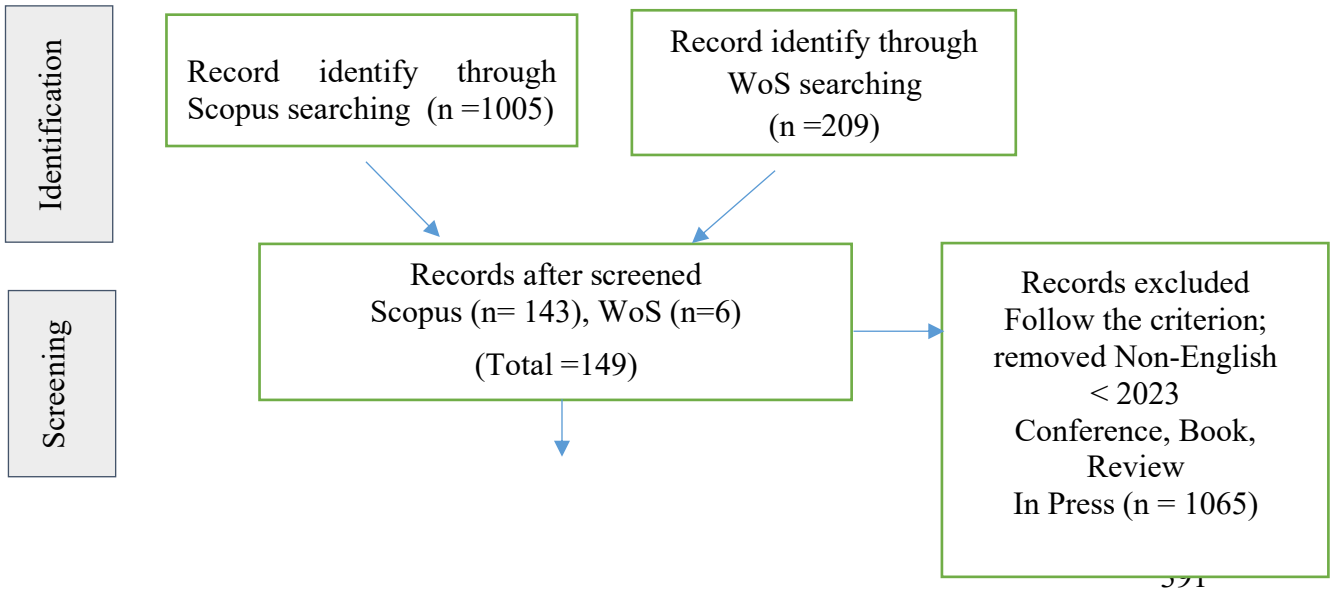
ecosystem culture. This step was essential to narrow down the evidence base and to avoid the inclusion of studies that, although tangentially related, would dilute the analytical precision of the review.

Each article was carefully examined for conceptual consistency with the PICo framework, which included the following parameters: Population (Assistant Headteachers), Interest (digital ecosystem culture), and Context (school based instructional leadership). In applying these parameters, attention was also given to study design and reporting quality to ensure robustness of the selected works. Articles were excluded if they did not centre on school leadership, involved higher education or unrelated fields, lacked empirical evidence, or were not peer reviewed journal articles. As a result, 34 articles were excluded, leaving 32 studies deemed eligible for the final synthesis. This process not only strengthened the reliability of the review findings but also enhanced confidence that the evidence base accurately reflects the relationship between digital ecosystem culture and instructional competency.

***Inclusion***

After the eligibility review, 32 studies were finally retained for the synthesis. These articles were included because they dealt directly with the link between digital ecosystem culture and instructional competency in primary education, and clearly fitted the PICo framework. Only studies that satisfied both methodological and conceptual standards were taken forward, which kept the evidence base focused and relevant to the aims of this review. This step also helped avoid the inclusion of papers that were less precise or not grounded in strong data. In other words, the inclusion phase acted as the final filter that separated relevant and high-quality works from those that would have weakened the overall analysis. By doing so, the review could move into the analysis stage with a solid and defensible pool of evidence.

The final group of studies offered a varied but coherent set of perspectives that enriched the review. They covered issues of instructional leadership, digital transformation, and the development of competency among Assistant Headteachers, allowing for a more rounded understanding of the topic. The inclusion of studies from diverse backgrounds provided breadth, while the consistency in meeting quality standards added depth to the evidence base. Taken together, these 32 studies created a strong platform for the thematic analysis, ensuring that the findings would be academically reliable and practically meaningful.



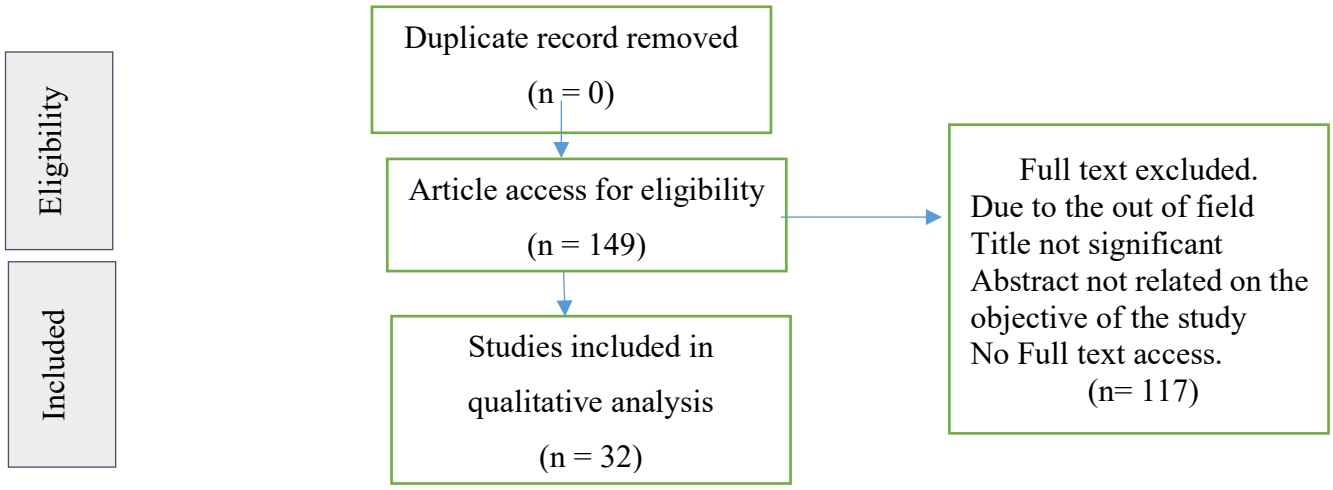



**Figure 1. PRISMA 2020 flow diagram of the study selection process (adapted from Moher et al. (2009)**

***Data Abstraction and Analysis***

The synthesis of findings from 32 selected studies employed an integrative thematic approach, which was chosen for its ability to consolidate diverse insights into a coherent analytical framework. This method facilitated the extraction and categorisation of recurring concepts, providing a deeper understanding of how Assistant Headteachers conceptualise, develop, and apply instructional competency within digitally evolving school environments. The analysis was guided by three broad domains: definitions and dimensions of instructional competency, professional development and institutional support, and leadership practices that shape digital school culture. In this way, the analytical framework not only structured the review but also ensured consistency in how evidence was interpreted across studies.

Each study was independently reviewed and coded against these domains, and the coding process was carried out iteratively to allow for refinement as new patterns emerged. To maintain rigour, a reflective coding log was kept to document decisions and revisions, while collaborative discussions among reviewers ensured transparency and resolved discrepancies. This systematic process allowed recurring insights to be refined and clustered into six emergent themes that reflected the multidimensional nature of digital instructional leadership. The iterative approach also enabled flexibility to capture context-specific variations across different educational environments. As a result, the synthesis achieved both depth and adaptability in identifying critical insights.

Reliability was further strengthened through cross validation of interpretations across multiple reviewers, which reduced potential bias and enhanced confidence in the stability of findings. The integrative thematic strategy therefore ensured both methodological robustness and conceptual depth, producing a structured synthesis of how Assistant Headteachers contribute to cultivating instructionally competent and digitally fluent school cultures. These six emergent themes form the empirical foundation for the findings presented in the next section. In doing so, the analysis created a strong bridge between the reviewed evidence and the research questions guiding this study. This bridging role highlights the importance of thematic synthesis as more than just a technical exercise but a means of theory-building.

Beyond methodological rigour, the synthesis also paid attention to the contextual richness of the selected studies. Each article was not only coded for thematic content but also considered in terms of its setting, sample characteristics, and cultural factors that shaped its findings. This attention to context enabled the review to avoid treating all studies as homogenous and instead recognised the variations across national policies, school environments, and leadership practices. Such sensitivity ensured that the emergent themes reflected both shared patterns and context-specific nuances, making the synthesis more relevant for application in diverse primary education systems. By valuing contextual variation, the review provided a nuanced evidence base that could inform both global debates and localised practices

**Table 3: Number And Details Of Primary Studies Database**

| No | Authors | Title | Year | Journal | Scopus | WOS |
|---|---|---|---|---|---|---|
| 1 | Rasdiana, Wiyono, et al. (2024) | Elevating Teachers' Professional Digital Competence: Synergies of Principals' Instructional E-Supervision, Technology Leadership and Digital Culture for Educational Excellence in Digital-Savvy Era | 2024 | Education Sciences | / | / |
| 2 | W. L. Sterrett & Richardson (2023) | Innovation beyond the pandemic: the powerful potential of digital principal leadership | 2023 | Development and Learning in Organizations | / | / |
| 3 | Cisneros-Barahona et al. (2024) | Assessing Teacher Digital Competence. An analysis integrating descriptive, inferential, and multivariate perspectives | 2024 | RIED-Revista Iberoamericana de Educacion a Distancia | / | |
| 4 | Howell et al. (2025) | Designing Performance-Based Professional Development: Stakeholder Views on Essential Competencies and Approaches | 2025 | Education Sciences | / | / |
| 5 | Al Nuaimi et al. (2023) | The importance of the school principals' role in the digital transformation of the education sector | 2024 | International Journal of Comparative Education and Development | / | / |
| 6 | Schmitz et al. (2023) | Transformational leadership for technology integration in schools: Empowering teachers to use technology in a more demanding way | 2023 | Computers and Education | / | / |

| No | Authors | Title | Year | Journal | Scopus | WOS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 7 | Riski et al. (2023) | Implementation of a Digital Leadership Model in Improving the Quality of Islamic Boarding Schools | 2024 | Munaddhomah | / | |
| 8 | Rasdiana, Nurhadi, et al. (2024) | The effect of digital leadership in nurturing teachers' innovation skills for sustainable technology integration mediated by professional learning communities | 2024 | Journal of Infrastructure, Policy and Development | / | |
| 9 | AlAjmi (2022) | The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait | 2022 | International Journal of Educational Research | / | / |
| 10 | Hassan & Berkovich (2023) | Digital instructional leadership in schools facing different levels of challenging contexts: A survey study during the COVID-19 pandemic | 2023 | Management in Education | / | / |
| 11 | Akim et al. (2024) | Toward Digital School: The Level of Usage, Competency and Awareness for Digital Storage among School Administrators Pre to the Covid-19 Era | 2024 | Journal of Advanced Research in Applied Sciences and Engineering Technology | / | |
| 12 | Izhak Berkovich (2023) | The great resignation: Exploring the effect of regular and digital instructional leadership on teachers' intention to leave | 2023 | Management in Education | / | / |

| No | Authors | Title | Year | Journal | Scopus | WOS |
|---|---|---|---|---|---|---|
| 13 | Nubun et al. (2024) | Exploring Digital Leadership Competencies among School Administrators and Digital Maturity in Sarawak, Malaysia: From Teachers' Perspectives | 2024 | Pakistan Journal of Life and Social Sciences | / | |
| 14 | Omar & Ismail (2020) | Mobile Technology Integration in the 2020s: The Impact of Technology Leadership in the Malaysian Context | 2020 | Universal Journal of Educational Research | / | |
| 15 | (Berhanu et al., 2022) | Teachers' digital competencies and technology integration in education: Insights from secondary schools in Wolaita Zone, Ethiopia | 2022 | Social Sciences and Humanities Open | / | |
| 16 | W. Sterrett & Richardson (2022) | Innovation beyond the pandemic: the powerful potential of digital principal leadership | 2023 | Development and Learning in Organizations | / | |
| 17 | Yurinova et al. (2022) | Transprofessional competences of school teachers in the digital environment: education employers' perspective | 2022 | Education and Information Technologies | / | / |
| 18 | Thyssen et al. (2023) | From TPACK to DPACK: The "Digitality-Related Pedagogical and Content Knowledge"-Model in STEM-Education | 2023 | Education Sciences | / | / |
| 19 | Artacho et al. (2020) | Teacher Training in Lifelong Learning—The Importance of Digital Competence in the Encouragement of Teaching Innovation | 2020 | Sustainability (Switzerland) | / | / |
| 20 | Karakose et al. (2021) | Examining Teachers' Perspectives on School Principals' Digital Leadership Roles and Technology Capabilities during the COVID-19 Pandemic | 2021 | Sustainability (Switzerland) | / | / |

| No | Authors | Title | Year | Journal | Scopus | WOS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 21 | So-Oabeb & du Plessis (2023) | Leadership competencies for teacher professional development: perspectives of Namibian principals, heads of departments and teachers | 2023 | Perspectives in Education | / | |
| 22 | I. Berkovich & Hassan (2024) | Principals' digital instructional leadership during the pandemic: Impact on teachers' intrinsic motivation and students' learning | 2024 | Educational Management Administration and Leadership | / | / |
| 23 | Ab (2024) | Developing Teacher Technology Leadership in Digital Transformation:Perspectives from Professional Learning Community in One Chinese University | 2024 | ICEIT 2024 | / | |
| 24 | H. Shaked (2020) | Boundaries of Israeli Assistant Headteachers' Instructional Leadership | 2020 | Leadership and Policy in Schools | / | / |
| 25 | Parlar et al. (2024) | Instructional leadership as a predictor of collaborative culture in schools | 2024 | International Journal of Leadership in Education | / | / |
| 26 | Leithwood et al. (2020) | Seven strong claims about successful school leadership revisited | 2020 | School Leadership and Management | / | / |
| 27 | Witthöft et al. (2024) | Leading digital innovation in schools: the role of the open innovation mindset | 2024 | Journal of Research on Technology in Education | / | / |
| 28 | Kirinić et al. (2023) | E-Schools Project-Framework for Digital Competencies of School Principals: Competencies in | 2023 | ICIM 2023 | / | |

| No | Authors | Title | Year | Journal | Scopus | WOS |
|---|---|---|---|---|---|---|
| | | the Area of Digital Technologies in Learning and Teaching | | | | |
| 29 | Karousiou (2025) | Navigating challenges in school digital transformation: insights from school leaders in the Republic of Cyprus | 2025 | Educational Media International | / | / |
| 30 | Haim Shaked et al. (2020) | How National Context Indirectly Influences Instructional Leadership Implementation: The Case of Israel | 2020 | Educational Administration Quarterly | / | / |
| 31 | Tzafilkou et al. (2023) | Assessing teachers' digital competence in primary and secondary education: Applying a new instrument to integrate pedagogical and professional elements for digital education | 2023 | Education and Information Technologies | / | / |
| 32 | Moreira-Choez et al. (2024) | Influence of gender and academic level on the development of digital competencies in university teachers: a multidisciplinary comparative analysis | 2024 | Frontiers in Education | / | / |

## Quality Appraisal

To ensure methodological integrity, all 32 studies that passed the eligibility stage were subjected to a structured quality appraisal. The assessment was conducted using the guidelines of Kitchenham and Stuart (2007), complemented by appraisal criteria adapted from Abouzahra et al. (2020). Three independent reviewers evaluated each study with a three-point rubric (Yes = 1, Partly = 0.5, No = 0), and a cumulative score above 3.0 was set as the threshold for acceptable rigour. This procedure allowed the review to assess not only the methodological soundness of the studies but also their conceptual alignment with the objectives of this research. By applying a transparent and systematic appraisal, the review ensured consistency in evaluating study quality and avoided the inclusion of weak or irrelevant evidence. The outcome of this appraisal established a credible foundation for the thematic synthesis, reinforcing both the reliability and the validity of the findings that followed

## Thematic Synthesis

All 32 studies that successfully passed the quality appraisal were synthesised thematically to address the three research questions outlined in this review. The integrative thematic approach enabled the clustering of recurring concepts and practices into coherent patterns that captured the complexity of instructional leadership in digitally transforming school environments. By examining how Assistant Headteachers conceptualise, develop, and apply instructional competency within these contexts, the analysis revealed both commonalities across studies and variations shaped by local settings.

From this process, six emergent themes were identified as central to understanding the interplay between digital ecosystem culture and instructional competency. These themes reflect distinct but interconnected dimensions: (i) conceptualisations and dimensions of instructional competency, (ii) the role of professional development and continuous learning, (iii) institutional and technical support structures, (iv) leadership practices that drive digital transformation, (v) cultural and contextual enablers of digital adoption, and (vi) challenges, gaps, and future directions for digital instructional leadership. Together, these themes form the analytical foundation for the findings, offering both theoretical insights and practical implications for primary education leadership.

This thematic synthesis not only identified patterns across studies but also highlighted the varying levels of methodological quality and conceptual contribution among them. To illustrate this, the results of the quality appraisal are presented in Table X, which summarises the performance of each study against the six appraisal criteria. The table provides a transparent overview of how the included works scored in terms of clarity, methodological soundness, theoretical grounding, and relevance. By presenting these details, the review strengthens its credibility and allows readers to better appreciate the robustness of the evidence base prior to engaging with the thematic findings.

**Table 4. Quality Appraisal Of The 32 Included Studies Based On Six Evaluation Criteria (QA1–QA6)**

| Author | Title | QA1 | QA2 | QA3 | QA4 | QA5 | QA6 | Total Mark | % |
|---|---|---|---|---|---|---|---|---|---|
| Schmitz et al. (2023) | Transformational leadership for technology integration in schools: Empowering teachers to use technology in a more demanding way | 1 | 1 | 1 | 1 | 1 | 1 | 6.0 | 100 |
| W. L. Sterrett & Richardson (2023) | Innovation beyond the pandemic: the powerful potential of digital principal leadership | 1 | 1 | 1 | 1 | 1 | 0.5 | 5.5 | 91.7 |
| Cisneros-Barahona et al. (2024) | Assessing Teacher Digital Competence. An analysis integrating descriptive, inferential, and multivariate perspectives | 1 | 1 | 1 | 1 | 0.5 | 1 | 5.5 | 91.7 |
| Howell et al. (2025) | Designing Performance-Based Professional Development: Stakeholder Views on Essential Competencies and Approaches | 1 | 1 | 1 | 1 | 0.5 | 1 | 5.5 | 91.7 |
| Al Nuaimi et al. (2023) | The importance of the school principals' role in the digital transformation of the education sector | 1 | 1 | 1 | 1 | 0.5 | 1 | 5.5 | 91.7 |
| Rasdiana, Wiyono, et al. (2024) | Elevating Teachers' Professional Digital Competence: Synergies of Principals' Instructional E-Supervision, Technology Leadership and Digital Culture for Educational Excellence in Digital-Savvy Era | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 5.0 | 83.3 |
| Riski et al. (2023) | Implementation of a Digital Leadership Model in Improving the Quality of Islamic Boarding Schools | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 5.0 | 83.3 |
| Rasdiana, Nurhadi, et al. (2024) | The effect of digital leadership in nurturing teachers' innovation skills for sustainable technology integration mediated by professional learning communities | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 5.0 | 83.3 |
| AlAjmi (2022) | The impact of digital leadership on teachers' technology integration | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 5.0 | 83.3 |

| Author | Title | QA1 | QA2 | QA3 | QA4 | QA5 | QA6 | Total Mark | % |
|---|---|---|---|---|---|---|---|---|---|
| | during the COVID-19 pandemic in Kuwait | | | | | | | | |
| Hassan & Berkovich (2023) | Digital instructional leadership in schools facing different levels of challenging contexts: A survey study during the COVID-19 pandemic | 1 | 1 | 0.5 | 1 | 0.5 | 0.5 | 4.5 | 75.0 |
| Akim et al. (2024) | Toward Digital School: The Level of Usage, Competency and Awareness for Digital Storage among School Administrators Pre to the Covid-19 Era | 1 | 1 | 0.5 | 1 | 0.5 | 0.5 | 4.5 | 75.0 |
| Izhak Berkovich (2023) | The great resignation: Exploring the effect of regular and digital instructional leadership on teachers' intention to leave | 1 | 1 | 0.5 | 1 | 0.5 | 0.5 | 4.5 | 75.0 |
| Nubun et al. (2024) | Exploring Digital Leadership Competencies among School Administrators and Digital Maturity in Sarawak, Malaysia: From Teachers' Perspectives | 1 | 1 | 0.5 | 1 | 0.5 | 0.5 | 4.5 | 75.0 |
| Omar & Ismail (2020) | Mobile Technology Integration in the 2020s: The Impact of Technology Leadership in the Malaysian Context | 1 | 1 | 0.5 | 1 | 0.5 | 0.5 | 4.5 | 75.0 |
| Berhanu et al. (2022) | Teachers' digital competencies and technology integration in education: Insights from secondary schools in Wolaita Zone, Ethiopia | 1 | 1 | 0.5 | 1 | 0.5 | 0.5 | 4.5 | 75.0 |
| W. Sterrett & Richardson (2022) | Innovation beyond the pandemic: the powerful potential of digital principal leadership | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| Yurinova et al. (2022) | Transprofessional competences of school teachers in the digital environment: education employers' perspective | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| Thyssen et al. (2023) | From TPACK to DPACK: The "Digitality-Related | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |

| Author | Title | QA1 | QA2 | QA3 | QA4 | QA5 | QA6 | Total Mark | % |
|---|---|---|---|---|---|---|---|---|---|
| | Pedagogical and Content Knowledge"-Model in STEM-Education | | | | | | | | |
| Artacho et al. (2020) | Teacher Training in Lifelong Learning—The Importance of Digital Competence in the Encouragement of Teaching Innovation | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| Karakose et al. (2021) | Examining Teachers' Perspectives on School Principals' Digital Leadership Roles and Technology Capabilities during the COVID-19 Pandemic | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| So-Oabeb & du Plessis (2023) | Leadership competencies for teacher professional development: perspectives of Namibian principals, heads of departments and teachers | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| I. Berkovich & Hassan (2024) | Principals' digital instructional leadership during the pandemic: Impact on teachers' intrinsic motivation and students' learning | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| Ab (2024) | Developing Teacher Technology Leadership in Digital Transformation:Perspectives from Professional Learning Community in One Chinese University | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| H. Shaked (2020) | Boundaries of Israeli Assistant Headteachers' Instructional Leadership | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| Parlar et al. (2024) | Instructional leadership as a predictor of collaborative culture in schools | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 4.0 | 66.7 |
| Leithwood et al. (2020) | Seven strong claims about successful school leadership revisited | 1 | 1 | 0.5 | 0.5 | 0.5 | 0 | 3.5 | 58.3 |
| Witthöft et al. (2024) | Leading digital innovation in schools: the role of the open innovation mindset | 1 | 1 | 0.5 | 0.5 | 0.5 | 0 | 3.5 | 58.3 |

| Author | Title | QA1 | QA2 | QA3 | QA4 | QA5 | QA6 | Total Mark | % |
|---|---|---|---|---|---|---|---|---|---|
| Kirinić et al. (2023) | E-Schools Project-Framework for Digital Competencies of School Principals: Competencies in the Area of Digital Technologies in Learning and Teaching | 1 | 1 | 0.5 | 0.5 | 0.5 | 0 | 3.5 | 58.3 |
| Karousiou (2025) | Navigating challenges in school digital transformation: insights from school leaders in the Republic of Cyprus | 1 | 1 | 0.5 | 0.5 | 0.5 | 0 | 3.5 | 58.3 |
| Haim Shaked et al. (2020) | How National Context Indirectly Influences Instructional Leadership Implementation: The Case of Israel | 1 | 1 | 0.5 | 0.5 | 0.5 | 0 | 3.5 | 58.3 |
| Tzafilkou et al. (2023) | Assessing teachers' digital competence in primary and secondary education: Applying a new instrument to integrate pedagogical and professional elements for digital education | 1 | 1 | 0.5 | 0.5 | 0 | 0 | 3.0 | 50.0 |
| Moreira-Choez et al. (2024) | Influence of gender and academic level on the development of digital competencies in university teachers: a multidisciplinary comparative analysis | 1 | 1 | 0.5 | 0.5 | 0 | 0 | 3.0 | 50.0 |

**Highest-Scoring Paper:**

Schmitz et al. (2023) achieved the highest appraisal score (6.0/6, 100%) as the study demonstrated a clearly articulated research purpose, employed a robust empirical design, and was strongly anchored in transformational leadership theory. The paper provided comparative insights into how school leaders empower teachers to integrate digital technologies in cognitively demanding ways, and it explicitly acknowledged methodological limitations, thereby enhancing its academic rigour.

**Lowest-Scoring Paper:**

Tzafilkou et al. (2023) and Moreira-Choez et al. (2024) received the lowest appraisal scores (3.0/6, 50%), reflecting certain methodological and theoretical weaknesses. While Tzafilkou et al. (2023) made a valuable contribution by proposing a new instrument to assess teachers' digital competence, the study remained largely descriptive, with limited critical discussion of its broader theoretical implications or constraints. Similarly, Moreira-Choez et al. (2024)

examined gender and academic-level differences in university teachers' digital competencies, but the analysis was primarily comparative, offering little engagement with deeper theoretical debates or limitations. As a result, both studies provide useful descriptive insights but lack the analytical depth and critical reflection found in stronger works within the review.

## Result

This review identified six major themes across the selected studies, illustrating how digital ecosystem culture shapes the professional development and instructional competency of Assistant Headteachers in primary schools. The thematic synthesis highlights the dynamic interplay between leadership practices, technological adaptation, and the evolving instructional roles of middle leaders in the digital era.

### Theme 1: Enhanced Digital Competence

Digital competence emerged as one of the most dominant dimensions shaping instructional competency among Assistant Headteachers, particularly in schools undergoing digital transformation. This theme directly addresses RQ1 by underscoring that digital competence is no longer confined to technical proficiency but is increasingly recognised as a strategic leadership asset that supports planning, monitoring, and the enhancement of pedagogical practices. Studies such as Hassan and Berkovich (2023), AlAjmi (2022), and Rasdiana et al. (2024) demonstrated that Assistant Headteachers with strong digital fluency were better positioned to mentor teachers, align technology with instructional objectives, and stimulate pedagogical innovation. Crucially, these competencies were not developed in isolation but were embedded within broader digital ecosystems that integrated technology into daily instructional routines.

Despite broad consensus on its importance, the level and manifestation of digital competence varied significantly across educational systems and national contexts. In countries where institutional frameworks and national policies actively supported digital transformation, Assistant Headteachers displayed more proactive leadership, employing digital strategies to strengthen instructional supervision and lesson design (Sterrett & Richardson, 2022; Karakose et al., 2021). Conversely, in schools constrained by limited infrastructure or fragmented digital strategies, leaders struggled to leverage technology meaningfully in their instructional roles. This variation illustrates that digital competence is not merely an individual trait but one cultivated through systemic alignment between leadership roles, teacher readiness, and school-level ICT policies.

Several studies, including Schmitz et al. (2023), further identified digital confidence as a mediating factor. Leaders working within robust digital ecosystems demonstrated greater initiative in implementing pedagogical change, while those in resource-poor contexts often exhibited hesitancy or passivity. This underscores that digital competence extends beyond technological literacy to encompass instructional judgement, pedagogical design, and the capacity to draw on digital insights for evidence-based decision-making.

Taken together, the synthesis across studies (n = 24) reinforces that digital competence represents a multidimensional instructional capability, encompassing technological fluency,

instructional discernment, and pedagogical foresight. It also signals a shift in leadership identity from enforcing compliance to enabling innovation. Assistant Headteachers with higher levels of digital competence were more likely to reposition their instructional leadership around collaborative decision-making, evidence-informed use of digital tools, and continuous professional learning. Moreover, studies such as Artacho et al. (2020) and Moreira-Choez et al. (2024) revealed that enhanced digital competence positively correlated with instructional impact, particularly when reinforced by a coherent school-wide digital vision. The weight of evidence affirms that digital competence is not an optional enhancement but an instructional imperative for Assistant Headteachers operating in progressive digital school systems.

**Theme 2: Role of Professional Learning Communities (PLCs)**

Professional Learning Communities (PLCs) consistently emerged as a powerful mechanism for strengthening instructional competency among Assistant Headteachers in digitally transforming schools. Addressing RQ2, the literature highlighted that PLCs served as collaborative platforms which moved beyond conventional, top-down models of professional development. Instead, they enabled Assistant Headteachers to critically reflect on practice, exchange digital pedagogical strategies, and co-construct solutions to instructional challenges (So-Oabeb & du Plessis, 2023; Parlar et al., 2024; Rasdiana, Nurhadi, et al., 2024; Karousiou, 2025). Importantly, these communities fostered a culture of shared responsibility and collective learning, reframing digital integration not as an externally imposed requirement but as a shared professional journey.

While the effectiveness of PLCs was widely acknowledged, their impact was not uniform. In schools with strong digital cultures, PLCs functioned as innovation hubs that facilitated peer mentoring, experimentation with digital tools, and continuous pedagogical renewal. By contrast, in schools where digital integration was at an earlier stage, PLCs tended to operate reactively, focusing on short-term problem solving rather than long-term instructional reform. For example, So-Oabeb and du Plessis (2023) observed that Assistant Headteachers in digitally maturing contexts promoted open conversations and collaborative inquiry, demonstrating that PLCs are central to cultivating leadership competencies and shared responsibility for digital integration.

From a synthesis perspective, PLCs functioned as more than venues for technical upskilling. They acted as mechanisms of transformational learning and leadership redefinition. Assistant Headteachers who engaged actively in PLCs displayed enhanced capacities for strategic thinking, reflective supervision, and cross-disciplinary collaboration. More significantly, these platforms redefined leadership identity, positioning Assistant Headteachers as instructional leaders among equals and advancing a bottom-up approach to digital integration. Evidence across multiple studies confirmed that sustained participation in PLCs was associated with greater confidence in leading technology-rich instruction and stronger coherence between school-wide digital strategies and classroom practices.

Taken collectively, the findings reaffirm that PLCs are not peripheral initiatives but structural pillars of digital instructional leadership. They provide the relational, reflective, and adaptive space necessary for embedding digital culture into the everyday life of schools. By doing so, PLCs enable Assistant Headteachers to shift from passive recipients of external training to

active co-constructors of professional knowledge, thereby elevating their role as transformative leaders in the digital age.

**Theme 3: Differentiated and Targeted Professional Development**

Differentiated and targeted professional development (PD) emerged as a pivotal mechanism for cultivating digital instructional competency among Assistant Headteachers, particularly within schools navigating digital transition. Addressing RQ2, the literature emphasised that PD tailored to the leadership demands and contextual realities of middle leaders yielded more sustainable outcomes than generic, one-size-fits-all training. Studies such as Howell et al. (2025) and Ab (2024) showed that effective PD was characterised by its close alignment with the instructional responsibilities of Assistant Headteachers, responsiveness to varying levels of teacher digital maturity, and sensitivity to the structural demands of individual schools. Crucially, these programmes moved beyond surface-level training on digital tools and instead focused on the practical enactment of digital leadership, ranging from lesson supervision and teacher mentoring to the planning of data-informed instruction. PD that incorporated reflection, experimentation, and coaching within school contexts proved particularly effective in developing confident, digitally competent instructional leaders.

Yet, evidence also highlighted inconsistencies in implementation. In many cases, PD initiatives were overly didactic, disconnected from classroom realities, and preoccupied with technical mechanics rather than pedagogical integration (Artacho et al., 2020; Moreira-Choez et al., 2024). In several contexts, particularly in developing countries, programmes were driven by compliance or administrative requirements, often fragmented and lacking continuity. This diluted their impact and undermined the empowerment of Assistant Headteachers as strategic instructional leaders. Common barriers such as limited time, insufficient access to expert mentorship, and heavy administrative workloads further constrained the effectiveness of PD. These findings underscore that the success of PD depends not only on the quality of its content but also on its delivery model, adaptability, and capacity to foster leadership agency.

Synthesising insights across studies (n = 19), several defining characteristics of effective PD for digital instructional leadership became evident: it must be sustained, differentiated, embedded within school practice, and pedagogically anchored. Rather than treating Assistant Headteachers as passive recipients of training, successful programmes positioned them as active contributors in shaping the digital learning ecosystems of their schools. When PD was integrated with professional learning communities or peer mentoring systems, its impact was amplified through collaborative reflection and shared inquiry (So-Oabeb & du Plessis, 2023). Ultimately, the literature reinforces that differentiated and targeted PD is not a supplementary support but a structural foundation for sustainable instructional leadership in the digital age.

**Theme 5: Addressing Barriers to Digital Competency**

Despite the growing adoption of digital tools in schools, many studies reported that Assistant Headteachers continued to face persistent challenges in building and applying digital instructional competencies. Research by Schmitz et al. (2023), Hassan and Berkovich (2023), and Rasdiana, Wiyono, et al. (2024) highlighted barriers such as uncertainty in using technology, lack of access to contextually relevant training, heavier workloads, and cultural resistance to change. In some cases, Assistant Headteachers were hesitant to apply digital tools

in supervision because they were unsure of their impact on teaching or feared making mistakes. These barriers often stemmed from insufficient exposure, the absence of digital mentorship, and rigid administrative systems that discouraged innovation. The evidence suggests that digital competence is not only a technical matter but also reflects the leadership culture, the emotional readiness of staff, and the overall organisational climate.

Several studies documented strategies that Assistant Headteachers employed to overcome these challenges. Effective leaders relied on peer mentoring, reflective engagement within professional learning communities, and role adjustments that created safer spaces for experimentation with digital tools. For instance, So Oabeb and du Plessis (2023) reported that Assistant Headteachers encouraged open dialogue about fears and anxieties related to digital tools, which in turn fostered psychological safety and mutual learning. Across the reviewed literature, success was stronger when leaders communicated a clear digital vision, provided consistent support, and allocated time for continuous professional growth. These findings reinforce the idea that instructional leadership in the digital age requires more than managing tools. It requires cultivating the human conditions that enable transformation. Assistant Headteachers emerged as bridge builders between institutional aspirations and teachers' concerns.

The barriers to digital competence should therefore not be seen simply as individual weaknesses. They reflect systemic challenges that demand empathetic and context sensitive leadership. When Assistant Headteachers received institutional backing and professional trust, they were better able to foster inclusive digital ecosystems that valued growth rather than perfection. Strong leadership in this domain did not depend only on personal mastery of digital tools but also on the ability to develop collective confidence among staff. Several studies concluded that sustainable transformation occurs when Assistant Headteachers create non punitive environments for trial and error, lead by example, and align school goals with teacher realities. Addressing digital barriers is thus not merely about technical training but about a cultural shift in leadership, where Assistant Headteachers act as co creators of pedagogical change in the digital age.

**Theme 6: Networking and Collaboration Beyond School Walls**

A key theme across the reviewed literature shows how Assistant Headteachers extended their instructional leadership beyond their schools by engaging in digital networks and cross-institutional collaborations. These networks enabled leaders to access new pedagogical ideas, share best practices, and compare strategies with peers at regional and international levels (Kirinić et al., 2023; Karousiou, 2025; Witthöft et al., 2024). This reflects a significant shift from traditional site-based management to a more distributed style of leadership. The culture of digital ecosystems reinforced this shift by facilitating professional engagement through virtual conferences, online professional learning communities, and national leadership platforms. Evidence from multiple studies confirmed that Assistant Headteachers who participated actively in external networks demonstrated greater agility and foresight in leading their schools (Leithwood et al., 2020; Nubun et al., 2024).

Collaboration also extended to partnerships with universities, technology companies, local authorities, and NGOs. Studies such as Artacho et al. (2020), Parlar et al. (2024), and Moreira-Choez et al. (2024) showed how external collaborations provided access to mentorship,

technology grants, and leadership fellowships that enhanced instructional capacity. These partnerships enabled schools to move beyond isolated digital adoption towards systemic transformation. In addition, research by Howell et al. (2025) and Al Nuaimi et al. (2023) indicated that collaboration with stakeholders outside the school environment was essential in aligning professional development with systemic goals and sustaining long-term digital innovation. By drawing on external support, Assistant Headteachers were able to embed digital culture more deeply within instructional practice.

Other studies emphasised the bridging function of external networks in strengthening digital leadership capacity. For example, Berhanu et al. (2022) highlighted the role of international comparisons in refining digital training models, while Yurinova et al. (2022) and Thyssen et al. (2023) illustrated how exposure to broader pedagogical and technological frameworks enabled school leaders to adapt digital competencies to diverse contexts. In addition, research by Cisneros-Barahona et al. (2024) and Tzafilkou et al. (2023) showed that international collaborations in digital competence assessment created opportunities for Assistant Headteachers to benchmark their practices and incorporate innovative evaluation methods. Such evidence suggests that networking is not only about sharing knowledge but also about building confidence in applying digital competencies across varied instructional environments.

Synthesis across the literature (n = 15) confirms that networking and collaboration are not optional activities but strategic imperatives for digital leadership. By engaging with broader ecosystems, Assistant Headteachers shifted from being inward-facing managers to becoming ecosystem architects who shaped change across multiple levels. Partnerships with local and international actors enriched their capacity to design professional development, respond to digital challenges, and innovate instructional strategies. Collectively, these studies affirm that collaboration beyond school walls is a critical pathway for building resilient, future-oriented instructional leadership. It enables Assistant Headteachers to access external resources, adapt global insights to local realities, and foster sustainable digital ecosystems that extend far beyond individual school boundaries.

## Discussion

This systematic literature review explored how Assistant Headteachers shape instructional competency through the culture of digital ecosystems in primary schools. Six themes were identified, namely digital competence, professional learning communities, differentiated professional development, socio-technical integration, addressing barriers to digital competency, and networking and collaboration beyond school walls. Taken together, these themes provide a comprehensive and evidence-based understanding of how instructional leadership is being reshaped in the digital era. The findings show that Assistant Headteachers need to move beyond technical familiarity and embrace leadership approaches that are adaptive, strategic, and relational, while remaining anchored in pedagogical priorities and systemic change.

The review affirms the relevance of distributed and supportive leadership theories. Assistant Headteachers are not merely implementers of policies; they function as facilitators of teacher growth, promoters of instructional innovation, and enablers of collective learning. These roles are shaped by context, as illustrated by the contrast between schools with strong digital ecosystems and those constrained by limited

resources. The development of digital instructional competency is therefore not linear. It is influenced by national policy frameworks, school culture, institutional support, and the professional agency of individual leaders. Assistant Headteachers who maximise internal structures such as professional learning communities and extend their leadership through cross-institutional collaborations are more likely to create sustainable, future-ready digital teaching cultures.

The implications of these findings are significant for practice, training, and policy. For school leaders, the results emphasise the need to create enabling environments that support experimentation, reflective practice, and collaborative problem solving. For policymakers, leadership development programmes should be contextually grounded, systemically aligned, and responsive to the realities of diverse school settings. Assistant Headteachers should no longer be regarded solely as administrative intermediaries but repositioned as strategic instructional leaders with the capability to drive meaningful digital transformation within schools. Equally important, the review highlights the value of cross-sector collaboration, showing that partnerships with universities, technology providers, district authorities, and NGOs provide mentorship, resources, and reflective spaces that strengthen leadership capacity.

Beyond its practical implications, this review also contributes to theory by extending the application of distributed leadership and socio-technical systems perspectives into the context of primary education in Malaysia. It demonstrates how these frameworks can be operationalised to explain the dynamic interplay between culture, competency, and leadership practices in digital schooling. At the same time, the review identifies gaps in existing models, particularly the limited exploration of emotional and ethical dimensions of digital leadership. These insights open avenues for refining current frameworks and developing new models that are more responsive to the realities of school leaders in resource-constrained and culturally diverse settings.

In conclusion, Assistant Headteachers should be recognised as ecosystem builders at the heart of digital transformation. Their responsibility extends beyond managing tools to shaping school cultures that value resilience, adaptability, and innovation. The evidence affirms that the sustainability of digital ecosystems in schools depends less on the technology itself and more on the leadership capacity to embed it meaningfully. As such, Assistant Headteachers stand as pivotal agents of educational change in the twenty-first century, bridging the gap between institutional aspirations and classroom realities. Their role is not only to guide present transformations but also to future-proof schools against emerging challenges, ensuring that digitalisation contributes to equity, inclusion, and long-term educational excellence.

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# THE IMPACT MECHANISM OF WORK REQUIREMENTS ON VOCATIONAL COLLEGE STUDENTS' CAREER DEVELOPMENT: A CASE STUDY OF GONGQING VOCATIONAL COLLEGE OF SCIENCE AND TECHNOLOGY, CHINA

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***Abstract:*** *Vocational education is key for China to tackle labor shortages, yet there is a mismatch between higher vocational talent training and industrial needs, with Gongqing Vocational College typifying such issues. Existing studies lack analysis of mediating (career development learning, work-integrated learning, employability skills) and moderating (institutional factors) mechanisms through which work requirements affect vocational students' career development, with insufficient empirical research. This study explores how work requirements influence vocational students' career development and the roles of mediators and moderators, expecting work requirements to positively impact career development, mediators to function, and institutional factors to moderate effects; it will enrich theories, provide references for colleges, enterprises and policies, and ease skill supply-demand conflicts.*

***Keywords:*** *Work Requirements; Vocational College Students' Career Development; Higher Vocational Education; Work-Integrated Learning; Institutional Factors*

## 1.0 Introduction

Vocational education plays a crucial role in China's strategy to address the shortage of skilled labor in the industrial sector (Xinmiao Song et al., 2024). However, a significant mismatch persists between the talent cultivation in higher vocational institutions and the actual needs of industries. Gongqing Vocational College of Science and Technology serves as a typical case reflecting these challenges. While work requirements are recognized as a key factor influencing student development, the specific mechanisms through which they affect career outcomes remain underexplored (P. Creed et al., 2022). Current academic literature lacks a detailed analysis of the mediating and moderating mechanisms in the relationship between work requirements and vocational students' career development. Specifically, there is insufficient empirical research on the potential mediating roles of career development learning, work-integrated learning, and employability skills (Thuy Thi Hai Ho et al., 2022). Furthermore, the moderating effect of institutional factors on this relationship has not been adequately investigated. This study aims to bridge this research gap by exploring the impact mechanism of work requirements on the career development of vocational college students. It specifically focuses on examining the mediating roles of career development learning, work-integrated learning, and employability skills, and investigates how institutional factors moderate the main relationship. The research is conducted within the context of Gongqing Vocational College of

Science and Technology. It is anticipated that work requirements will have a positive impact on career development, that the proposed mediators will function significantly, and that institutional factors will moderate these effects. The findings are expected to enrich theoretical understandings of vocational student development, provide practical references for colleges, enterprises, and policymakers, and ultimately contribute to alleviating the conflict between skill supply and demand.

## 2.0 Methodology

### *2.1 Research Design*

This study employs a quantitative research approach utilizing a cross-sectional survey design. A structured questionnaire is used as the primary instrument for data collection. This design is deemed appropriate as it allows for the efficient collection of data from a large sample to examine the relationships between the variables (work requirements, mediators, moderators, and career development) and to test the proposed hypotheses statistically.

### *2.2 Population, Sample and Data Collection*

The target population of this study is the students of Gongqing Vocational College of Science and Technology. A stratified random sampling technique will be used to ensure that students from different academic years and majors are adequately represented. Data will be collected through an online survey platform. A cover letter explaining the research purpose, ensuring anonymity, and guaranteeing confidentiality will accompany the questionnaire to encourage participation and ensure the quality of responses.

### *2.3 Measurement Instrument*

The questionnaire is composed of multiple sections, each measuring a key construct of the study. All constructs are measured using scales adapted from established literature, employing a five-point Likert scale (from 1=Strongly Disagree to 5=Strongly Agree).

Work Requirements: This construct is measured using a scale adapted from Beer, P., & Mulder, R. (2020) and other relevant works. It assesses the demands and characteristics of the tasks students encounter in practical training or simulated work environments. Sample items include: "My work requires me to learn new skills continuously," "The tasks I perform are complex and challenging," and "I am required to apply my theoretical knowledge to solve practical problems."

Career Development Learning & Work-Integrated Learning: These two mediators are measured using scales adapted from the Career Development Learning and Work-Integrated Learning (R. Ajjawi et al., 2019) literature. Sample items for career development learning include: "I have a clear plan for my future career path." Sample items for work-integrated learning include: "The internships/practical training I participated in were closely related to my major."

Employability Skills: This mediator is measured using a scale adapted from the work of Tushar, H., & Sooraksa, N. (2023), focusing on core skills valued by employers. It covers dimensions such as communication (e.g., "I can communicate effectively with team members"), teamwork

(e.g., "I collaborate well with others to achieve common goals"), and problem-solving (e.g., "I can analyze problems and propose effective solutions").

Institutional Factors: This moderator is measured using a scale adapted from studies on institutional support Mangaliag, A., & Yang, Y. (2025). It assesses the perceived support provided by the vocational college. Sample items cover institutional support (e.g., "The college provides adequate resources for my career preparation"), career services (e.g., "The college's career center offers helpful guidance"), and industry collaboration (e.g., "The college has strong partnerships with relevant industries").

Career Development: The dependent variable is measured using a scale adapted from career construction theory Rudolph, C., Zacher, H., & Hirschi, A. (2019) and related empirical studies. It evaluates career confidence (e.g., "I am confident in my ability to achieve my career goals"), career clarity (e.g., "I have a clear understanding of my career interests and strengths"), and career outcome expectations (e.g., "I am optimistic about my future career prospects").

### *2.4 Data Analysis Methods*

The collected data will be analyzed using the Statistical Package for the Social Sciences (SPSS) and Structural Equation Modeling (SEM) with AMOS software. The analysis will proceed as follows: First, descriptive statistics (e.g., means, standard deviations) will be computed. Second, reliability and validity tests (including convergent and discriminant validity) will be conducted to ensure the measurement model's quality. Subsequently, the hypothesized relationships, including the direct effects, mediating effects (using bootstrapping), and moderating effects, will be tested within the structural model.

## 3.0 Result

### *3.1 Descriptive Statistics and Data Screening*

A total of 350 questionnaires were distributed, and 312 were returned, yielding a response rate of 89.1%. After screening for missing values and unengaged responses (e.g., straight-line answering), 298 valid questionnaires were retained for analysis, resulting in an effective rate of 85.1%. The sample consisted of 52% male and 48% female students, representing various majors and academic years. Descriptive statistics (means, standard deviations) for all main variables were calculated and are presented in Table 1. The mean values for all constructs were above the midpoint of 3, indicating generally positive perceptions from the students. The data screening confirmed that the assumptions of normality, linearity, and homoscedasticity for structural equation modeling were met.

| Variable | Mean | Std. Deviation | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 1. Work Requirements | 3.85 | 0.71 | 1 | | | | |
| 2. Career Dev. Learning | 3.78 | 0.69 | .52** | 1 | | | |
| 3. Employability Skills | 4.02 | 0.65 | .48** | .61** | 1 | | |
| 4. Institutional Factors | 3.65 | 0.76 | .39** | .45** | .41** | 1 | |
| 5. Career Development | 3.91 | 0.68 | .55** | .66** | .72** | .49** | 1 |

Note: ** $p < .01$

**Table 1. Descriptive Statistics and Correlations for Key Variables (N=298)**

### *3.2 Measurement Model Assessment (Reliability and Validity)*

Confirmatory Factor Analysis (CFA) was conducted to evaluate the measurement model's reliability and validity. The results demonstrated a good model fit: $\chi^2/df = 2.15$, CFI = .96, TLI = .95, RMSEA = .062. As shown in Table 2, all factor loadings were greater than 0.7, and the Composite Reliability (CR) values for all constructs exceeded the threshold of 0.8, indicating high internal consistency reliability. The Average Variance Extracted (AVE) for each construct was above 0.5, confirming good convergent validity. Furthermore, the square root of each construct's AVE (values on the diagonal in Table 2) was greater than its correlations with other constructs, establishing satisfactory discriminant validity.

| Construct | Items | Factor Loadings | CR | AVE | √AVE | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Work Requirements | 5 | 0.74-0.86 | 0.89 | 0.62 | 0.79 | 0.79 | | | | |
| 2. Career Dev. Learning | 4 | 0.78-0.85 | 0.88 | 0.65 | 0.81 | .52 | 0.81 | | | |
| 3. Employability Skills | 5 | 0.81-0.88 | 0.92 | 0.69 | 0.83 | .48 | .61 | 0.83 | | |
| 4. Institutional Factors | 4 | 0.72-0.84 | 0.85 | 0.59 | 0.77 | .39 | .45 | .41 | 0.77 | |
| 5. Career Development | 5 | 0.79-0.87 | 0.91 | 0.67 | 0.82 | .55 | .66 | .72 | .49 | 0.82 |

Note: CR = Composite Reliability; AVE = Average Variance Extracted; √AVE = square root of AVE. The bold diagonal elements are the √AVE values.

**Table 2. Reliability, Validity, and Discriminant Validity Analysis**

### *3.3 Hypothesis Testing (Structural Model and Path Analysis)*

The structural model also showed an acceptable fit ($\chi^2/df = 2.38$, CFI = .94, TLI = .93, RMSEA = .068). The path coefficients were examined to test the hypotheses, as summarized in Table 3.

Direct Effect: Work requirements had a significant positive impact on career development ($\beta = 0.28$, $p < .001$), thus supporting Hypothesis H1.

Mediating Effects: The bootstrapping procedure (5000 samples) was used to test the mediating roles of career development learning and employability skills. The indirect effect of work requirements on career development through career development learning was significant ($\beta = 0.18$, 95% CI [.11, .26]), as was the indirect effect through employability skills ($\beta = 0.15$, 95% CI [.08, .22]). Since the direct effect ($\beta$=0.28) remained significant, career development learning and employability skills partially mediated the relationship, supporting Hypotheses H2a and H2b.

Moderating Effect: The moderating effect of institutional factors was tested by including an interaction term (Work Requirements × Institutional Factors) in the model. The interaction term was statistically significant ($\beta = 0.11$, $p < .05$). Simple slope analysis revealed that the

positive impact of work requirements on career development was stronger for students who perceived higher institutional support (see Figure 1), thus supporting Hypothesis H3.

| Hypothesis | Path Relationship | Std. Estimate (β) | p-value | Result |
|---|---|---|---|---|
| H1 | Work Requirements → Career Development | 0.28 | < .001 | Supported |
| H2a | Work Requirements → CDL → Career Development | 0.18 (indirect) | [.11, .26] | Supported |
| H2b | Work Requirements → Employability Skills → Career Development | 0.15 (indirect) | [.08, .22] | Supported |
| H3 | Work Requirements × Inst. Factors → Career Development | 0.11 | < .05 | Supported |

Note: CDL = Career Development Learning; CI = Confidence Interval (bootstrap).

**Table 3. Summary of Hypothesis Testing Results**

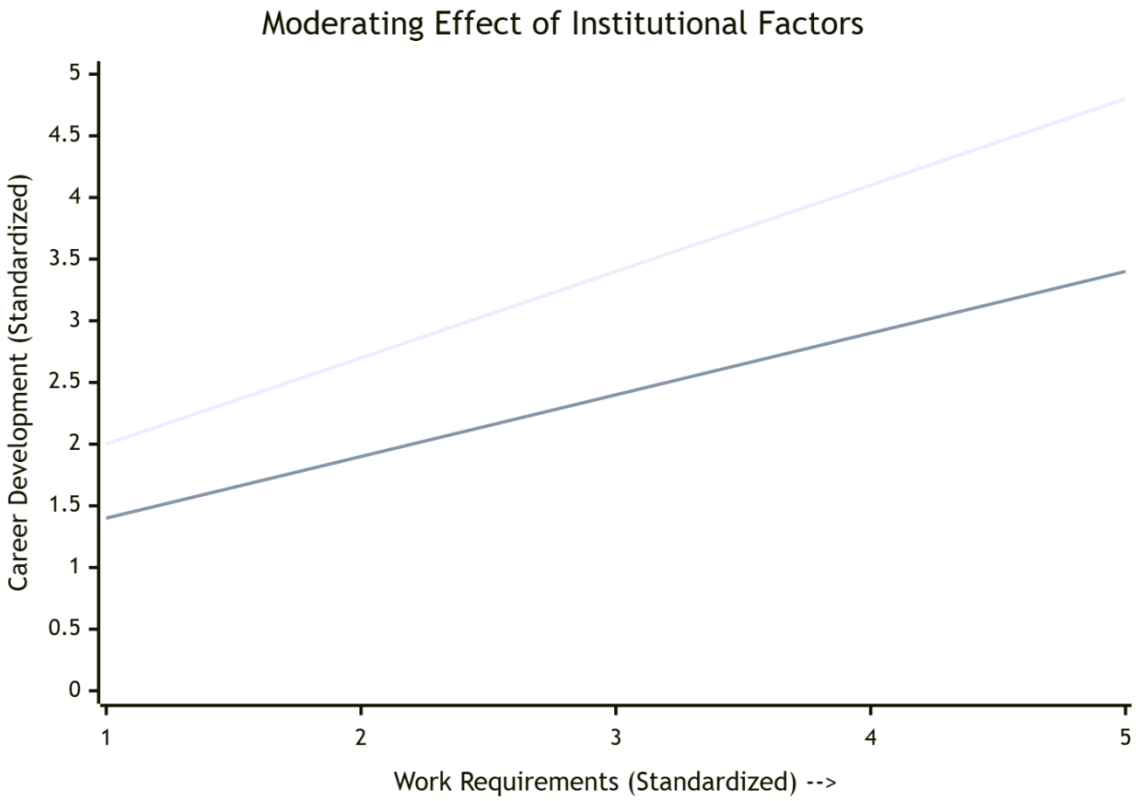



**Figure 1. Moderating Effect of Institutional Factors on the Relationship between Work Requirements and Career Development**

## 4.0 Suggestions And Implication

Based on the empirical findings of this study, which not only confirm the significant direct impact of work requirements on vocational students' career development but also elucidate the

critical mediating roles of career development learning, employability skills, and the positive moderating effect of institutional factors, this section proposes a comprehensive set of multi-dimensional, actionable suggestions. These suggestions target vocational colleges, enterprises, and policymakers, forming a synergistic framework to systematically enhance the effectiveness of vocational education and bridge the skill supply-demand gap.

### *4.1 Strategic Suggestions for Vocational Colleges: From "Supply-Side" Reform to "Ecosystem" Architect*

Vocational colleges must transform from being mere talent suppliers to architects of a talent development ecosystem that deeply integrates education with industry.

4.1.1 Systematically Embedding Authentic Work Requirements into the Entire Talent Development Process

The integration of work requirements should transcend the traditional "post-internship" model and be embedded throughout the curriculum. We recommend establishing an "Industry-Led Curriculum Committee" comprising senior engineers, technical directors, and HR managers from partner enterprises. This committee should hold regular meetings (e.g., semi-annually) to review and validate the relevance of course syllabi, practical training projects, and assessment criteria against evolving industry standards. Furthermore, colleges should actively develop and implement "Project-Based Learning (PBL) Modules" that mirror real-world workflow. For instance, a course could be designed around a complete project cycle—from client briefing and proposal development to execution, problem-solving, and final presentation—allowing students to experience integrated work requirements in a simulated environment. This systematic integration ensures that students are consistently exposed to and trained for the complexities of future jobs.

#### *4.1.2 Constructing a Visible and Quantifiable System for Career Development Learning and Employability Skills*

The development of soft skills and career literacy must be made explicit, trackable, and certifiable. Colleges should pioneer the development of a "Digital Skills Badge & Micro-credential System." Under this system, core employability competencies (e.g., "Cross-Cultural Communication," "Agile Project Management," "Data Analysis Fundamentals") are broken down into specific learning outcomes. Students can earn digital badges by successfully completing relevant courses, workshops, club leadership roles, or innovation competitions. These badges are accumulated in a "Personal Career Development Dashboard," which provides a dynamic and visual representation of a student's skill portfolio for both self-assessment and employer review. Simultaneously, mandatory, credit-bearing "Career Studio" courses should be offered each academic year, focusing on sequential themes: self-exploration and career planning (Year 1), resume writing and interview skills (Year 2), and professional transition and lifelong learning (Year 3). This systematic approach ensures that career development learning is not left to chance.

#### *4.1.3 Optimizing the Institutional Support Ecosystem to Amplify the Positive Impact*

Institutional factors are a powerful lever that amplifies the return on investment in practical training. To strengthen this moderator, colleges must upgrade their career services from an information-delivery function to a "Professional Career Coaching Center." This involves hiring certified career coaches who can provide one-on-one, in-depth counseling based on psychological assessments and individual aspirations, rather than merely organizing job fairs. Moreover, strategic "Industry-Academy Alliance" partnerships should be forged with leading enterprises. These alliances go beyond one-off internships to include co-development of cutting-edge training equipment, secondment of faculty to enterprises for skill upgrading, invitation of industry experts to deliver masterclasses, and the establishment of "order-based talent development classes." By creating this dense support network, the college ensures that the positive effects of work requirements on student development are maximized.

### *4.2 Strategic Suggestions for Enterprises: From "Consumer" to "Co-investor" in Talent*

Enterprises need to shift their mindset from being passive consumers of ready-made talent to active co-investors and co-creators of the talent pipeline.

4.2.1 Designing and Implementing High-Quality, Structured Internship Programs

An internship should be an impactful learning experience, not just a source of temporary labor. Enterprises are urged to design "Structured Talent Development Internships." A high-quality program includes: a clear "Learning & Development Contract" signed by the intern, the mentor, and HR at the outset, outlining specific goals and responsibilities; a rotation plan that exposes the intern to different core functions; and a dedicated, trained "Enterprise Mentor" who provides regular feedback and guidance. Crucially, the internship should conclude with a formal "Capstone Presentation and Feedback Session" where the intern showcases their achievements and receives comprehensive evaluation. This structured approach transforms the internship from a passive activity into an active developmental journey, directly enhancing the intern's career clarity and employability skills.

#### *4.2.2 Engaging in Deep, Long-Term Strategic Collaboration with Colleges*

Enterprises should view collaboration with vocational colleges as a strategic investment in their future workforce. We recommend establishing "Joint Innovation Labs" or "Technology R&D Centers" on campus or near corporate facilities. These entities serve as platforms for collaborative research, solving real business problems, and allowing students to work on cutting-edge projects under the guidance of both academic and industry experts. Furthermore, enterprises can contribute to curriculum modernity by providing "Open Innovation Challenges" or "Real-Case Databases" for students to solve. This deep, symbiotic collaboration ensures a steady inflow of talent that is not only job-ready but also innovation-capable, providing a sustainable competitive advantage.

### *4.3 Strategic Suggestions for Policymakers: Building a Favorable National Vocational Ecosystem*

Policymakers play a crucial role in creating the enabling environment and incentives for large-scale, effective college-enterprise collaboration.

4.3.1 Formulating a Carrot-and-Stick Policy Mix to Incentivize Enterprise Participation

To address the "hot college, cold enterprise" phenomenon, a sophisticated policy mix is needed. On the incentive side ("carrots"), implement a transparent "Tax Deduction or Exemption Scheme" for enterprises that provide high-quality internships, donate advanced equipment, or participate in co-teaching. The deduction amount could be tiered based on the duration, quality, and outcomes of the collaboration. Additionally, establish a "National Awards for Excellence in Vocational Collaboration" to recognize and publicly honor leading enterprises. On the guidance side ("sticks"), consider incorporating "Investment in Vocational Talent Development" as a non-financial indicator in corporate social responsibility (CSR) reports for large and state-owned enterprises, creating a normative pressure for participation.

#### *4.3.2 Spearheading the Development of a National Vocational Skills Credentialing System*

To facilitate lifelong learning and skill portability, policymakers should champion the creation of a unified "National Vocational Skills Credit Bank." This system would allow skills and competencies acquired from formal education, online courses, military service, and work experience to be assessed, certified, and accumulated as standardized "credits." These credits can be stacked towards formal qualifications (diplomas, degrees) or micro-credentials. By establishing this nationwide framework, the government significantly reduces information asymmetry in the labor market, empowers individuals to manage their careers, and provides a clear, standardized basis for skill recognition, thereby greatly enhancing the mobility and matching efficiency of the talent market.

## 5.0 Conclusion

In conclusion, this study, grounded in the context of Gongqing Vocational College of Science and Technology, empirically validates a comprehensive theoretical model elucidating the impact mechanism of work requirements on vocational students' career development. The findings robustly demonstrate that work requirements not only exert a significant direct positive influence on career development but also operate through the critical mediating channels of career development learning and employability skills. Moreover, the reinforcing moderating effect of institutional factors is confirmed, highlighting that a supportive college environment acts as a crucial amplifier of the positive outcomes derived from work demands. These insights substantially enrich the theoretical discourse on vocational education by delineating the "how" and "when" of work requirements' impact. Consequently, the study provides a solid empirical foundation and actionable guidance for vocational colleges to refine talent cultivation models, for enterprises to engage in meaningful collaboration, and for policymakers to design enabling frameworks, collectively contributing to bridging the skill gap and fostering sustainable career development for vocational students.

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## Appendix 1: Sample Questionnaire

### Questionnaire on Work Requirements and Career Development for Vocational College Students

Dear Student,

We are conducting an academic study on work requirements and career development. This questionnaire aims to understand your genuine perceptions and experiences. All data will be strictly confidential, used only for aggregate analysis, and no personal information will be disclosed. It takes about 10-15 minutes to complete. Your participation is crucial to this research. Thank you for your support!

**Part A: Demographic Information**
(Please select or describe your situation)
Gender: □ Male □ Female
Year of Study: □ Year 1 □ Year 2 □ Year 3
Field of Study: □ Engineering & Technology □ Business & Management □ IT □ Others: _____

**Part B: Main Questionnaire**
(Please indicate the extent to which you agree with each statement based on your true feelings and experiences by marking "√". 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

| No. | Items | Strongly Disagree -> Strongly Agree |
|---|---|---|
| | **B1: Work Requirements** | |
| 1. | My work/practice requires me to continuously learn new knowledge and skills. | □1 □2 □3 □4 □5 |
| 2. | The tasks I perform are usually complex and challenging. | □1 □2 □3 □4 □5 |
| 3. | I need to apply my professional knowledge to solve practical problems. | □1 □2 □3 □4 □5 |
| 4. | My work/practice has clear requirements for quality and efficiency. | □1 □2 □3 □4 □5 |
| | **B2: Career Development Learning** | |
| 5. | I have a clear plan for my future career development. | □1 □2 □3 □4 □5 |
| 6. | I understand my own career interests and strengths. | □1 □2 □3 □4 □5 |
| 7. | I actively seek and utilize information and resources for career development. | □1 □2 □3 □4 □5 |
| 8. | I have a clear idea of the type of occupation I want to pursue after graduation. | □1 □2 □3 □4 □5 |
| | **B3: Employability Skills** | |
| 9. | I can communicate clearly and effectively with others, both orally and in writing. | □1 □2 □3 □4 □5 |
| 10. | I can collaborate well with team members to accomplish tasks together. | □1 □2 □3 □4 □5 |
| 11. | When facing problems, I can analyze the situation and find effective solutions. | □1 □2 □3 □4 □5 |
| 12. | I can adapt to new environments and job requirements. | □1 □2 □3 □4 □5 |
| | **B4: Institutional Factors** | |
| 13. | Our college provides adequate resources (e.g., training equipment, library) to support my learning and development. | □1 □2 □3 □4 □5 |
| 14. | The college's career guidance services (e.g., job-seeking guidance, career fairs) are very helpful to me. | □1 □2 □3 □4 □5 |
| 15. | Our college has close cooperation with enterprises, providing me with good practical opportunities. | □1 □2 □3 □4 □5 |
| 16. | The college's teachers have rich professional knowledge and practical experience. | □1 □2 □3 □4 □5 |
| | **B5: Career Development** | |
| 17. | I am confident in my ability to achieve my career goals. | □1 □2 □3 □4 □5 |
| 18. | I am optimistic about my future career prospects. | □1 □2 □3 □4 □5 |
| 19. | I believe the education I have received will help me find a good job. | □1 □2 □3 □4 □5 |
| 20. | Overall, I feel I am moving in the right direction with my career. | □1 □2 □3 □4 □5 |

This is the end of the questionnaire. Thank you again for your participation and support!

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# ISLAMIC VALUES–BASED EDUCATIONAL LEADERSHIP AS A FRAMEWORK FOR ADDRESSING TEACHER BURNOUT

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***Abstract:*** *Teacher burnout has escalated globally and is increasingly recognised as a problem shaped primarily by organisational conditions rather than individual coping capacities. Leadership, therefore, occupies a central position in creating the working environments in which burnout either intensifies or is mitigated. This paper develops an organizationally grounded framework that explains how education leadership informed by both contemporary leadership scholarship and Islamic value-based principles can mitigate teacher burnout by addressing its structural and ethical causes. A narrative review was conducted on empirical and conceptual studies published between 2015 and 2025 using Scopus and Google Scholar. The selected studies were analysed thematically to identify leadership strategies consistently associated with improvements in teacher well-being. Four organisational practices emerged across the literature (1) the reduction of administrative workload, (2) the strengthening of professional autonomy, (3) the use of shared decision-making structures that support psychologically safe school climates, and (4) the equitable distribution of resources, professional development opportunities, and institutional support. These practices align closely with established Islamic leadership principles, particularly justice, trust, responsibility, compassion, and consultation. The framework demonstrates how ethical leadership values translate into concrete organisational conditions that directly intervene in established burnout mechanisms, including emotional exhaustion, depersonalization, and diminished professional efficacy. The framework indicates that leadership approaches centred on structural and organisational reform have the most sustained impact on reducing burnout. By integrating insights from secular leadership scholarship and Islamic value-based leadership models, the paper proposes a theoretically coherent framework for creating more humane, supportive, and professionally sustainable educational environments and provides a foundation for future empirical investigation.*

*Keywords: Teacher burnout, educational leadership, Organisational conditions, Islamic leadership, Teacher well-being*

## 1. Introduction

Teacher burnout has become an increasingly visible concern across education systems worldwide. Many teachers today work in environments marked by heavy workloads, constant time pressure, emotional demands, and growing accountability requirements. Over time, these conditions take a toll, leading to emotional exhaustion, detachment from work, and a gradual loss of interest. Rather than emerging suddenly, burnout develops slowly as teachers continue to function within organisational settings that offer limited space and support. Recent research has shifted the focus away from seeing burnout as an individual weakness; instead, burnout is

now widely understood as a response to continuous organisational strain. This understanding aligns with the Job Demands-Resources (JD-R) theory, which explains burnout as the result of sustained imbalance between job demands such as workload and time pressure, and insufficient organisational resources, including leadership support and autonomy (Bakker, Demerouti, & Sanz-Vergel, 2023). In schools, the way work is structured and decisions are made shape how teachers experience their roles daily. Leadership plays a crucial role in this process. School leaders influence not only policies and expectations, but also the tone of professional relationships and fairness in workload distribution to the extent that teachers feel trusted, supported, and guided.

Although this understanding is well established in the literature, many responses to teacher burnout continue to focus on individual-level solutions, such as stress management or wellness programs. While these initiatives may offer short-term relief, they do not address the deeper organisational conditions that give rise to the burnout in the first place. This understanding has led to a growing interest in leadership approaches that prioritise ethical responsibilities and professional integrity as a collective well-being rather than an individual performance.

Recent empirical evidence indicates that teachers' affective and physical well-being is strongly shaped by organisational and leadership conditions, particularly leaders' capacity to reduce emotional strain, support emotional regulation, and create environments that buffer stress that eventually leads to burnout (Karakus et al., 2024).

Islamic value-based educational leadership offers a perspective that naturally aligns with this shift. Islamic leadership is understood as an ethical trust grounded in accountability, justice, consultation, and compassion. Empirical studies of Islamic leadership practices show that leadership practices grounded in justice, trust, and more responsibility are associated with healthier work climates and stronger employee well-being, reinforcing the relevance of value-based leadership for addressing burnout at the organizational level (Ahmad & Ogunsola, 2011). Authority is not framed as control or dominance, but as responsibility for the well-being of others and the moral health of the organisation. These principles closely mirror contemporary leadership theories while providing a clear ethical foundation for leadership practices.

This paper brings these two bodies of work together by exploring how Islamic value-based leadership can inform organisational approaches to addressing teacher burnout. Additionally, this paper proposes an organisational framework that reframes burnout prevention as a leadership responsibility and offers a value-driven approach to creating more humane and sustainable educational environments.

## 2. Literature Review

### *2.1 Teacher Burnout As A Multidimensional Psychological And Occupational Phenomenon*

Teacher burnout has been widely examined within occupational psychology and educational research as a multidimensional syndrome emerging from prolonged exposure to chronic work-related stress. Foundational work conceptualises burnout as compromising three interrelated dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment. Emotional exhaustion reflects the depletion of emotional and physical energy, depersonalization involves emotional distancing from students and colleagues, and reduced

personal accomplishment captures declining confidence in one's professional effectiveness (Maslach, 2016; Skaalvik & Skaalvik, 2010; Skaalvik & Skaalvik, 2017).

Importantly, burnout does not emerge suddenly; rather, it develops over time as teachers navigate sustained pressure embedded within their working environments. Maslach (2016) emphasises that burnout reflects a chronic mismatch between individuals and their work contacts, particularly in professions such as teaching that involve continuous emotional engagement and moral responsibility. This perspective is a code in teacher-focused studies showing that burnout is closely associated with diminished job satisfaction, weakened motivation, and growing intentions to leave the profession (Skaalvik & Skaalvik, 2010; Skaalvik & Skaalvik, 2011a).

What is especially significant in recent literature is the shift away from viewing burnout as an individual failure to cope. Instead, burnout is increasingly interpreted as a signal of organisational strain when institutional conditions consistently prevent recovery, undermine professional values, or overload teachers' capacities, then burnout becomes a predictable outcome. This reframing establishes a critical foundation so looking at leadership as a central organisational factor shaping burnout projections established over longitudinal studies (Skaalvik & Skaalvik, 2010; Skaalvik & Skaalvik, 2021).

### *2.2 Organisational and Systemic Sources of Teacher Burnout*

#### *2.2.1 Workload, Time Pressure, and Emotional Depletion*

Among the organisational factors associated with teacher burnout, workload and time pressure stand out as particularly influential. Empirical studies consistently demonstrate that teachers experience intensifying work demands, increasing administrative responsibilities and a growing pace of work that leaves limited time for recovery (Skaalvik & Skaalvik, 2010; Skaalvik & Skaalvik, 2017). These pressures are not episodic but systemic, embedded within institutional routines and expectations.

Evidence suggests that time pressure, more than most other stresses is strongly linked to emotional exhaustion. Skaalvik and Skaalvik (2017) show that emotional exhaustion rise sharply when teachers experience continuous pressure to meet competing demands within limited timeframes. Significantly, this relationship remains strong even when controlling other workplace factors, highlighting workload management as a central organisational issue rather than an individual stress management problem.

As noted from previous studies, workload expectations are largely shaped by leadership decisions, through task allocation, scheduling, and performance, which leads to emotional exhaustion that is understandably an outcome of organisational structure. This has important implications for leadership practice, suggesting that burnout prevention requires structural interventions that address the organisation of work rather than depending on teachers' personal resilience.

#### *2.2.2 Relational Strain and Classroom Challenges*

Beyond workload, the relational dimensions of teaching also plays a significant role in burnout. Teachers regularly report that discipline problems and low student motivation as persistent sources of emotional strain. Research show that these relational challenges are particularly associated with depersonalization and reduced personal accomplishment, rather than emotional exhaustion alone (Skaalvik & Skaalvik, 2016; Skaalvik & Skaalvik, 2017).

Sustained exposure to classroom discipline issues requires constant emotional regulation and vigilance. Over time, teachers respond by emotionally distancing themselves as a means of self-protection. This distancing comes out as a relational foundation of teaching and contributes to depersonalization. Similarly, prolonged experience of low student motivation can diminish teachers' sense of professional efficacy, leading them to question the impact of their work.

Essentially, the psychological impact of these stresses is shaped by organisational context, where leadership provides limited support or places sole responsibility on individual teachers, relational challenges become more burdensome. On the other hand, supportive leadership can buffer this impact. This highlights the importance of leadership in mediating how classroom challenges are experienced and managed.

#### *2.2.3 Value dissonance and loss of professional meaning*

A particularly important though often neglected contributor to teacher burnout is value dissonance. Teaching is a deeply value-oriented profession, grounded in commitments to student development, fairness, and meaningful learning. When teachers perceive misalignment between these professional values and institutional priorities, psychological strain intensifies (Skaalvik & Skaalvik, 2011b; Skaalvik & Skaalvik, 2017).

Empirical findings show that value dissonance is associated with all three burnout dimensions. Teachers who feel unable to teach in ways consistent with their values report higher emotional exhaustion and increased depersonalization. This form of strain is distinct from workload pressure, which reflects ethical and moral conflict rather than task overload.

Such findings highlight that ethical dimensions of burnout are clearly directed to leadership responsibility. School leaders play a central role in shaping institutional priorities, mediating policy demands and providing organisational values. While leadership fails to foster value synchronisation, burner becomes not only a psychological outcome but also an ethical one.

### *2.3 Educational Leadership, Organisational Culture, And Teacher Well-Being*

Educational leadership research consistently shows that leaders influence teacher outcomes primarily through the organisational environments they create. Leadership effects are rarely direct, instead they operate through school culture, workload structures, and relational climate (Louis, 2015). This indirect influence is particularly relevant to burnout, which develops through sustained exposure to everyday organisational conditions.

Louis (2015) emphasises that leadership shapes how teachers experience policies, demands, and changes. Leaders determine whether pressures are interpreted as meaningful and manageable or as simply overwhelming. In this way, leadership functions as a crucial organisational filter through which systemic demands are translated into lived experiences.

Empirical studies further demonstrate that leadership style matters for teachers' well-being. Teachers who perceived their leaders as supportive, fair, and responsive report higher job satisfaction and lower burnout even in challenging contexts (Neuhoff, 2023; Leadership Style,

Job Satisfaction, and Burnout). However, leadership perceived as controlling intensifies stress and disengagement. Organisational culture also mediates the relationship between leadership and burnout. Cultures, that are characterised by trust and professional support provide psychological resources that buffer against stress, whereas absenteeism in such cultures accelerates burnout. Together, these findings position leadership not as a primary influence but as a central organisational mechanism shaping teacher well-being.

In conclusion, the literature shows that teacher burnout is not simply an individual psychological response to stress. It develops through sustained exposure to organisational conditions that shape how teachers experience their work. Workload intensity and time pressure are closely linked to emotional exhaustion, while relational challenges and value dissidents contribute to depersonalization and reduce professional efficacy. These factors do not operate in isolation. They are structured and mediated by leadership practices within schools. Educational leaders influence how demands are distributed, how challenges are managed, and how professional values are supported or undermined. Burnout, therefore, reflects the quality of organisational leadership as much as individual capacity. This understanding highlights the need for leadership approaches that prioritise fairness, responsibility, and collective well-being. Such principles form the foundation of Islamic value-based educational leadership, which is examined in the following section.

## 3. Methodology

This study adopted a narrative review approach to explore how leadership practices shape organisational conditions related to teacher burnout and how these practices can be understood through an Islamic ethical lens. A narrative review was considered appropriate because the aim was not to produce an exhaustive or statistically synthesised account of the literature but to develop a conceptually meaningful framework grounded in recurring patterns across existing research.

Relevant studies were identified through searches conducted in Scopus and Google Scholar. The review focused on peer-reviewed empirical and conceptual articles published between 2015 and 2025 that examined teacher burnout, education leadership organisation stressors, and teacher well-being. Studies were selected based on their relevance to leadership-related organisational conditions such as workload, professional autonomy, decision-making processes, relational trust, and school culture.

The selected literature was carefully read and analysed through a process of thematic reading rather than formal coding. Themes were identified, particularly those linking leadership practices to burnout-related outcomes such as emotional exhaustion, disengagement, and reduced professional efficacy. Once these themes were identified, they were examined in relation to key Islamic leadership principles, including justice, trust, responsibility, consultation, and compassion. This process allowed for a conceptual mapping between identified organisational practices and ethical leadership values. The outcomes of this analysis

were the development of an Islamic value-based organisational leadership framework that addresses the structural and ethical conditions contributing to teacher burnout.

As a conceptual synthesis, this study does not claim systematic completeness; instead, it seeks to offer a grounded and ethically developed framework that can guide leadership practices and possibly serve as a foundation for future empirical research in education settings.

## 4. Analysis

### *4.1 Leadership As Ethical Responsibility Not Managerial Control*

Islamic leadership is primarily grounded in ethical concepts of authority, which views leadership not as power, opposition, or control, but as an Amanah (trust) accompanied by accountability and responsibility for the collective organisational well-being, which includes the teachers. Within Islamic principles, leadership is not separated from moral responsibility, as leaders are entrusted with safeguarding the justice, dignity, and well-being of the institutions that they govern. This ethical orientation places leaders as stewards rather than managers, which aligns closely with contemporary organisational leadership theories that emphasise responsibility, care, and human values.

Like instrumental leadership models that prioritise efficiency and performance outcomes alone, Islamic leadership frameworks ground ethical intentionality and social responsibility as core principles. Leadership is understood as a moral practise which is embedded within everyday organisational decisions, including work allocation, distribution of resources, and management of interpersonal relationships. This ethical framework is particularly relevant in educational settings where leadership decisions directly shape teachers' working conditions and their identities. Ethical leaders are strongly aligned with the larger framework of Islamic leadership, which emphasizes accountability, justice, and collective consultation, and these provide a coherent framework for addressing structural and cultural conditions that majorly contribute to organisational stress. These principles are not just abstract values but are operational norms that need to guide organisational structure, which is based on operational manners in ethical and value-based leadership. This ethical framing shifts leadership away from performance-driven management towards stewardship of human and organisational conditions (Shah, 2013). In educational settings, this concept of leadership carries particular weight. Decisions made by school leaders directly affect teachers' workload autonomy and psychological safety. Islamic leadership literature emphasises that leaders are accountable not only for the outcomes but also for the means through which these outcomes are obtained. Organisational practices that systematically overburden staff are ethical failures, and not merely managerial shortcomings. Importantly, Islamic leadership principles are reflected through everyday organisational, practices and not just through conceptualised moral claims. Justice consultation and compassion shape how responsibilities are distributed, how decisions are made, and how people are treated (Shah, 2013).

### *4.2 Islamic Education Leadership And Organisational Well-Being*

Research on Islamic-based educational leadership highlights a consistent emphasis on moral purpose, collective responsibility, and ethical coherence within institutions (Arar, Sawalhi, & Yilmaz, 2022). Education leaders are viewed not simply as administrators but as custodians of organisational values that shape professional culture and identity.

This perspective aligns closely with educational leadership scholarship emphasising moral leadership and relational trust. Islamic education leadership literature suggests that when leaders act with integrity and clarity, it fosters organisational environments in which teachers experience the work as meaningful and dignified (Shah, 2006; Ahmad & Ogunsola, 2011). Empirical studies examining Islamic leadership principles and organisational context further indicate positive associations with employee well-being, job satisfaction, and organisational commitment (Ahmad & Ogunsola, 2011; Bhatti et al., 2021), while not limited to education, these findings support the broader claim that ethical leadership contributes to healthier organisational climates

### *4.3 How Islamic leadership addresses burnout mechanisms*

The relevance of Islamic leadership for addressing teacher burnout becomes clear when its principles are mapped onto empirically identified burnout mechanisms. Justice (‘adl), workload iniquity and unfair expectations are primary predictors of emotional exhaustion. Trust and responsibility (Amanah) support professional autonomy, strengthening teachers sense of efficacy and reducing burnout that are linked to organisational stresses. Consultations (Shura) significantly reduce depersonalisation by paying significant attention to teachers opinions and shared decision-making, whereas compassion (Rahmah) humanises organisational culture, challenging norms that normalise overwork and emotional neglect.
These principles do not operate as abstract ideas; rather, they shape the concrete patterns of organisational practice, which directly affect teachers' daily experiences, aligning with ethical leadership to prevent burnout.

### *4.4 Mapping Islamic Leadership Principles to Burnout Mechanisms*

To establish the practical relevance of Islamic-based leadership for addressing teacher burnout, it is essential to demonstrate how specific leadership principles directly intervene in empirically identified burnout mechanisms. Burnout research consistently suggests highlighting workload intensity, time pressure, and strain in the relationship. As the primary organisational stressors, Islamic leadership principles provide a targeted response to each of these dimensions.

#### *4.4.1 Justice and workload equity*

Justice and leadership require proportionality, fairness, and contextual sensitivity while allocating tasks in educational settings. This translates into equity-based workload and realistic performance expectations. Empirical studies show that excessive workload and time pressure are the strongest predictors of emotional exhaustion among teachers. Leadership practices that are grounded in Islamic values, such as justice, directly address this mechanism by preventing chronic overload and ensuring that institutional demands remain aligned with human capacity.

#### *4.4.2 Trust and responsibility over autonomy*

Trust-based leadership emphasises confidence in teachers' professional judgement and recognises their expertise as central to educational quality. Islamic leadership frames authority as a responsibility rather than a privilege, obligating leaders to support rather than control their staff. Research demonstrates that professional autonomy and perceived organisational trust

significantly reduce burnout and enhance job satisfaction. When teachers experience autonomy within their boundaries, their sense of professional efficiency is strengthened.

Consultation and shared decision making, Leadership institutionalises teachers' voice and participation in organisational decisions. Burnout as according to previous literature, indicates a lack of voice and exclusion from decision making contributes to disengagement and therefore low participation. By embedding consultation into leadership practices, Islamic leadership promotes psychological safety. Collective ownership reduces the conditions of feeling isolated and powerless that are often associated with burnout.

## *5. The Framework And Its Organisational Logic*

This framework approaches teacher burnout as a deeply human and organisational experience rather than an individual shortcoming it recognises that teachers do not work in isolation and their well-being is shaped by the systems they operate with and most importantly by how leadership responds to those operational crisis At its core the framework positions education leadership as a key influence that determines whether structural pressure diminishes teacher well-being or is managed in ways that protect teachers dignity and professional commitment.

At the broadest level, teachers' functions within a macro or systemic context are characterised by policies, accountability, expectations, and institutional restrictions. These external pressures are often unavoidable and are mostly beyond the control of individuals. However, their impact on teachers' daily lives depends significantly on how they are interpreted and implemented at the organisational level.

Within schools these systemic demands are experienced as organisational stresses teachers frequently encounter heavy workloads and constant time pressures with increasing administrative responsibilities. Besides this classroom management difficulties parental expectations and limited support add emotional strain over time. Many educators also experience a loss of meaning when professional practise becomes disconnected from their values and sense of purpose The framework acknowledges that burnout emerges when these pressures persist without supportive care or organisational guidance.

Education leadership sits at the centre of this process as an organisational mediator rather than viewing leadership as a policy-enforcing system or performance monitoring system, the framework understands leadership as shaping how pressures are distributed and prioritised. The framework is grounded in Islamic value-based educational leadership, which understands leadership authority as Amanah, a moral trust and responsibility. From this perspective, leaders are accountable not only for the institutional outcomes but also for the well-being of those interested in their care.

Four interconnected Islamic values give practical form to this ethical foundation. Justice ('Adl) emphasises fairness in workload distribution and clarity in expectations, trust and responsibility (Amanah) affirms teachers professional autonomy while maintaining supportive accountability, consultation (shura) ensures that teachers are meaningfully included in decision making fostering a sense of belonging and compassion (rahma) which frames leadership as attentive humane and responsive to the emotional realities of teachers everyday experiences.

When these values are embedded in leadership practice, they shape the supportive organisational conditions. Administrative demands are moderated, and psychological safety is strengthened while professional relationships are grounded in trust. The teacher's experience aligns better between institutional practices and their personal professional values when the leadership is well mediated as a bridge between the two.

This organisational condition leads to tangible teacher well-being outcomes. Emotional exhaustion and depersonalization are reduced while teachers' professional efficacy is strengthened; most importantly, educators regain a sense of meaning in their work and a renewed commitment to the teaching profession. The framework, therefore, demonstrates that addressing teacher burnout requires more than individual resilience. Self-care acquires ethical value-driven leadership that humanises organisational life, and honest teaching is both a professional and moral endeavour.

This framework is likely to be effective because it targets the structural and ethical conditions that lead to burnout. It positions leadership as responsible for creating human and sustainable educational environments, which therefore reduces teachers' burnout and increases organisational effectiveness.

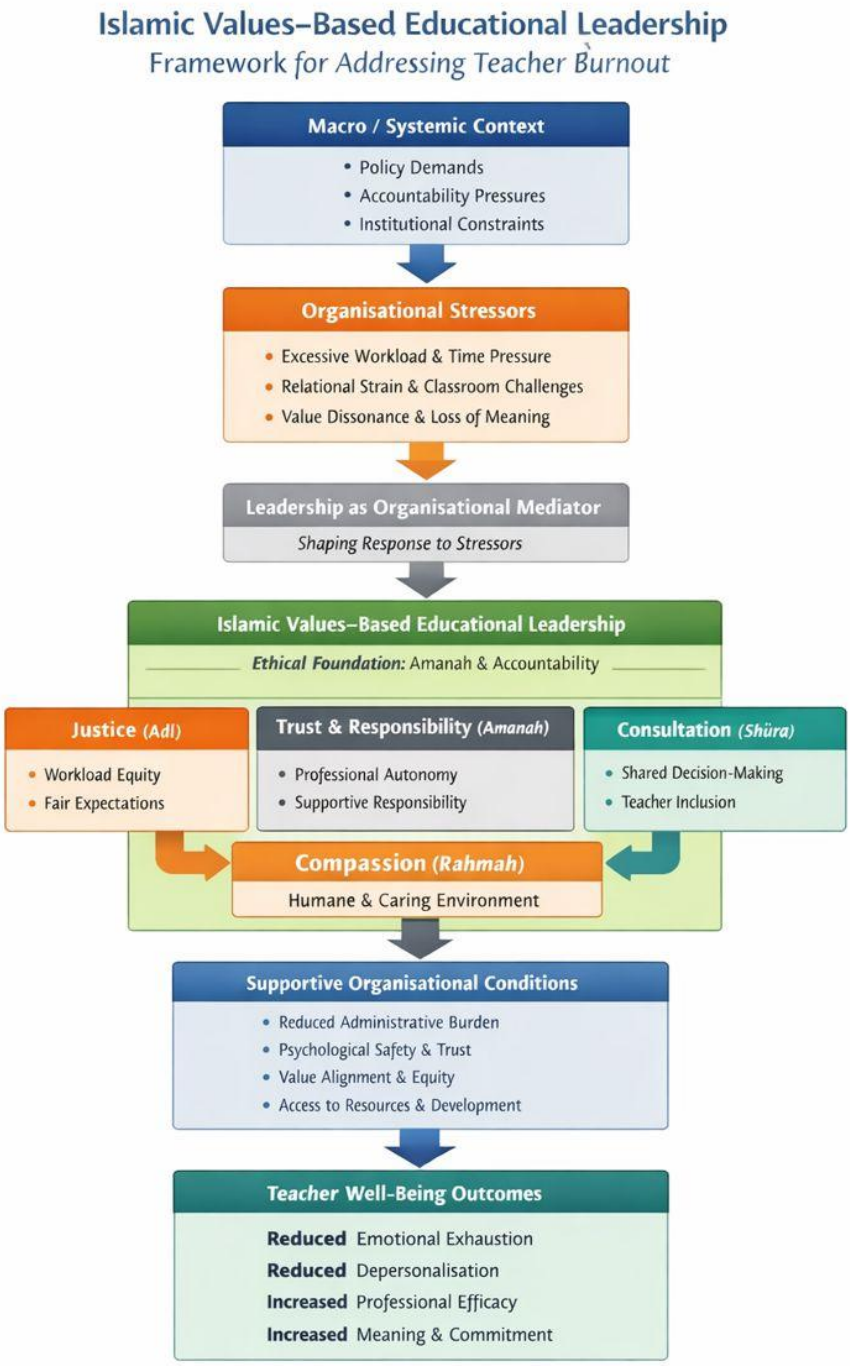



***Figure 1: Islamic Values–Based Educational Leadership As An Organisational Framework For Addressing Teacher Burnout***

## *6. Research Gaps*

Although scholarship on teacher burnout and ethical leadership has expanded in recent years, several gaps remain prominent. Existing studies largely examine burnout through

psychological or managerial lenses with limited attention to leadership frameworks grounded in Islamic values, particularly within educational settings where Islamic leadership is discussed. It is predominantly presented in descriptive and normative terms, emphasising ideals such as justice, trust, consultation, and compassion without sufficient analytical linkage to organisational conditions that shape teachers' daily work experiences. Moreover, there is a notable absence of empirical and theoretical studies that systematically connect Islamic leadership principles to empirically established Bernard mechanisms such as workload intensity and time pressure.

## *7. Scope*

In response to these gaps, the scope of the present study is deliberately analytical and conceptual rather than empirical. Drawing on selected peer-reviewed literature and teacher burnout in Islamic educational leadership published between 2015 and 2025. Previous studies identify key burnout-related themes and map them against core Islamic leadership principles. However, the study is limited to synthesising and integrating existing theoretical insights to develop a value-based analytical framework, but it does not seek to test this framework empirically.

By clarifying both the boundaries and contributions of the study, this paper aims to provide a theoretically grounded foundation for future empirical research examining the application of Islamic leadership principles in addressing teacher burnout within educational institutions across multiple contexts.

## *8. Conclusion*

This paper argues that teacher burnout is not merely an individual psychological response to stress, but a predictable outcome of sustained organisational conditions shaped by leadership practices. Drawing on burnout research and education leadership scholarship, it has been shown that workload intensity diminishes professional autonomy and value dissonance as central mechanisms through which burnout develops. These mechanisms are not accidental but are structured and mediated by how leadership responsibilities are enacted within educational institutions.

By engaging Islamic value-based educational leadership, this study has demonstrated how ethical principles such as justice, trust, responsibility, consultation, and compassion offer a coherent organisational response to these challenges. Rather than functioning as abstract moral ideals, these principles were shown to align closely with empirically identified burnout mechanisms as informed leadership practices that shape workload distribution, decision-making processes, and organisational culture.

The proposed framework reframes burnout prevention as a leadership and organisational responsibility rather than an individual coping task. By incorporating ethical stewardship into leadership structures and daily practices that educational institutions can move towards more humane, sustainable, and professionally supportive environments for teachers. While the framework is conceptual in nature, it provides a grounded foundation for future empirical research and offers guidance for educational leaders seeking to address teacher burnout through ethically informed organisational practices.

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# SYSTEMATIC REVIEW OF RISK FACTORS AFFECTING TAKAFUL PRICING: A PRISMA-BASED APPROACH

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***Abstract:*** *Takaful, or Islamic insurance, is a vital part of the global Islamic finance ecosystem. It is founded on mutual risk-sharing and cooperative contributions among participants, aligned with Shariah principles. Pricing in Takaful schemes is critical for sustainability, competitiveness, and fairness. The mechanisms behind Takaful pricing are influenced by many factors that go beyond traditional actuarial considerations. This systematic review examines the demographic, financial, operational, and macroeconomic factors influencing Takaful pricing. It uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework 2020. Following the PRISMA 2020 guidelines, the researcher conducted a structured search in the major academic databases of Scopus, Web of Science, ScienceDirect, and Google Scholar. The search covered studies published between 2000 and 2025. The review identifies common themes, patterns, and research gaps within various contexts and Takaful models. Out of 562 initially identified articles, 51 met the inclusion criteria. Findings reveal that demographic factors, such as age, gender, life expectancy, and family composition, are primary determinants of mortality and morbidity in Takaful products. Financial factors, such as investment performance, profit-sharing ratios, and fluctuations in the discount rate, significantly influence contribution levels and surplus distribution. Operational factors, including underwriting efficiency, claim management, and governance structures, play a critical role in equitable pricing. Macroeconomic variables, such as inflation, GDP growth, and monetary policy, indirectly affect the pricing environment by influencing costs and investment returns. The synthesis concludes with an integrated conceptual framework connecting these four dimensions. It also highlights future research directions on dynamic pricing models that incorporate behavioural and technological variables.*

***Keywords:*** *Takaful pricing, demographic factors, financial determinants, operational performance, macroeconomic indicators, PRISMA, Islamic insurance.*

## Introduction

Life is embedded in risks that are beyond the expected outcomes within the contemporary world. People are exposed to risks of death, illness, and destruction of assets on their own or through their assets. However, people are increasingly aware of the need to protect their lives, health, and assets from future risks by taking preventive measures. Despite making a proper attempt to minimise risks in life, some risks are inevitable. However, one must ensure that the risk is minimised by having adequate awareness of the importance of implementing

security measures to mitigate risks in life. Such securities are referred to as 'insurance.' Insurance is now a crucial aspect of people's lives, owing to its role in providing financial security by mitigating life's risks, offering the same importance as having the safest investment alternatives available in the market. There are two primary types of insurance available on the market. These types include conventional insurance. Once an agreement is made between the two parties in traditional insurance, one of the parties to the contract must act in accordance with the terms of the contract. This party must either provide the necessities of life through different means in the event of the insured aspect of the contract being involved in the losses. Otherwise, the latter must provide the insurer in the form of a predetermined number of payments in the market. However, the aspects of losses must involve certainty. Such certainty in the future must come from the event's certainty of occurring in the future. Additionally, the event must include uncertainty regarding its likelihood of happening in the future, in terms of its frequency. Additionally, the event must involve uncertainty if it relies on specific fortuitous outcomes, as it may be impossible to occur in the future. Insurance is one of the securities in the market. Additionally, one of the oldest securities in the market.

"Takaful" is the Islamic equivalent of the conventional insurance system, originating from the Arabic word "kafalah," which means "guaranteeing each other." It is the collective effort for mutual support made in line with the precepts of Shariah (Billah, 2020). Unlike the conventional system, which focuses on risk transfer, Takaful's approach emphasises the joint contribution to a common risk fund, which is managed in accordance with Shariah laws. Whether the model shall prove sustainable would depend entirely on the fairness of the pricing mechanism. While the conventional system's pricing process is purely actuarial in nature, in the context of Shariah-compliant systems, such as the takaful model, the process involves Islamic teachings on justice (Billah, 2020). Additionally, in terms of pricing within the takaful model, compared to the conventional approach to providing similar protections against life risks, the emphasis is on fairness, transparency, and mutuality (Olorogun & Othman, 2021). However, in the takaful model, the contributions given in the form of “tabarru'" must also take into consideration the adequacy of the members' contributions to defray the risks incurred without going against the Shariah law provisions (Olorogun & Othman, 2020). Of course, in the process of calculating all the risks associated with the takaful system's proposed premiums for potential members, various extrinsic and intrinsic elements must also come into play. According to actuarial professionals and Shariah researchers, the rates of premiums for the takaful model's contributions must be based on studied demographic aspects, organisational structures, dynamics, and broader economic parameters (Masood et al., 2021). Unlike the organisational structures in the conventional system, where the involved firms act simply in their capacity as "insurer" in the business setup, in the takaful system, the firms act either in the capacity of the "agent" together with the "entrepreneur" in the business setup. Thus, in the takaful system, apart from actuarial parameters, risks also include demographic, organisational, dynamic, and broader economic aspects.

At the beginning of 2024, the international market for Islamic financial services of Takaful exceeded $ 30 billion (Islamic Financial Services Board, 2024). By the same token, the pricing process for takaful business is complex in nature because the pricing model in the Islamic finance industry must also satisfy the actuarial requirement. However, because Shariah laws and bylaws govern it, the process in Islamic finance must also adhere to the principles of Shariah. This aspect clearly indicates the importance of having advanced pricing processes for

the takaful business as performed by actuarial firms. However, prior research studies in the field of takaful business pricing in the Islamic finance industry suggest the likelihood of discrepancies. Hence, to make the research more comprehensive, it is necessary to effectively address the different aspects of the topic from the perspectives of various stakeholders involved in the field of concern. Thus, the problem in focus in the research work requires the arrangement of different research studies having multidirectional views on the research topic. Hence, the primary concern of this research work is to review various existing research studies. The other research works should focus on the specific topic. Additionally, the review process for research works should follow the PRISMA 2020 Guidelines. Hence, the research work's primary concern is related to the organisation of research on the topic. Additionally, the research work aims to investigate all the research works in the chapter to provide a comprehensive overview of research related to actuarial firms. Hence, the research work aims to compile all existing research on the topic to provide relevant ideas related to it.

## Literature Review

### *Takaful Pricing*

Takaful pricing involves calculating fair contribution rates for members, considering the risks incurred and the costs of administration in accordance with Shariah principles. There are two theoretical frameworks applicable to the process of takaful pricing. These frameworks are the actuarial fairness theoretical framework and the Shariah theoretical framework. Actuarial fairness is the rule that demands contribution rates in line with the likelihood of incurring losses. Shariah compliance on its part requires all operations to forbear from any form related to Riba (interest), Gharar (excessive uncertainty), and Maysir (gambling). This means that the process of Takaful pricing is more susceptible to external factors compared to the conventional pricing process in the insurance field. Traditional actuarial methods, such as mortality tables, loss ratios, and expense allowances, are modified in line with the mutual approach to sharing risks in the takaful model. Additionally, in the takaful model, various models, such as the Wakalah (Agency) model and the Mudharabah (profit-sharing) model, influence the pricing process. Models in the takaful system determine the percentage payable by the operator (insurer) and are used to calculate the premium. According to the Wakalah model, the operator imposes an administration fee on the contributions from the members.

Meanwhile, in the profit-sharing model (Mudharabah), the sharing of profits in an investment made by the operator is between the members. However, the fee for administration in the Wakalah model combines the profits earned from the investment (Billah, 2012 & 2023). Additionally, rather than the conventional approach to pricing insurance premiums in Takaful business operations, the issue of justice in terms of Adl (justice) must also be taken into consideration. Overcharging premiums contradicts the cooperative nature of the business. However, lower premiums pose risks of insolvency.

### Demographic Risk Factors

Demographic factors are among the most extensively researched factors that play a crucial role in the contribution rate in Takaful. These factors include age, gender, marital status, educational level, and health status, all of which act as significant risk factors in determining the mortality and morbidity risk in assessing the contribution rate in health and family Takaful (Soualhi & Djafri, 2021). The mortality risk can be viewed in the context of uncertain participant deaths

over a given duration and the uncertainty in the distribution of the related mortality claims in family Takaful. The morbidity risk can be viewed in the context of disease intensity, especially in health and long-term care Takaful. In fact, the intensity and likelihood of disease and morbidity, especially in healthcare and long-term care, have become significant factors in the actuarial contribution process, hence the need and significance of actuarial studies by different researchers, such as those conducted by Soualhi & Djafri (2021) and Billah (2023). The primary factor and determinant in mortality and morbidity risk and their intensity in actuarial studies is the age factor, whereby the risk, intensity, and likelihood are higher among older members. The actuarial contribution rate in the United States and other countries has adequately reflected the intensity in the contribution rate, whereby the contribution rate in the actuarial studies and participation and contribution levels rise with increased mortality and morbidity intensity, especially in older people, hence lower contribution levels in the actuarial contribution process, whereby the risk in the younger individuals, among others, tends to be lower, and the contribution rates among others, among men and women, tends to be high in men compared to the extent and likelihood in the actuarial contribution process, whereby the risk in men tends to rise. The risk of health issues, among others, tends to increase over longer durations among female members. In the actuarial studies in Malaysia and other South African countries, the contribution to family coverage tends to be high among the male gender. The factors and variables in the actuarial contribution process include the impact on the family, among others, whereby the contribution in the actuarial process tends to be high among couples. In actuarial studies in Malaysia, couples in the actuarial contribution process tend to be predominantly male, among others. Moreover, the factors that play an essential role in the actuarial contribution process include the factors and variables in the likelihood, risk, and intensity in the actuarial studies, whereby the factors and variables in the likelihood, risk, and intensity in the actuarial contribution process and the contribution rate in the actuarial contribution process, whereby the factors and variables in the actuarial studies, the extent, and likelihood in the actuarial contribution process and the contribution rate, among others, in the actuarial contribution process.

**Financial Risk Factors**

The financial factors influencing Takaful rates stem from the investment and sharing processes inherent in Shariah-based models. Variability in investment returns directly affects the viability of the Takaful fund, as these returns are used to cover liabilities and boost the participant's surplus (Rofika & Meylianingrum, 2024). Also, investment returns directly influence Takaful rates because the net earnings of Shariah-based investment pools offset member contributions (Soualhi, 2016; Alhabshi, 2021). The mudharabah model allows improved investment results to be translated into lower contribution rates or increased surplus sharing. On the other hand, the imminent danger of diminishing returns may be due to the inadequacy of contributions along with the overdependency on high-risk and Shariah-incompatible investment instruments. Investment performance also directly impacts Takaful rates since the net income from

Shariah-compliant investment pools offsets members' contributions (Soualhi, 2016; Alhabshi, 2021). In the mudharabah model, better investment performance is reflected in lower contribution rates or higher surplus sharing. Another major financial factor is lapse risk, where members end their premium payments before the maturity date of the policy. High lapse rates may create a threat to cash flow forecasts and the time value of expected future liabilities (Berdin et al., 2017; Pavlović, 2021; Manteigas & António, 2024). The interlinking of lapse

rates with economic conditions complicates the matter further and shows the importance of allowing dynamism in the lapse rate assumptions in financial models. Also, discount rates and estimated claim liabilities are factors that have significant effects on the actuarial valuation of long-term Takaful contracts (Ogungbene et al., 2025). The secondary factors include obligation variability like zakat, retakaful premiums, and setting aside reserves.

**Operational Risk Factors**

Operational risks include internal operations, governance, and management of Takaful institutions. Of late, there is greater recognition that operational efficiency acts as an important determinant factor in deciding the adequacy of Takaful prices. These risks relate to underwriting, claims, and governance with respect to Shariah compliance errors (Al-Amri, 2020). More recent academic deliberations also point out model risks and issues with data quality in the actuarial computations. Inaccurate information related to claim frequency and participant demographics could lead to unhindered risks in Takaful pricing (Crevecoeur et al., 2023; Solontio & Hidayanto, 2024). In addition, it is common to see limited available actuarial information in new markets for Takaful, and this situation frequently leads to pricing based on conventional insurance industry norms. Digitalisation, automation, and advancements in data analytics have significantly influenced these areas. As such, technological capabilities and human resources are considered very important in maintaining operational viability and pricing accuracy (Sukmaningrum et al., 2022; Ahmad et al., 2023; Hassan et al., 2023). Empirical evidence is noted for indicating that those Takaful operators that support advanced technological platforms and actuarial models manage a better scenario of decreased operational cost coupled with improved pricing (Hassani, 2020; Brauer, 2024). In addition, Shariah governance frameworks, comprising of the approval process by the Shariah board and the efficiency of internal audit functions, indirectly reinforce operational stability and member confidence. It acts as an important factor that affects the pricing viability (Hassan et al., 2021; Sueb et al., 2022; Bashir et al., 2023). Of late, increased technological improvements in digitisation and InsurTech are starting to affect operational viability through technology-enabled risk analysis and member-specific pricing (Stoeckli et al., 2018; Hassan et al., 2023). However, many Takaful entities still face structural challenges that lead to higher administrative costs and contribution rates costs.

**Macroeconomic Risk Factors**

The macroeconomic conditions in a region have a systematic effect on the Takaful pricing process with regard to investment returns, income level, and frequency of claims. It is important to note that a rise in medical and replacement costs due to a rise in medical inflation increases the expected levels of claims (Kaunain & NazAkhtar, 2016; Abdeljawad, 2020; Rofika & Meylianingrum, 2024; Qubbaja, 2025). Medical and replacement cost increases can be attributed to a rise in medical prices due to medical inflation, thereby leading to an increase in the cost of replacement due to an escalation in prices of other goods and services. A rise in medical costs increases the possibility of an increase in total costs due to an increase in the cost of medical treatment and, eventually, an increase in the cost of replacement due to an increase in prices of other goods and services due to medical inflation. The effects of contribution income, because of economic growth rates and employment levels, on the rates of contribution and affordability will be impacted by economic downturns, leading to a reduction in income levels, especially disposable income, due to which people will be forced to opt for a downgrade

of Takaful cover rather than abandoning it altogether due to economic requirements versus Takaful protection. Due to economic downturns, contribution defaults will increase, leading to a reduction in the solvency level of the fund due to contribution income levels being indirectly impacted because of economic downturns, leading to a rise in contribution default levels due to economic downturns rather than increased contribution levels due to economic growth rates and employment levels. Low economic growth rates have an impact on investment returns due to low investment levels, leading to investment income levels being indirectly impacted due to economic growth rates and employment levels because a rise in economic growth rates and employment levels will increase investment income due to an increase in investment levels rather than a low investment income level due to low economic growth rates and employment levels. As a potential factor with regard to investment income, interest rates indirectly impact the economy with regard to investment income levels due to the Islamic Shariah principles being fully followed in the field of Takaful with regard to contribution income levels because Shariah principles do not recognize interest rates due to which a rise in interest rates will be indirectly impacted rather than a rise in investment income levels due.

## Methodology

This study employs a systematic review methodology guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework (Page et al., 2021). The design ensures transparency and reproducibility in identifying, selecting, evaluating, and synthesising empirical and theoretical research on factors affecting Takaful pricing. A systematic review is particularly appropriate for this topic because the literature is scattered across various disciplines, including Islamic finance, actuarial science, and risk management, which require a structured approach to synthesis.

## Systematic Review

A systematic review uses standard analysis tools to systematically analyze secondary data (Nunn & Chang, 2020; Park et al., 2022). As a form of evidence synthesis, systematic reviews develop a research question, which can be broad in scope and detail, and then extract and synthesize relevant data related to that question. A systematic review is considered the most reliable source of evidence for developing scientific practices, providing a conclusive overview of available primary research related to a specific question (Satnarine, 2023). According to

Satnarine (2023), systematic reviews can be defined as a form of secondary research, or ‘research on research,’ that includes existing research relevant to a systematic overview of current research works. Systematic reviews can be used for guideline synthesis and are often a necessary activity for researchers examining the current state of research within their field of interest. While the healthcare industry is the most common sector for systematic review applications, other fields can also benefit from their potential. The main goal of a systematic overview is to present evidence within a specific research area by identifying primary works related to the topic, critically reviewing these works, and then synthesizing their results to provide conclusive evidence (Yannascoli et al., 2013; Pollock & Berge, 2018). They state that systematic reviews can integrate information from multiple studies to produce a new, comprehensive conclusion that combines different types of evidence for interpretation and analysis. However, some researchers have developed well-structured systematic reviews following eight steps: 1) formulate the research questions; 2) define inclusion and exclusion

criteria; 3) develop a search strategy and locate studies; 4) select studies; 5) extract data; 6) assess study quality; 7) analyze and interpret results; and 8) disseminate findings. The schematic diagram is shown below;

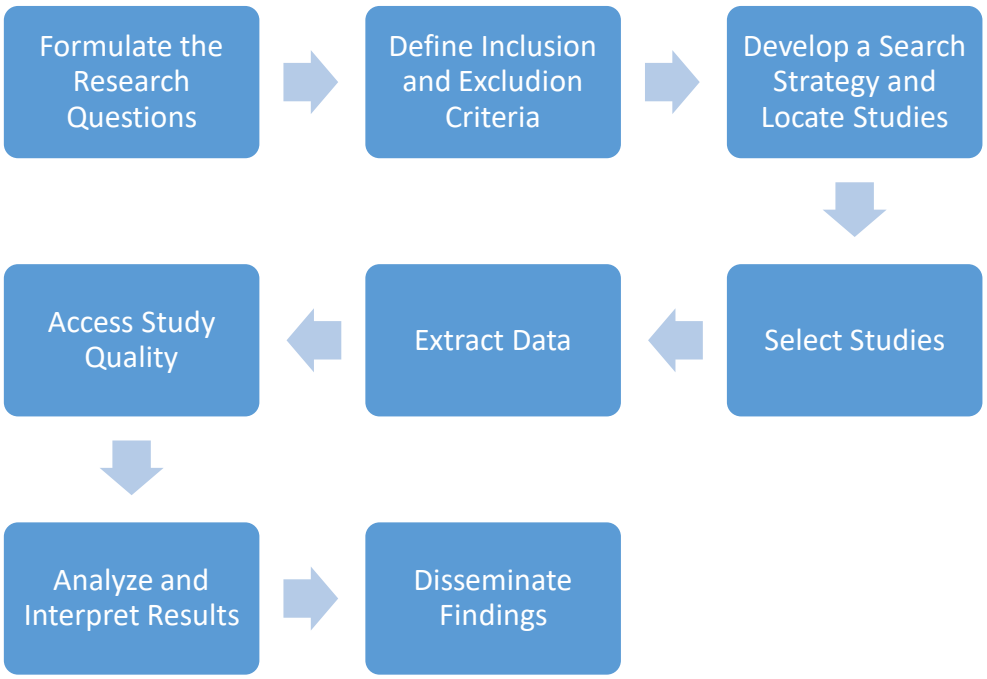



**Figure 1: PRISMA Flow Diagram**

## Research Questions

A systematic review design was adopted to consolidate existing knowledge and identify patterns, trends, and gaps in the literature concerning risk determinants of takaful pricing. This approach is particularly suited for emerging fields such as Islamic actuarial science, where empirical studies are dispersed across multiple disciplines, including finance, risk management, and Islamic economics. We established several specific research questions to understand the primary purpose of this study. The research questions for this study are: What are the most significant risk factors affecting the Takaful pricing of Takaful? How have previous researchers measured and modelled takaful pricing risks? Moreover, what are the research gaps and future directions in this domain?

## Inclusion and Exclusion

After the research questions were developed, the next phase in the systematic review process is defining the inclusion and exclusion search criteria. To find research that can solve the research problem, researchers must determine which studies are eligible for inclusion and exclusion in the search. It is essential for the reviewer to thoroughly understand the inclusion and exclusion criteria to achieve a more effective search outcome in the next step. Although the requirements may be revised as the systematic review progresses, specific criteria are essential for gathering the research standards that will be used to assess the research objective. The eligibility criteria determine which studies will be included and which will be excluded from the systematic review data, ensuring both rigour and acceptability for the review. The criteria for including and excluding studies constitute the operational definition of the problem.

In a systematic review, the guidelines for what to include and exclude are crucial in determining the scope of the review. These criteria help decide which studies are relevant to the research question and will be included in the review, and which ones will not be included as they are not relevant or for some other reason. This step ensures that the review is thorough, fair, and repeatable.

**Search Strategy**

A search approach was then designed and implemented. A structured and comprehensive literature search was conducted using Scopus, Web of Science, Emerald Insight, and ScienceDirect, the four major academic search engines, in conjunction with the use of Google Scholar, to search and include peer-reviewed journal articles and high-quality conference papers, in the hope of arriving at the totality of risk factors affecting the price of Takaful from the predetermined elements. Simultaneous searches were also conducted using the repository systems of other major Islamic finance think tanks, namely INCEIF, IRTI, and the Knowledge Repository Bank Negara Malaysia. The search range spanned from January 2000 to May 2025, in an effort to capture the latest trends in the field of Takaful, as developments in the field would have kept pace with advancements in technology, regulations, and the economic environment. The search utilised keywords and Boolean logic to ensure that it was comprehensive and included all available pertinent studies. The primary search string was the following:

("Takaful pricing" OR "Islamic insurance pricing") AND ("determinants" OR "factors" OR "influences") AND ("demographic" OR "financial" OR "operational" OR "macroeconomic")

In an effort to make the scope and comprehensiveness of the search even more exhaustive, the search approach also included the search and review of the citation lists in all available studies that were discovered in the search process.

**Screening and Selection Process**

Using the list compiled, an electronic search in the database platform earlier mentioned was done to identify studies which had met the stipulated criteria. This was done through close scrutiny of the studies identified from the database. Among the different database platforms available, the most relevant studies in relation to the questions being raised were identified. These studies particularly involved primary sources with regard to risk factors that influence the cost of insurance and Takaful.

The search yielded 447 records. After eliminating duplicates, there were 350 studies remaining. The process moved forward to the screening of title and abstract in relation to the inclusion criteria, and results of this action further narrowed the studies down to 109 that fulfilled the stipulated inclusions and exclusions. The process continued with the screening of studies in relation to the inclusion and exclusion criteria, and a final sample of 51 studies was obtained. The updated PRISMA flow diagram of 2020 was utilized for the process in order to provide insight into the various stages and flow.

**Table 1: Screening and Selection Results**

| Stage | Description | Number of Studies |
|---|---|---|

| | | |
|---|---|---|
| Identification | Records identified through database searching | 447 |
| Screening | Records screened after duplicates removed | 350 |
| Eligibility | Full-text articles assessed for eligibility | 109 |
| Inclusion | Studies included in the qualitative synthesis | 51 |

**Data Extraction**

Next, proceed with data extraction from all selected research papers and studies. At this stage, data extraction is beneficial in identifying the most relevant risk factors that affect Takaful pricing later in the review process. The extraction process involves several steps, including removing duplicate studies from databases and irrelevant studies that do not align with the targeted research objectives. The data extraction is conducted on each previously gathered study and summarised as a tabulation of the most relevant factors.

For each included study, data were systematically extracted using a standardised template encompassing:

1. Author(s), year, and publication source
2. Study type (empirical, theoretical, or review)
3. Geographical focus and takaful model (Mudharabah or Wakalah)
4. Key risk factors examined
5. Methodological approach (actuarial model, simulation, regression, etc.)
6. Main findings and implications

A thematic synthesis approach was employed to integrate findings across studies. Risk factors were categorised into four principal dimensions: demographic, financial, operational, and macroeconomic. Patterns, interrelationships, and research gaps were identified through qualitative coding and comparative analysis.

**Assessing Quality of Selection**

Next, we assess the selected studies for quality. At this stage, the assessment is done by using the Preferred Items for Systematic Review and Meta-Analysis (PRISMA) method. PRISMA is the most efficient method to overcome quality differences between studies that could lead to misunderstandings and misinterpretations by reviewers (Selçuk, 2019). Selçuk (2019) stated that PRISMA is a method to efficiently scan all the selected published papers or studies to identify the most accurate answer to the research questions and objectives.

**Analysing Result**

After assessing the quality of each study, the results and outcomes are interpreted and analysed accordingly. Initially, after the quality assessment of the study has been made, the outcome needs to be appropriately analysed to ensure that the quality of the study aligns with its research

objectives and questions. It is to ensure that the research question and objectives of the systematic review are achieved accordingly.

**Disseminate Findings**

Upon completing the analysis, the results are examined within the framework of the two distinct assessments to identify any important details or conclusions that may be derived from both. This is significant because both analysis and interpretation can yield valuable insights into how various similarities can be compared with analogous factors identified by different authors. After analysing and interpreting the results, findings are disseminated by identifying authors with similar results or discussing related factors.

**Findings**

The paper first gives an introduction to the studies, then describes the arrangement of research findings in terms of themes, risk factors, and their impact on the Takaful pricing process. As explained, the review includes a total of 51 studies. The studies range in terms of publication dates, with the earliest publication in 2005 and the latest in 2025, reflecting an escalating

interest in the field among researchers, albeit related to the development and growing popularity and performance of the Takaful industry. In terms of geographic distribution, most studies related to Southeast Asia, and specifically Malaysia, where the takaful industry exhibits extensive development and structures, were initially focused on and then supplemented with studies related to the GCC region. Some studies have adopted broader perspectives. In the thematic domain, risk factors can be explicitly classified and include variables such as age, gender, health status, and occupation. Table 1 below provides insight into the listed risk factors, with references provided in the text.

**Table 2: Summary of Factors Influencing Long-Term Takaful Pricing**

| Category | Example Variables | Frequency of Mention (n=51) | Key Insight |
|---|---|---|---|
| Demographic | Age, gender, marital status, education, income | 21 studies (50%) | Demographic heterogeneity influences the contribution |
| Financial | Investment returns, solvency ratio, capital adequacy, Retakaful | 17 studies (40%) | Financial stability and Shariah-compliant portfolio performance shape pricing sustainability |
| Operational | Claims ratio, expense ratio, underwriting policy, digitalisation | 14 studies (33%) | Efficiency in claims and administration has a direct impact on pricing margins |
| Macroeconomic | Inflation, GDP, unemployment, exchange rate | 12 studies (29%) | Macroeconomic volatility alters affordability and the cost of claims |

## Demographic Risk Factors

Research has revealed that mortality and morbidity risks, specifically, are the strongest determinants in takaful pricing. Such studies include those by Andirasdini & Suryaningsih in 2023 and Attar & Hachloufi in their 2022 work, which stressed the significant impact of mortality experience on the expected claims risk ratio in family takaful plans. The risk of morbidity, which includes illness, hospitalisation, and disability, is considered influential in takaful medical and long-term care plans, especially for the ageing population. Life tables, morbidity incidence matrices, and probabilities of transition into disability typically contain the risks. These risks require proper estimation to avoid underpricing, which can lead to the exhaustion of funds, and overpricing, resulting in the company becoming uncompetitive in the marketplace. Some studies recommend the use of experience assumptions and stochastic mortality models, such as the Lee-Carter model and the Cairns-Blake-Dowd model. Furthermore, other secondary demographical factors include age, gender, family structure, and educational attainment. The age factor was generally supported across all studies. Younger members are determined to contribute lower tabarru' because they have lower risks against mortality (Wulandari et al., 2023). However, gender risk differentials and adjustments have appeared, although Takaful companies usually refrain from discriminating based on gender factors in favour of equality and equity among Shariah-compliant models (Cahyadi et al., 2024; Siregar et al., 2024). Male members, in general, have higher mortality risks and shorter claim durations, compared with female members who have higher lifetime probabilities and exposure risks against morbidity.

## Financial Risk Factors

Financial risk factors came in the second grouping, referring to the volatility of investment returns, the lapse process, and surplus distribution models. The returns on investment constitute an essential factor in the sustainability of the takaful fund. Saeed, in the 2019 study, and other researchers in the field, such as those in the 2020 paper by Puspita et al., have asserted that lower and uncertain returns on investment make it difficult for takaful operators to maintain constant contributions and remain financially healthy. In takaful systems, through wakalah, mudharabah, and their combination, the outcomes and performance on the invested side have an immediate impact on the members' contribution fund and the takaful fee incomes. In these systems, such as the mudharabah model, better performance enables increased surplus distribution, resulting in reduced contributions, even lowering them, and a more equitable distribution of surplus. Variations in the rate of profits and returns on sukuk portfolios can cause misalignments between liabilities and asset funds, hence the need for actuarial repricing in terms of assumptions. Lapse risk, which refers to the cessation of contributions made by takaful members, was identified as the third critical risk. The risk of high lapses could misalign the risks in the pool, leading to lower accumulation in the takaful funds and resulting in mis-estimation of the claims liabilities. Various studies over the years have supported the link between the lapse process and macroeconomic variables, including inflation and product characteristics.

## Operational Risk Factors

Operational risks are now also gaining increased recognition in the arena of takaful underwriting, and they play an important role in ensuring the accuracy and certainty of takaful premium pricing. The sources of such risks include the underwriting process, claim handling systems, and governance and Shariah compliance frameworks in takaful businesses (Mustafa & Ab Rahman, 2018; Al-Amri, 2020). The takaful company employing data-informed underwriting has stable premium pricing compared to the one using the conventional approach (Mahohoho et al., 2024; Wu et al., 2024). The actuarial work highlights the importance of model quality and governance in the risk process. Inadequate capture, inconsistencies in the codes, and a lack of actuarial knowledge and skills may impair experience analyses and, hence, the contribution rates. Inadequate Shariah audit and compliance frameworks may contain risks, some of which may indirectly influence contribution structures, leading to increased operational costs.

Higher Shariah governance quality positively affects sustainable contribution structures and members' confidence (Hassan et al., 2023). The reviewed literature has also cited the increased performance and reduced variability in contributions that result from operational efficiencies. The application of InsurTech and actuarial automation has been cited as a solution that could minimise cost ratios and maximise accuracy.

**Macroeconomic Risk Factors**

The macroeconomic scenario plays an influential and indirect role in the pricing of takaful. From the aspects that seem most evident, there is increased medical, claim, and administrative expenditure as a result of inflation, a factor that has gained much cause for alarm. Inflation heightens the stress on future contributions, and thus actuarial adjustments to retain adequate contributions become of utmost importance, according to the perspective proffered by Khan and Azmi 2021. Inflation decreases the purchasing power of contributions and payments for claims, making repricing a necessary point, as seen from the perspective proffered by Abdullah and Othman 2020. Similarly, volatility in interest rates along with economic growth affects the yield on investment and cost of contributions in Takaful. Economic development increases purchasing power and the participation rate, thus improving risk diversification, as argued by Haron et al. in 2021. Secondly, in case of an economic downturn, members are more likely to withdraw from Takaful and hence diminish the scope of the fund. Volatility in exchange rates exposes takaful companies that have a worldwide portfolio of investments to risks that may lead to asset and liability mismatch. The use of advanced actuarial models, economic scenario simulation, and stress testing in Takaful cannot be overemphasized; hence, the need to test the sensitivity of contribution costs.

**Discussion**

This systematic review confirms that Takaful pricing is a multidimensional construct influenced by demographic, financial, operational, and macroeconomic contexts; these dimensions are interacting in a dynamic way, often in ways that amplify each other.

**Demographic Risk Factors**

Consistently, age and gender turn out to be significant predictors of contribution rates. Younger participants, being lower-risk, are charged lower contributions, reflecting classical actuarial

logic. However, demographic effects are moderated by cultural and religious factors; for instance, larger family size in the case of Muslim households raises coverage demand. Education positively relates to Takaful awareness and the willingness to contribute, thereby strengthening financial inclusion imperatives.

**Financial Risk Factors**

Pricing stability is underpinned by financial soundness. Some evidence provided in literature shows that investment yield volatility in Islamic money markets affects the ability of operators to maintain contribution consistency

(Nouman et al., 2022; Ghassan & Krichene, 2024). Capital adequacy requirements, prescribed by regulatory authorities, increase costs while reinforcing solvency. Re-Takaful arrangements protect but are also an additional overhead cost burden to incorporate into the pricing structures.

**Macroeconomic Risk Factors**

Inflation, interest-rate movements, and GDP cycles-even if benchmarked to Islamic equivalents-affect both cost and demand. Participants often allow their policies to lapse in economic downtrends; this forces operators to reprice products for a smaller pool of customers. Exchange-rate volatility impacts investment returns from abroad, making investments even more uncertain. These are the macroeconomic factors that need nimble and scenario-driven pricing models, attuned to external shocks.

**Conclusion**

This systematic review, framed based on the PRISMA guidelines, gives an extensive and well-integrated perspective on the role and importance of various factors, ranging from demographic, financial, and operational issues to macroeconomic factors, in both the process and impact of takaful pricing. Multiple areas come together to provide a comprehensive platform for developing Iklal-compliant data-driven takaful pricing models. This work integrates 51 studies on empirical and conceptual knowledge over the last 25 years, forming a useful reference point for enhancing the Takaful Industry in terms of transparency and robustness. The field requires further model developments that identify the ethical imperative in actuarial science to advance the use of Takaful in sustainable finance.

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# EXPLORING STUDENTS' PERCEPTIONS OF CHATGPT AS AN AI-ASSISTED LANGUAGE LEARNING TOOL IN ESL CLASSROOMS

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***Abstract:*** *The integration of Artificial Intelligence (AI) into education has transformed language learning by offering interactive, personalised, and self-directed opportunities. ChatGPT, a generative AI language model, has been increasingly adopted in English as a Second Language (ESL) classrooms to support writing tasks, vocabulary development, and overall language proficiency. Despite its growing use, empirical research on students' perceptions of ChatGPT in Malaysian higher education remains limited. This study aims to investigate students' perceptions regarding the usefulness, ease of use, motivation, and ethical concerns associated with ChatGPT in ESL courses at Universiti Islam Antarabangsa Tuanku Syed Sirajuddin (UniSIRAJ). A quantitative survey will be conducted with 100 participants (50 diploma and 50 bachelor's students). Data will be collected via an online questionnaire and analysed using descriptive statistics and correlation analysis. The findings are expected to reveal that students generally perceive ChatGPT as a valuable learning tool that enhances writing skills, fosters autonomous learning, and increases engagement, while also highlighting potential ethical considerations such as dependency and academic integrity. The study provides practical implications for educators and curriculum designers seeking to integrate AI responsibly into language teaching.*

***Keywords:*** *ChatGPT, AI-assisted learning, ESL education, student perceptions, language pedagogy.*

## 1.0 Introduction

Advancements in artificial intelligence (AI) have significantly influenced educational practices, particularly within language learning contexts. AI-assisted tools such as ChatGPT provide students with opportunities to enhance writing skills, expand vocabulary, and refine grammar while receiving instant feedback. Despite these benefits, the implementation of AI in English as a Second Language (ESL) classrooms raises critical questions about students' perceptions, motivation, and responsible use. This chapter outlines the background of the study, identifies the problem, and presents the research objectives, research questions, and significance, highlighting the importance of understanding how AI tools can be integrated effectively in Malaysian higher education.

## 1.1 Background of the Study

Artificial Intelligence (AI) has rapidly transformed the landscape of higher education, particularly in the field of language learning. AI-driven tools are now capable of offering personalised learning pathways, generating instant feedback, and facilitating authentic, interactive language practice (Rahimi & Zhang, 2022; Park & Kim, 2023). In English as a

Second Language (ESL) education, such technological developments support learners in improving writing proficiency, expanding vocabulary, and engaging in self-directed learning.

Among the emerging AI technologies, ChatGPT, developed by OpenAI, has gained significant global attention for its ability to produce human-like responses, scaffold academic writing tasks, and enhance students' confidence in using English (Kohnke, Zou & Zhang, 2023; Dwivedi et al., 2023). Recent studies indicate that learners frequently use ChatGPT to draft essays, refine sentence structures, generate vocabulary alternatives, and clarify linguistic concepts (Smutny & Schreiber, 2023).

In Malaysia, the adoption of generative AI tools in tertiary institutions is increasing, especially for supporting writing tasks in ESL courses. Studies have shown that Malaysian university students view AI-assisted learning tools as beneficial for improving productivity and reducing anxiety associated with writing assignments (Rosli & Yunus, 2023; Nordin et al., 2024). However, concerns remain regarding over-reliance on AI, loss of critical thinking, and issues related to academic integrity (Mahmud & Jamal, 2023).

Despite the growing presence of ChatGPT in educational settings, empirical evidence on students' perceptions; particularly within Malaysian private universities; remains limited. As higher education institutions move towards blended, technology-enriched pedagogies, it is crucial to examine how students perceive and engage with ChatGPT in their ESL learning process. Understanding these perceptions can help educators integrate AI responsibly, promote ethical usage, and enhance teaching and learning practices.

### 1.2 Problem Statement

Despite the growing popularity of ChatGPT and other AI assisted tools in language education, there remains a notable gap in empirical research that systematically investigates students' perceptions of these technologies, particularly within Malaysian higher education contexts. While anecdotal evidence suggests that ChatGPT can support writing, grammar, and idea generation in ESL classrooms, few studies have critically examined how learners perceive its usefulness, ease of use, and motivational impact, or how concerns related to academic integrity, plagiarism, and ethical usage influence engagement and learning behaviours. This gap is especially pronounced when considering differences across academic levels, such as Diploma and Bachelor students, whose prior exposure to technology, language proficiency, and learning autonomy may vary significantly.

Without a nuanced understanding of these factors, educators risk implementing AI tools in ways that may lead to over-reliance, misuse, or misalignment with curriculum objectives. For instance, students may depend excessively on AI-generated content, potentially undermining the development of independent writing skills, critical thinking, and problem-solving abilities. Additionally, ethical challenges, such as concerns over plagiarism or improper attribution, may compromise both student learning and institutional standards of academic integrity. The absence of clear, evidence-based guidance on the integration of ChatGPT also limits educators' ability to design pedagogically sound interventions that balance innovation with accountability.

Therefore, there is an urgent need for empirical research that explores how Malaysian ESL students perceive and interact with ChatGPT, considering both motivational and ethical dimensions. Such evidence can inform instructional strategies, curriculum design, and institutional policies, ensuring that AI tools are used effectively, responsibly, and in ways that genuinely enhance language learning outcomes. By addressing this gap, the study aims to provide actionable insights that support the responsible integration of AI in higher education, contributing to both theory and practice in the field of ESL education.

### 1.3 Research Objectives

The primary objective of this study is to examine Malaysian ESL students' perceptions of ChatGPT as an AI assisted language learning tool. Specifically, the study aims to:

1. Investigate students' perceived usefulness of ChatGPT in supporting English language learning tasks.
2. Examine students' perceived ease of use when interacting with ChatGPT.
3. Assess the motivational impact of ChatGPT on students' engagement and confidence in ESL learning.
4. Identify students' concerns regarding ethical use, academic integrity, and potential over-reliance on ChatGPT.

### 1.4 Research Questions

The study addresses the following research questions:

1. How do Malaysian ESL students perceive the usefulness of ChatGPT in supporting language learning tasks?
2. How do students perceive the ease of use of ChatGPT in their learning activities?
3. What is the motivational impact of ChatGPT on students' engagement and confidence in ESL learning?
4. What are students' concerns regarding ethical use, academic integrity, and potential over-reliance on ChatGPT?

### 1.5 Significance of the Study

This study is significant as it offers empirical insights that support the pedagogical integration of AI-assisted tools, particularly ChatGPT, into ESL classrooms. By examining students' perceptions, the findings will assist educators in developing evidence-based strategies for incorporating ChatGPT effectively into teaching and learning activities. The study also provides curriculum designers with valuable guidance on embedding AI literacy and promoting responsible usage practices within English language courses. In addition, the results may

inform policymakers in strengthening institutional frameworks that govern the use of AI-supported learning technologies in higher education. More broadly, this research contributes to the expanding body of literature on AI adoption in education, offering practical implications for balancing technological innovation with academic integrity and ethical considerations.

## 2.0 Literature Review

This chapter reviews the relevant literature on artificial intelligence in language education, with specific attention to AI assisted writing support, student acceptance of educational technologies, and the role of AI in English as a Second Language contexts. The discussion also highlights current issues and research gaps that justify the need for the present study, followed by the conceptual framework guiding the investigation.

### *2.1 Artificial Intelligence in Language Education*

Artificial intelligence has increasingly transformed the landscape of language education by providing innovative opportunities for automation, immediate feedback and personalised learning experiences. Current AI tools, particularly generative text systems, have been extensively applied to support writing development, vocabulary acquisition and grammar refinement. These platforms are often employed to enhance language practice by offering rapid responses, customised corrections and adaptive learning pathways that respond to individual learner needs. Research has indicated that AI supported instruction can significantly improve learner engagement, facilitate self-directed learning and accelerate the development of linguistic competence when implemented alongside structured pedagogical guidance (Lee 2023; Rahimi and Li 2024). For instance, students can practise writing tasks repeatedly with instant feedback, experiment with alternative sentence structures and receive suggestions tailored to their proficiency level, thereby fostering a more active and autonomous approach to learning.

Despite these benefits, scholars have also emphasised several important concerns regarding the integration of AI into language education. Over reliance on automated feedback may lead to diminished opportunities for learners to engage in critical thinking and reflective learning, potentially undermining the development of independent problem solving and analytical skills. Additionally, ethical considerations such as data privacy, responsible use of AI outputs and the authenticity of student work remain prominent issues. These challenges underscore the importance of implementing AI in a balanced manner, ensuring that it serves as a supplementary support tool that enhances, rather than replaces, traditional human instruction. Educators are thus encouraged to adopt AI as an instrument to facilitate active learning, scaffold instruction and provide tailored guidance, while maintaining careful oversight to safeguard academic integrity and promote critical engagement.

### *2.2 ChatGPT in ESL Classrooms*

ChatGPT has become one of the most widely adopted AI tools in contemporary educational settings, particularly for language related tasks where students often require assistance with idea generation, paraphrasing, drafting and the refinement of grammar. Its prominence stems from its ability to produce rapid and context sensitive responses that mimic human writing patterns, making it an appealing support mechanism for learners who struggle with linguistic accuracy or academic expression. Recent studies indicate that many students perceive ChatGPT as a practical tool for enhancing clarity, coherence and overall organisation in their written work. These benefits are frequently reported in writing courses where learners are

expected to produce extended essays or reflective pieces, and ChatGPT offers immediate guidance that traditional classroom instruction may not always provide (Ismail 2023; Noor and Tan 2024).

However, despite these advantages, the accelerated adoption of ChatGPT has raised several pedagogical and ethical concerns. Scholars have highlighted issues related to plagiarism, where students may submit AI generated content as their own without demonstrating genuine comprehension. There are also ongoing debates about the authenticity of learning, as some educators fear that excessive dependence on automated suggestions may undermine the development of independent writing skills and critical thinking. In addition, concerns have been raised about a gradual decline in writing autonomy, where students may rely on ChatGPT not to enhance their ideas but to construct them entirely. These concerns underscore the need for clear instructional frameworks that promote responsible and purposeful use of AI in language learning rather than unregulated adoption.

Within the Malaysian ESL context, existing studies suggest that ChatGPT can positively influence learner confidence and motivation, especially when implemented with proper teacher supervision. Students often report feeling more supported and less anxious when completing writing tasks, as the tool offers immediate reinforcement and alternative phrasing options that help them express ideas more effectively. Nonetheless, current research remains limited in examining how these perceptions may differ across academic levels. In particular, there is a lack of comparative evidence involving Diploma and Bachelor students in Malaysian private universities, even though these groups may vary significantly in terms of linguistic proficiency, academic maturity and familiarity with digital tools. This gap highlights the need for further empirical investigation to understand how different learner profiles shape the acceptance and educational impact of ChatGPT in ESL writing courses.

### *2.3 Technology Acceptance Model (TAM)*

The Technology Acceptance Model (TAM), introduced by Davis (1989), provides a robust theoretical foundation for understanding user acceptance of technological tools. TAM posits that technology adoption is influenced primarily by two constructs: Perceived Usefulness (PU) and Perceived Ease of Use (EOU). PU refers to the degree to which individuals believe that a particular technology enhances their performance, while EOU relates to the extent to which using the technology is free of effort.

In recent years, TAM has been widely applied in research examining AI adoption in educational settings. Studies have shown that when students perceive AI tools as useful and easy to use, their motivation and intention to engage with such tools increase significantly (Zheng & Wang, 2022). In the case of ChatGPT, PU may be reflected in improved writing outputs, enhanced understanding of English structures, and faster task completion. EOU is observed when learners find ChatGPT accessible, intuitive, and convenient.

In addition to PU and EOU, scholars have argued that perceived concerns, such as accuracy, ethical issues, dependency, or fears of plagiarism, may influence students' acceptance of

generative AI in education (Dwivedi et al., 2023). Thus, supplementing TAM with a third dimension, namely concerns, may provide a more holistic understanding of students' perceptions in relation to ChatGPT.

### *2.4 Pedagogical and Ethical Implications*

The integration of ChatGPT into ESL classrooms presents both pedagogical opportunities and ethical dilemmas. From a pedagogical perspective, ChatGPT can support writing development by generating sample paragraphs, suggesting improvements, and offering instant explanations of grammar rules. This supports student-centred learning approaches, which emphasise autonomy, creativity, and personalised learning trajectories (Huang, 2024).

Nevertheless, ethical issues present significant challenges. The ease of generating complete assignments raises concerns about plagiarism, loss of originality, and reduced critical thinking (Mahmud & Jamal, 2023). Educators must ensure that students use ChatGPT as a supportive tool rather than a replacement for cognitive effort. Institutions are beginning to incorporate AI literacy modules to educate students about responsible usage, transparency, and academic integrity (Nordin et al., 2024).

Furthermore, over-reliance on AI tools could lead to misleading interpretations, as ChatGPT may occasionally produce inaccurate or fabricated information. These concerns necessitate the development of pedagogical frameworks that encourage reflective thinking, verification skills, and ethical awareness.

### *2.5 Research Gaps*

Although many studies have explored general student perceptions of AI, several areas remain under examined. First, limited research focuses on direct comparisons between Diploma and Bachelor students, especially within a single institutional environment. Second, few studies investigate the specific influence of ChatGPT on assignments that require critical writing skills. Third, existing literature has highlighted concerns about academic integrity, but empirical findings that differentiate between levels of student experience remain scarce. These gaps underscore the relevance of conducting a structured investigation in a Malaysian private university.

### *2.6 Conceptual Framework*

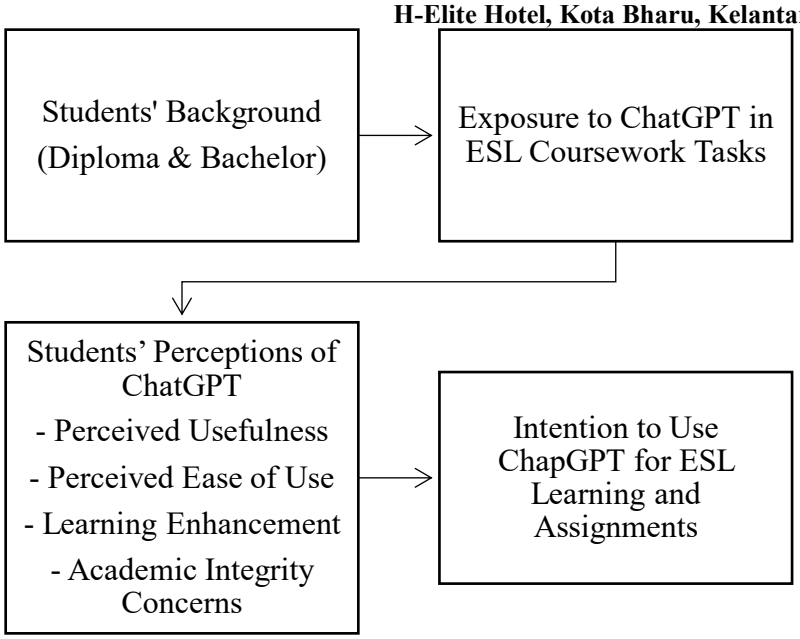



**Figure 1: Conceptual Framework Adapted From The Technology Acceptance Model (TAM) To Examine Students' Perceptions And Intention To Use Chatgpt In ESL Learning.**

The conceptual framework for this study is adapted from the Technology Acceptance Model (TAM) and describes the relationships between students' background characteristics, their exposure to ChatGPT in ESL coursework, and the resulting perceptions and behavioural intentions. In this model, students' academic levels, which include Diploma and Bachelor students, form the initial contextual factor that shapes their engagement with ChatGPT, particularly when completing writing tasks. This exposure then influences their perceptions across four key dimensions: perceived usefulness, perceived ease of use, learning enhancement, and concerns related to academic integrity. These perception constructs together shape students' intention to continue using ChatGPT as an AI assisted learning tool. The framework presents a clear progression in which the learners' profiles and learning environments interact with their experiences of ChatGPT, which in turn determines their acceptance and continued adoption of the technology in ESL learning.

## 3.0 Research Methodology

This chapter outlines the research methodology employed in the study, including the design, participants, instruments, data collection procedures, and data analysis techniques. The methodology has been carefully selected to ensure the collection of valid and reliable data that addresses the research objectives and questions. By providing a clear and systematic approach, this chapter demonstrates how the study investigates students' perceptions of ChatGPT as an AI assisted learning tool in ESL classrooms and ensures that the findings are both credible and ethically sound.

### *3.1 Research Design*

This study adopted a quantitative research design using a survey method to investigate students' perceptions of ChatGPT in ESL classrooms. A quantitative approach was suitable for this study because it allows the collection of measurable data from a defined population,

facilitates statistical analysis, and enables comparisons between subgroups, specifically Diploma and Bachelor students. The survey method provided an efficient means of gathering data regarding students' perceived usefulness, perceived ease of use, motivation, and concerns related to ChatGPT.

### *3.2 Research Setting and Participants*

The study was conducted at Universiti Islam Antarabangsa Tuanku Syed Sirajuddin (UniSIRAJ), Malaysia. A total of 100 students participated, comprising 50 Diploma students and 50 Bachelor students, all of whom were enrolled in English courses that incorporated ChatGPT for completing writing assignments. Participants were selected using purposive sampling to ensure that all respondents had prior experience with ChatGPT and could provide informed perspectives on its usefulness, ease of use, motivational impact, and ethical considerations. This sampling strategy allowed for meaningful comparisons between Diploma and Bachelor students' perceptions.

### *3.3 Research Instrument*

Data were collected using a structured questionnaire, developed based on prior studies on technology acceptance and AI assisted learning (Ismail 2023; Nordin, Ismail & Yunus 2024). The questionnaire consisted of four sections:

- Demographic Information: Academic level, gender, prior experience with AI tools, and frequency of ChatGPT usage.
- Perceived Usefulness: Items measuring the extent to which students believed ChatGPT enhanced their ESL learning outcomes.
- Perceived Ease of Use: Items assessing how simple and convenient students found ChatGPT for completing writing tasks.
- Concerns and Motivation: Items evaluating ethical considerations, academic integrity concerns, and motivation to continue using ChatGPT for ESL learning.

Responses were recorded on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was designed to ensure clarity, validity, and reliability, and was pilot tested with 10 students prior to full administration. Minor revisions were made based on pilot feedback to improve precision and comprehensibility.

### *3.4 Pilot Testing and Reliability*

Prior to the full-scale survey, the questionnaire was pilot tested with 10 students to evaluate clarity, comprehension, and the estimated time required for completion. The pilot test enabled the identification and revision of any ambiguous or confusing items. Internal consistency of the questionnaire was assessed using Cronbach's alpha, with a value of 0.70 or higher

considered acceptable for reliability. The results confirmed that the instrument was reliable and suitable for capturing students' perceptions of ChatGPT in ESL learning, and no further significant modifications were required before the main data collection.

### *3.5 Data Collection Procedure*

Data were collected using an online survey platform, distributed via email and the university's learning management system. All participants received an information sheet explaining the purpose of the study, voluntary participation, confidentiality, and ethical considerations. Informed consent was obtained prior to completion of the questionnaire. The survey was completed by all 100 participants and took approximately 10–15 minutes per respondent.

### *3.6 Data Analysis*

The survey had been fully completed, and the collected data were subjected to descriptive and inferential statistical analyses. Descriptive statistics, including frequencies, percentages, means, and standard deviations, summarised participants' demographic characteristics and responses to each questionnaire item. Inferential analyses included Pearson correlation to examine relationships between perceived usefulness, perceived ease of use, concerns, and motivation, as well as independent samples t-tests to compare perceptions between Diploma and Bachelor students. All analyses were performed using SPSS version 27.

### *3.7 Ethical Considerations*

This study adhered to strict ethical standards. Participation was voluntary, and participants were able to withdraw at any stage without consequence. All responses were kept confidential and anonymised prior to analysis. The study complied with the university's ethical guidelines, ensuring that no harm was caused to participants and that data was handled responsibly.

## 4.0 Data Analysis

This chapter presents the analysis and interpretation of the data collected from 100 students at Universiti Islam Antarabangsa Tuanku Syed Sirajuddin (UniSIRAJ). The primary objective was to examine students' perceptions of ChatGPT as an AI assisted tool for ESL learning, including perceived usefulness, perceived ease of use, motivation, and concerns related to ethical and academic integrity issues. Descriptive statistics, Pearson correlation, and independent samples t-tests were employed to provide a comprehensive understanding of the findings.

### *4.1 Demographic Profile of Participants*

The participants consisted of 50 Diploma students and 50 Bachelor students. The gender distribution was approximately 55% female and 45% male. All participants reported prior exposure to ChatGPT in their English courses, primarily for writing assignments. Table 4.1 summarises the demographic characteristics of the participants.

**Table 4.1 Demographic Characteristics of Participants**

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| **Academic Level** | Diploma | 50 | 50 |
| | Bachelor | 50 | 50 |
| **Gender** | Female | 55 | 55 |
| | Male | 45 | 45 |
| **Frequency of ChatGPT Use** | Daily | 20 | 20 |

| | | | |
|---|---|---|---|
| | Weekly | 50 | 50 |
| | Occasionally | 30 | 30 |

### 4.2 Descriptive Statistics for Perceptions

Table 4.2 presents the mean scores and standard deviations for the main constructs: perceived usefulness, perceived ease of use, motivation, and concerns.

**Table 4.2 Descriptive Statistics for Perception Constructs**

| Construct | Mean | Standard Deviation |
|---|---|---|
| **Perceived Usefulness** | 4.12 | 0.57 |
| **Perceived Ease of Use** | 4.05 | 0.61 |
| **Motivation** | 4.20 | 0.54 |
| **Concerns** | 3.30 | 0.72 |

The results indicate that students generally perceive ChatGPT as a useful and easy-to-use tool for completing writing tasks, with strong motivation to continue using it. Concerns related to academic integrity and over reliance were moderate, suggesting that while students recognise ethical implications, these do not significantly diminish their acceptance of the tool.

### 4.3 Pearson Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships among perceived usefulness, perceived ease of use, motivation, and concerns. Table 4.3 presents the correlation coefficients.

**Table 4.3 Pearson Correlations Between Constructs**

| Variable | PU | PEU | MOT | CON |
|---|---|---|---|---|
| **Perceived Usefulness (PU)** | 1 | 0.68** | 0.72** | -0.35** |
| **Perceived Ease of Use (PEU)** | 0.68** | 1 | 0.65** | -0.28** |
| **Motivation (MOT)** | 0.72** | 0.65** | 1 | -0.32** |
| **Concerns (CON)** | -0.35** | -0.28** | -0.32** | 1 |

**Note: **p < 0.01**

The analysis shows significant positive correlations between perceived usefulness, perceived ease of use, and motivation, indicating that students who find ChatGPT useful and easy to use are more motivated to continue using it. Conversely, concerns were negatively correlated with the other constructs, suggesting that higher concerns slightly reduce perceived usefulness and motivation.

### *4.5 Summary of Results*

The findings suggest that students perceive ChatGPT as a valuable, user-friendly, and motivating tool for ESL learning. While moderate concerns regarding ethical use and academic integrity exist, these do not substantially impede acceptance or intention to continue use. Additionally, perceptions are consistent across Diploma and Bachelor students, implying that the tool can be effectively integrated across different academic levels. The results support the

incorporation of AI assisted tools such as ChatGPT in language classrooms, provided that educators establish clear guidelines for responsible use.

## 5.0 Discussion

This chapter discusses the findings presented in Chapter 4 in relation to the research objectives and the existing literature. It provides an interpretation of the results, explores the pedagogical implications of using ChatGPT in ESL classrooms, addresses limitations, and offers recommendations for future research. By synthesising empirical findings with theoretical insights, this chapter highlights the contribution of the study to the field of AI assisted language learning.

### *5.1 Discussion of Findings*

#### *Perceived Usefulness and Ease of Use*

The findings indicate that students perceive ChatGPT as highly useful and easy to use for completing writing tasks. These results are consistent with previous studies (Ismail 2023; Lee 2023) which emphasised that AI assisted tools enhance clarity, organisation, and efficiency in language learning. The strong correlation between perceived usefulness, ease of use, and motivation suggests that students are more likely to engage with AI when they recognise tangible benefits in their learning process.

Despite the positive perceptions, moderate concerns regarding academic integrity were observed. This aligns with the literature emphasising ethical considerations and the potential risk of over reliance on AI (Noor and Tan 2024). The negative correlation between concerns and other constructs highlights the importance of integrating ChatGPT within a structured pedagogical framework to mitigate misuse while maximising educational value.

#### *Motivation*

Students reported high motivation to use ChatGPT, reflecting its role in enhancing learner confidence and engagement. These results resonate with studies in Malaysian ESL contexts that have noted similar outcomes, particularly under teacher supervision (Rahimi and Li 2024). Motivation appears closely linked to perceived usefulness and ease of use, reinforcing the theoretical assumptions of the Technology Acceptance Model. This suggests that AI tools not only support learning but also foster positive attitudes towards independent and self-directed language practice.

#### *Academic Level Differences*

No significant differences were observed between Diploma and Bachelor students in terms of perceived usefulness, ease of use, motivation, or concerns. This finding implies that ChatGPT can be effectively integrated across different academic levels without diminishing its perceived educational benefits. It also suggests that learners, regardless of their academic maturity, can adapt to AI assisted tools when they are properly introduced and scaffolded within course activities.

### *5.2 Pedagogical Implications*

The findings of this study offer several meaningful implications for ESL educators, curriculum designers, and policymakers seeking to integrate AI tools such as ChatGPT into language learning. First, the strong positive perception of ChatGPT's usefulness and ease of use indicates that AI can serve as a powerful scaffolding tool for writing tasks, particularly in enhancing clarity, organisation, and grammatical accuracy. Educators are encouraged to deliberately embed AI use within lesson plans, providing structured activities that encourage critical engagement with the tool. For example, teachers can design exercises in which students draft an essay using ChatGPT, then critically evaluate and revise the generated content, thus promoting analytical skills alongside language development (Ismail 2023; Lee 2023).

Second, the findings highlight the importance of responsible and ethical AI use in educational settings. Although students were motivated to use ChatGPT, moderate concerns regarding plagiarism and over reliance were evident. To mitigate these risks, educators should implement clear guidelines and classroom policies that emphasise the tool as a support rather than a substitute for independent work. Incorporating reflective tasks, peer review, and scaffolded assignments can help students internalise language skills while using AI responsibly. Research has shown that when AI is framed as a collaborative learning partner rather than a replacement for cognitive effort, learners are more likely to develop both competence and autonomy (Noor and Tan 2024; Rahimi and Li 2024).

Third, the integration of ChatGPT presents opportunities to enhance learner motivation and engagement. The study confirmed that students feel more confident and motivated when AI tools are incorporated under structured supervision. Motivational benefits can be maximised by designing tasks that are interactive, personalised, and aligned with student interests, such as creative writing prompts, summarisation exercises, or vocabulary expansion tasks. AI's ability to provide immediate feedback and alternative phrasing encourages experimentation with language, reduces writing anxiety, and supports iterative learning processes (Lee 2023).

Fourth, the absence of significant differences between Diploma and Bachelor students suggests that AI integration can be effectively applied across multiple academic levels. This finding implies that instructional designs do not need to vary dramatically based on academic level, although differentiation can be applied in terms of task complexity, feedback depth, or independent versus collaborative activities. For instance, Bachelor students may benefit from more sophisticated tasks that require critical evaluation of AI outputs, while Diploma students may focus on foundational writing skills supported by guided AI prompts.

Finally, the findings emphasise the need for AI literacy in curriculum design. As AI tools become increasingly prevalent, students must not only learn language skills but also understand how to critically evaluate, ethically apply, and adapt AI-generated content. Embedding AI literacy within courses can include discussions on data privacy, ethical use, academic integrity, and strategies for critically integrating AI outputs into original work. By fostering AI literacy alongside language development, educators can prepare students for lifelong learning in a digitally mediated environment (Nordin, Ismail & Yunus 2024).

In conclusion, the pedagogical implications of this study demonstrate that AI assisted tools like ChatGPT can enhance learning, engagement, and autonomy, provided they are integrated thoughtfully, ethically, and with clear pedagogical support. The findings offer a practical

roadmap for educators to leverage AI while maintaining academic rigor and promoting critical thinking in ESL classrooms.

### *5.3 Theoretical Contributions*

This study contributes to the theoretical understanding of AI adoption in educational contexts by extending the Technology Acceptance Model (TAM) to include concerns as a third critical dimension, alongside perceived usefulness and perceived ease of use. Traditionally, TAM has been widely applied to examine user acceptance of technology, predicting adoption primarily through these two dimensions. However, in the context of AI assisted language learning, ethical considerations, academic integrity, and cognitive autonomy emerge as significant factors that influence students' engagement and acceptance of technology. By incorporating concerns into the model, this study provides a more holistic and contextually sensitive framework for examining AI adoption in ESL classrooms.

The findings demonstrate that while perceived usefulness and ease of use positively influence motivation, concerns negatively correlate with these constructs. This indicates that even when AI tools are functional and user-friendly, students' adoption and engagement are moderated by their perceptions of ethical and academic risks. This aligns with recent research on AI in education, which highlights that learners' attitudes toward AI are shaped not only by utility but also by trust, ethical apprehensions, and perceived cognitive impact (Ismail 2023; Noor and Tan 2024). By empirically validating these relationships, the study provides evidence that the integration of ethical and motivational considerations into TAM enhances its explanatory power in educational AI contexts.

Furthermore, the study contributes to the growing body of literature on AI in ESL instruction by demonstrating that students' perceptions are consistent across academic levels. This finding extends TAM's applicability, showing that the model can account for user acceptance in heterogeneous learner groups, including those at different stages of academic maturity. The inclusion of motivation as an additional mediating variable also enriches the model, highlighting that engagement and willingness to adopt AI tools are not solely determined by functionality but are also influenced by learners' intrinsic and extrinsic motivational factors.

Finally, the study offers a conceptual framework that balances innovation with ethical oversight, providing a practical and theoretically grounded model for educators, researchers, and policymakers. By integrating perceived usefulness, ease of use, motivation, and concerns, the framework captures the multidimensional nature of AI adoption in education. This comprehensive approach encourages further research on AI adoption in diverse educational settings, offering a blueprint for investigating how emerging technologies can be implemented responsibly while maximising learning outcomes.

In summary, this study advances theoretical understanding by:

- Extending TAM to include concerns as a critical factor influencing AI adoption.
- Demonstrating the relevance of motivation as a mediating variable between perceptions and adoption behaviour.
- Providing empirical evidence of TAM's applicability across different academic levels in ESL learning contexts.

- Offering a holistic framework that integrates ethical considerations, learner engagement, and pedagogical relevance, supporting future research and practical implementation of AI in education.

### *5.4 Limitations*

Despite its contributions, this study has several limitations that should be acknowledged. First, the research was conducted at a single private university in Malaysia, which may limit the generalisability of the findings to other educational contexts, such as public universities, secondary schools, or institutions in different cultural settings. Second, the study relied exclusively on self-reported survey data, which may introduce response bias and does not capture students' actual performance or behaviour when using ChatGPT. Third, while the study examined students' perceptions, it did not measure the direct impact of ChatGPT on learning outcomes, such as improvements in writing quality, critical thinking, or language proficiency over time. Finally, the study focused on English courses and ESL contexts, which may limit the applicability of the findings to other disciplines or subject areas. Recognising these limitations is important for interpreting the results cautiously and for guiding future research.

### *5.5 Recommendations for Future Research*

Building on the limitations and findings of this study, several directions for future research are recommended. Firstly, expanding the scope to include multiple universities, both public and private, would enhance the generalisability of findings across diverse educational and cultural contexts. Secondly, employing a mixed-methods approach that combines quantitative surveys with qualitative techniques, such as interviews, focus groups, or classroom observations, could provide richer insights into students' experiences, perceptions, and behaviours when interacting with AI tools. Thirdly, investigating the direct impact of ChatGPT on learning outcomes, including writing quality, vocabulary acquisition, and critical thinking, would complement perception-based data and offer stronger evidence of pedagogical effectiveness. Furthermore, conducting longitudinal studies could examine how students' perceptions, motivation, and concerns evolve over time, particularly as AI tools become more integrated into the curriculum. Additionally, exploring AI adoption across different subjects and disciplines would yield broader insights, enabling comparisons between STEM, social sciences, and language learning contexts. Finally, future research should consider ethical and regulatory aspects, such as institutional policies, ethical guidelines, and data privacy issues, to support the development of evidence-based AI literacy programs and frameworks for responsible use. Collectively, these recommendations aim to advance the understanding of AI-assisted learning and ensure its effective and ethical implementation in higher education.

### *5.6 Conclusion*

This study examined students' perceptions of ChatGPT as an AI assisted language learning tool in ESL classrooms, focusing on perceived usefulness, perceived ease of use, motivation, and concerns. The findings indicate that students view ChatGPT as a useful, easy-to-use, and motivating tool, with moderate concerns regarding academic integrity and ethical use. These perceptions were consistent across Diploma and Bachelor students, suggesting the applicability of AI assisted tools across different academic levels.

The study contributes both theoretically and pedagogically by extending the Technology Acceptance Model to include concerns and motivation, providing a holistic framework for understanding AI adoption in educational settings. Practically, the findings offer guidance for educators, curriculum designers, and policymakers on integrating AI tools responsibly while enhancing engagement, learner autonomy, and ethical awareness.

In conclusion, AI tools like ChatGPT hold significant potential to transform ESL education by supporting independent learning, enhancing motivation, and improving writing skills, provided that their integration is guided by structured pedagogical strategies and ethical oversight. By offering empirical insights and practical recommendations, this study contributes to the growing body of literature on AI in education and sets the stage for future research aimed at optimising the use of AI for meaningful and responsible learning outcomes.

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# IMPLEMENTATION OF THOUGHT-RECORD TECHNIQUE ON LOW SELF ESTEEM BULIMIC ADULT

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***Abstract:*** *This study is aimed at implementing thought-technique on low self-esteem bulimic adult. The study was conducted to identify the level of self-esteem using the Rosenberg Self-Esteem Scale (RSES) on bulimic adults, identifying low self-esteem symptoms and reviewing the effectiveness of the thought-record techniques from the Cognitive Behavioral Theory approach in raising the level of low self-esteem. The research design involves a combination of quantitative and qualitative approaches. The sample of the study was selected using Purposive Sampling technique from the college student population (N = 8) that was administered with the Rosenberg Self-Esteem Scale. Sample that received the lowest self-esteem score was chosen as the sample of this study (N = 1). The researcher uses two forms of data collection that is quantitative and qualitative. Quantitative data collection uses the Rosenberg Self-Esteem Scale, while the collective data are collected through transcript and observation methods. Descriptive data analysis involves RSES score on Baseline phase and Treatment phase analyzed using Percentage of Non-Overlapping Data (PND). In order to identify low self-esteem symptoms, qualitative data was analyzed based on counseling session transcripts and observation using Mental Status Examination (MSE) involving six counseling sessions. Intervention effects were analyzed using triangulation methods involving observation through MSE, RSES score and counseling session transcripts. The findings show that there is an increase in self-esteem of the participant. The effectiveness of the implementation of thought-recording technique is supported through increased percentage of RSES score, PND, transcripts analysis and observation.*

***Keywords:*** *Cognitive Behavioral Therapy (CBT), thought-record technique; bulimia, low self-esteem, Rosenberg Self-Esteem Scale (RSES), counseling intervention, triangulation analysis*

## Introduction

Adults in the current generation are known to be more conscious on their self and they are known to take the issues related to their body weight seriously. They are known to be affected by various external and internal factors that contributes to their awareness on body image. They are living in a society with a social stigma that being thin defines beauty and it is necessary. An adult tried by all means to live up to the social expectation and the beauty standard that is set by the society (Ramos-Jiménez, Hernández-Torres, Urquidez-Romero, Wall-Medrano, & Villalobos-Molina, 2017).

Adults takes various means to maintain their body image according to the social standard that is set. One of the ways that adult choose to maintain their body weight is by being bulimic. The rates of bulimic cases is in the rise and it needs to be given more attention as the society aren't aware of its seriousness (Crow, Swanson, le Grange, Feig, & Merikangas, 2014).

The National Eating Disorder Association (2016), collected data from various sources that shows the rise in bulimic activity in adults in various demography throughout the world. It shows that between 1.1% and 4.6% of females and 0.1% to 0.5% of males will develop bulimia nervosa in their young adult years.

A study conducted by (Dryer, Uesaka, Manalo, & Tyson, 2015), states that there are three main contributing factors that leads an adult to be involved in bulimic activity such as dieting and eating practices, family dynamics and social cultural practices. The study complies to the cross-cultural examination of beliefs about the causes of bulimia nervosa among Australian and Japanese adult females.

Bulimia nervosa has become an increasingly serious issue that needs attention and preventive measure to be taken against it. According to the National Institute of Mental Health (2016), bulimia nervosa is defined as an eating disorder that are caused by the fear of being overweight that advances to serious dieting, self-induced vomiting and severe exercising.

In the recent years, the number of bulimia nervosa cases has increased and it is subjected to major health concern among young adults. In 2015, it is approximated that bulimia nervosa in United States is 1.5% in women and 0.5% in men. It is interpreted as an approximate 4.7 million females and 1.5 million males suffers from bulimia nervosa. Bulimia nervosa is more prone during the adolescent and young adult years (Ouellette, 2015).

The population for bulimia nervosa ranged from 0% to 2.1% in males and from 0.3% to 7.3% in female subjects in Western countries. The population rates in non-Western countries for bulimia nervosa ranged 0.46% to 3.2% in female subjects (Makino, Tsuboi and Dennerstein, 2004).

In Malaysia, there is no concrete research done on the population on eating disorder. However, approximately the estimated figure suffering for bulimia nervosa is 3% which is between 250,000 to 900,000 subjects (Andexer, 2016). A study conducted by the Malaysian Psychiatric Association (MPA), it shows that bulimia nervosa happens more commonly within the young adult population.

## Literature Review

### *Cognitive Behavioural Therapy (CBT)*

Cognitive Behavioural Therapy (CBT), developed by Aaron Beck, is based on the principle that maladaptive emotions and behaviours result from distorted thinking patterns (Corey, 2005). CBT integrates both cognitive and behavioural approaches and focuses on identifying and restructuring negative core beliefs that influence behaviour. Under emotional stress, individuals may develop faulty beliefs and irrational thoughts, which CBT aims to correct through cognitive restructuring (Nor Shafrin & Rohany, 2013).

CBT assumes that humans are capable of rational thinking, self-improvement, and change, but may also develop maladaptive behaviours through avoidance, blame, and negative assumptions (Gladding, 2000). Numerous studies have demonstrated the effectiveness of CBT in treating emotional disorders, anxiety, personality disorders, self-esteem issues, and psychotic conditions. Techniques commonly used in CBT include Socratic questioning, homework

assignments, cognitive restructuring, stress inoculation, thought stopping, and the thought-record technique. This study specifically focuses on the use of the thought-record technique in addressing low self-esteem among bulimic adults.

### *Thought-Record Technique*

The thought-record technique is a structured CBT strategy used to identify automatic thoughts and modify dysfunctional core beliefs (Corey, 2013). Oliveira et al. (2012) introduced the trial-based thought record as an effective tool for changing negative core beliefs, particularly in social phobia. Core beliefs are fundamental assumptions formed through life experiences and significantly influence emotional and behavioural reactions.

Delavechia et al. (2016) further explained that thought records help in restructuring dysfunctional core beliefs rooted in negative life events that may lead to psychiatric disturbances. Josefowitz (2017) highlighted that the technique allows clients to recognize and analyze their thoughts and replace them with balanced, rational alternatives. However, emotional change may be limited unless cognitive work is supported with emotional processing. The integration of imagery into thought records enhances emotional engagement and therapeutic outcomes.

### *Self-Esteem Theory*

Self-esteem refers to how individuals evaluate their own worth and abilities. It is generally categorized as either high or low. High self-esteem is associated with positive growth, motivation, and emotional well-being, while low self-esteem is linked to self-criticism, negative self-perception, and fear of failure (Cast & Burke, 2002). Individuals with low self-esteem tend to exaggerate mistakes and focus heavily on perceived shortcomings.

Research indicates that low self-esteem is strongly associated with bulimia nervosa and increases the risk of suicidal ideation and emotional disturbances (Crow et al., 2014). The Curvilinear Model of Self-Esteem (Karmos & Karmos, 1981) explains varying levels of self-esteem, while Guindon (2002) describes common traits of individuals with low self-esteem, including withdrawal, poor self-image, lack of confidence, dependency, and negative emotions.

### *Research on Self-Esteem*

Self-esteem is closely related to self-image and personal identity (Frant, 2016). Wang (2015) defined self-esteem as an evaluative response based on an individual's perception of self-worth and linked it to personal power, authenticity, and relationship satisfaction. Frant (2016) also highlighted that family, media, culture, emotional intelligence, and socioeconomic status significantly influence self-esteem development.

Lohan, Adrian, and Fiona (2016) examined self-esteem measurement using the Rosenberg Self-Esteem Scale, which reliably assesses global self-worth and competence beliefs. Alessandri et al. (2015) described self-esteem as a latent psychological construct measured through emotional and cognitive responses. Barnum and Perrone-McGovern (2017) found that high self-esteem is associated with healthier relationships, while low self-esteem contributes

to insecurity, communication difficulties, and psychological distress. Counselling interventions were identified as effective in improving attachment security and overall mental well-being.

### *Self-Esteem and Thought-Record Technique Research*

Although many studies have used CBT to treat low self-esteem, limited research has focused specifically on the thought-record technique in bulimic adults. The thought-record technique helps identify automatic negative thoughts, examine evidence, and generate alternative rational thoughts (Corey, 2013; Trustees of Indiana University, 2016).

Previous studies show strong support for the effectiveness of this technique. Oliveira et al. (2012) confirmed its success in reducing social anxiety. Clore and Gaynor (2006) demonstrated significant improvements in self-esteem and depressive symptoms among college students. CBT interventions were also found effective for psychotic patients (Hall & Tarrier, 2003) and individuals with learning disabilities (Whelan et al., 2007). Irismar Reis de Oliveira (2008) further reported that sentence reversion and judicial metaphors within thought records effectively changed negative core beliefs.

### *Theoretical Framework*

This study applies the thought-record technique derived from CBT as the independent variable, while self-esteem functions as the dependent variable. The framework proposes that systematic cognitive restructuring through thought records leads to improvements in self-esteem among bulimic adults.

## Methodology

### *Research Design*

This study employed a single-subject case study design using an AB design. The baseline phase (A) involved repeated measurement of the participant's self-esteem without intervention, while the intervention phase (B) involved the implementation of the Thought-Record Technique. The Rosenberg Self-Esteem Inventory was administered three times during baseline to establish score stability before the intervention was introduced. Intervention commenced only after consistent baseline results were obtained (McLeod, 2010).

### *Research Sample and Sampling Method*

This study involved one participant, selected using purposive sampling. The participant was identified from a group of eight students in a private college through the SCOFF questionnaire, which screens for eating disorders. The student who exhibited bulimic symptoms and recorded the lowest self-esteem score on the Rosenberg Self-Esteem Inventory was selected. Selection criteria focused on the presence of bulimia nervosa and low self-esteem, while race, gender, and socioeconomic background were not considered.

### *Case Conceptualization*

The participant was a 21-year-old Indian female, currently pursuing her law degree at a private college in Penang. She is single and resides with her aunt. Medically, she reported acid reflux and bulimia nervosa. She had no prior diagnosis of depression or other psychological disorders. Developmentally and socially, she reported positive family relationships and adequate peer interactions.

Her presenting issue was low self-esteem, which began at the age of 16 due to constant self-comparisons with her sister and others. To control her body weight, she developed persistent purging behaviours. Physical discomfort related to digestion eventually prompted her to seek professional help.

***Data Collection***
***Quantitative Data***

The Rosenberg Self-Esteem Inventory (RSES) (Rosenberg, 1979) was used to measure the participant's self-esteem across six administrations—three during baseline and three during treatment. The instrument consists of 10 items scored on a four-point Likert scale. The RSES demonstrates strong reliability ($\alpha = .92$) and high test–retest stability ($r = .85–.88$), with strong construct validity supported by cross-cultural applications in over 50 countries.

Self-esteem scores were interpreted as:
1–14: Low
15–25: Moderate
26–40: High

***Qualitative Data***

Qualitative data were obtained through: Verbatim counselling transcripts across all six sessions Behavioural observations based on Mental Status Examination (MSE)
Transcripts were analysed thematically, while observation focused on verbal and non-verbal behavioural changes including affect, insight, and judgement.

***Procedure of Treatment***

The intervention consisted of six counselling sessions, each lasting 45–60 minutes, conducted in a therapeutic counselling room. Sessions followed the stages proposed by Corey (2013), including: Initial rapport building, Exploration, Goal setting, Intervention,Termination.

During the intervention phase, the participant was trained to use the Thought-Record worksheet to identify automatic negative thoughts, challenge cognitive distortions, and restructure irrational core beliefs. Homework assignments and repeated RSES measurements were integrated systematically across sessions.

***Data Analysis***

Data were analysed based on:

a) Level of self-esteem
b) Symptoms of low self-esteem

c) Effectiveness of the Thought-Record Technique

Self-esteem changes were analysed using Percentage of Non-Overlapping Data (PND) by comparing baseline and intervention scores. PND values were interpreted as:
90% = Highly effective
70–90% = Moderately effective
50–70% = Minimally effective
<50% = Ineffective

Symptoms of low self-esteem were analysed thematically from verbatim transcripts and observation, focusing on emotional, cognitive, and behavioural domains.

Treatment effectiveness was evaluated using triangulation, integrating:

a) RSES scores
b) Verbatim transcript themes
c) MSE-based observations

This study utilised a mixed-method single-subject case study approach to evaluate the effectiveness of the Thought-Record Technique among a bulimic adult with low self-esteem. Data were collected through standardised psychometric testing, verbatim transcript analysis, and behavioural observation, and analysed using statistical and thematic procedures to ensure methodological rigour.

**Results**

The results are presented according to the three research objectives:

a) The level of self-esteem
b) The symptoms of low self-esteem
c) The effectiveness of the Thought-Record Technique for a bulimic adult with low self-esteem.

Both quantitative (RSES, PND) and qualitative (transcripts, MSE, thought records) data are reported.

***1. Levels of Self-Esteem***

The participant's self-esteem was measured six times using the Rosenberg Self-Esteem Scale (RSES): three times during baseline and three times during the intervention (at the end of Session 2, Session 4 and Session 6).

**Table 1: Rosenberg Self-Esteem Scale – Baseline and Treatment Results**

| RSES | Score | Difference in Score | Difference in Percentage (%) | Self-esteem level |
|---|---|---|---|---|
| Baseline 1 | 11 | 0 | 0.0 | Low |
| Baseline 2 | 11 | 0 | 0.0 | Low |
| Baseline 3 | 12 | 1 | 2.5 | Low |

| RSES | Score | Difference in Score | Difference in Percentage (%) | Self-esteem level |
|---|---|---|---|---|
| Treatment 1 | 12 | 0 | 0.0 | Low |
| Treatment 2 | 15 | 3 | 7.5 | Moderate |
| Treatment 3 | 24 | 9 | 22.5 | Moderate |

Overall increase in percentage from Baseline 1 to Treatment 3: 32.5%
Expected trend: Increasing self-esteem.

Self-esteem remained low during baseline and at Treatment 1, then increased to the moderate range at Treatment 2 and Treatment 3, indicating a meaningful improvement in self-esteem following the intervention.

To further evaluate intervention effectiveness, the Percentage of Non-Overlapping Data (PND) was calculated. The highest baseline score was 12; the non-overlapping treatment scores were 15 and 24.

A PND of 67% falls within the minimally to moderately effective range, indicating that the Thought-Record Technique produced a moderate positive effect on self-esteem.

### *2. Symptoms of Low Self-Esteem*

Qualitative analysis of the six counselling session transcripts showed that the participant's low self-esteem was expressed through three main domains: emotional, behavioural, and cognitive symptoms (Table 1).

**Figure 1. Symptoms of Low Self-Esteem**

| Emotion | Behavioural | Cognitive |
|---|---|---|
| • **Guilty**<br>• **Angry**<br>• **Sense of Failure**<br>• **Scared** | • Openness<br>• Vomiting<br>• Curiosity<br>• Secretive | • Core Belief<br>• Self-Criticism<br>• Comparative |

### *2.1 Emotional Symptoms*

The participant frequently reported guilt, anger, a sense of failure, and fear related to eating, body image, and others' perceptions. For example, she described feeling "guilty" after eating and "angry" with herself for overeating and purging. She often expressed being "scared" of becoming fat or being judged by others, reflecting deep emotional distress and body-related anxiety.

### *2.2 Behavioural Symptoms*

Behaviourally, the participant:

- Was open to change, stating that she wanted to change herself.

- Engaged in repeated vomiting after meals, a core bulimic behaviour.
- Displayed curiosity, for example, reading about bulimia and trying out behaviours.
- Was highly secretive about her condition and asked for reassurance that her problem would not be disclosed.

These behaviours show how low self-esteem and body dissatisfaction translated into maladaptive coping: purging and secrecy, while still holding a desire for change.

### *2.3 Cognitive Symptoms*

Cognitively, she held strong core beliefs such as "being thin is nice" and "being fat is ugly," and believed that vomiting was necessary to prevent weight gain. She engaged in intense self-criticism, frequently describing herself as "fat," "ugly," and "useless." She also displayed comparative thinking, often comparing herself negatively to her sister, friends, and even the counsellor, which reinforced her negative self-image. These cognitive patterns provided important targets for the Thought-Record Technique and other CBT strategies.

### *3. Observation Based on Mental Status Examination (MSE)*

The participant's functioning was also monitored through Mental Status Examination (MSE) across six sessions. The observations covered domains such as appearance, speech, eye contact, motor activity, affect, mood, cognition, perception, thoughts, behaviour, insight, and judgement.

Overall, the participant:

- Appeared neatly dressed in all sessions.
- Showed initial hesitation, guardedness, and avoidant eye contact in early sessions.
- Became progressively more cooperative, open, relaxed, and confident over time.
- Exhibited no hallucinations, delusions, or suicidal/homicidal ideation.
- Showed a gradual improvement in insight and judgement, which progressed from poor to fair and finally to good by Session 6.

These changes support the quantitative and qualitative findings, reflecting improved psychological stability and self-perception by the end of the intervention.

### *4. Effectiveness of the Thought-Record Technique*

The Thought-Record Technique was introduced in Session 2 and used as guided homework across Sessions 2, 4, and 5. Three completed worksheets illustrated the participant's cognitive and behavioural changes over time.

In Worksheet 1 (Session 2), after overeating at a birthday party, she felt "happy and guilty," believed her stomach would get fatter, and ultimately vomited despite identifying a more rational alternative thought ("eating for one day won't make me that fat").

In Worksheet 2 (Session 4), she described severe hunger, overeating, and vomiting but was able to generate more balanced thoughts ("being hungry is not my fault; it's okay to eat what you want") and reduced the intensity of purging.

In Worksheet 3 (Session 5), after eating KFC, she did not vomit and identified healthier alternatives such as exercising and diet balancing. She reported feeling both guilty and happy, but importantly, she chose not to purge and felt "good" about that choice.

Across the three worksheets, there was a clear shift from:

Automatic self-critical thoughts and rigid beliefs → More balanced alternative thoughts →

Behavioural change (reduced vomiting and increased self-control).

This pattern suggests that the Thought-Record Technique effectively increased her awareness of negative thinking and supported cognitive restructuring, which, in turn, contributed to behavioural change.

***5. Effectiveness Based on Transcripts and Observation***

Transcript excerpts showed progressive cognitive and emotional change. The participant reported that the sessions and worksheets helped her "see more clearly," "think a lot," and distinguish between facts and opinions about herself. She noted that previously she would only think negatively, but later she was able to also think positively and challenge her own thoughts.

By the final sessions, she reported:

- Feeling better and more confident
- Being able to talk to herself more positively
- Recognising that many of her negative thoughts were opinions rather than facts

MSE-based observation supported this, showing improvements in:

- Affect and mood (more relaxed, less helpless)
- Behaviour (more cooperative, willing to share)
- Insight and judgement (from poor to good)

***Summary of Findings***

In summary, the findings from the RSES scores, PND analysis, symptom themes, thought records, session transcripts, and MSE observations consistently indicate that:

- The participant's self-esteem increased from low to moderate.
- The frequency and intensity of bulimic behaviour (vomiting) decreased.
- Emotional, behavioural, and cognitive symptoms of low self-esteem showed clear improvement.

The Thought-Record Technique, as part of CBT, was moderately effective in increasing self-esteem and supporting healthier thinking and behaviour in a bulimic adult.

## Discussion

This study examined the use of the Thought-Record Technique, within a CBT framework, to improve self-esteem in a bulimic adult. Quantitative and qualitative findings together indicate that the intervention produced meaningful improvements in self-esteem, symptoms, and cognition.

### *Change in Self-Esteem*

RSES scores showed a 32.5% increase from baseline to the end of treatment, with self-esteem moving from low to moderate. The PND value of 67% indicates a moderate treatment effect, which is consistent with expectations for a brief, single-case intervention.

The improvement appears linked not only to the technique itself but also to the therapeutic relationship. As sessions progressed, the participant became more willing to share sensitive information and to discuss her "biggest secret." This supports CBT literature that emphasizes the importance of rapport, trust, and collaborative work in facilitating cognitive restructuring and behavioural change (Corey, 2013; Konstantinou, 2014). Positive reinforcement, psychoeducation about CBT, and ongoing encouragement likely enhanced the client's readiness to challenge her negative beliefs and contributed to the rise in self-esteem.

The client's long-standing negative self-view, beginning in adolescence, was evident in the language she used ("ugly", "useless", "fat"). These internalized views explain her low initial RSES scores. The gradual shift in self-description and self-talk observed during sessions aligns with the increase in RSES scores, suggesting that cognitive and emotional shifts were reflected in the quantitative measures.

### *Symptoms of Low Self-Esteem*

The participant displayed classic low self-esteem symptoms across emotional, behavioural, and cognitive domains. Emotionally, she frequently reported guilt, anger, fear, and a sense of failure, particularly around eating and body image. This pattern is consistent with previous work that links low self-esteem with guilt, self-blame, and emotional vulnerability (Kvist Lindholm & Zetterqvist Nelson, 2015; Garofalo et al., 2016).

Behaviourally, she engaged in vomiting as a bulimic behaviour, remained secretive about her condition, yet showed openness to change and high curiosity. These findings parallel earlier research indicating that low self-esteem is associated with maladaptive coping and eating disorder behaviours, and that internal "critical voices" can make behavioural change difficult (Crow et al., 2014; Noordenbos et al., 2014). The study's results also support the view that increases in self-esteem can reduce the likelihood of maladaptive behaviours and improve eating patterns over time (Crow et al., 2014; Rieger et al., 2016).

Cognitively, the participant held rigid core beliefs (e.g., "being fat is ugly," "I must be thin to be accepted"), engaged in strong self-criticism, and frequently compared herself with others.

These cognitions are consistent with the role of self-critical thinking and harsh self-evaluation in both low self-esteem and eating disorders (Abd & Gouda, 2016; Kelly & Tasca, 2016). The findings also align with earlier case-based and empirical research suggesting that core beliefs strongly influence eating patterns and body image, and are difficult to change without targeted intervention (Corey, 2013; Damian & Robins, 2011; Abd & Gouda, 2016).

MSE observations confirmed that, although the participant did not display overt psychotic or severe mood symptoms, her insight, judgement, and affect improved over time. By the final sessions, she appeared more relaxed, more cooperative, and more confident, which is consistent with her reported increase in self-esteem.

***Effects of the Thought-Record Technique***

The Thought-Record worksheets showed a clear progression from automatic negative thinking and strong self-criticism towards more balanced and alternative thoughts and improved behaviour. Initially, although she could generate alternative thoughts ("nobody says that I'm

fat"), she still engaged in vomiting, reflecting the strength of her core beliefs. By the fourth and fifth worksheets, she began to challenge her self-criticism more effectively, accept hunger as normal, and identify healthier options such as diet balance and exercise. In the final worksheet, she successfully refrained from vomiting and reported feeling happy about this change.

These changes support previous work suggesting that the Thought-Record Technique is useful in modifying dysfunctional core beliefs and promoting healthier thinking patterns (Irismar Reis De Oliveira, 2008). The client's own statements—such as "I can see more clearly," "I can see what I think and what I should think," and "I can ask whether what I think is fact or opinion"—indicate increased metacognitive awareness and better ability to differentiate thoughts from reality. This reflects a core goal of CBT and demonstrates that the client understood and used the technique in daily life.

The role of client factors and therapeutic relationship is also important. As highlighted by Lambert (1992), outcomes in counselling are influenced by multiple components: client factors, the therapeutic relationship, hope, and specific techniques. In this study, the participant's high level of cooperation and commitment, combined with a supportive therapeutic relationship and the structured use of the Thought-Record, together contributed to the positive outcome.

Overall, the findings suggest that the Thought-Record Technique, within a CBT framework, can be an effective and practical tool to increase self-esteem and reduce bulimic behaviour in a single-subject context.

**Implications of the Study**

This study has several implications for practice, education, and future research:

***Clinical Practice***

The Thought-Record Technique can be used as a simple, structured tool to help bulimic adults identify, monitor, and challenge self-critical thoughts related to body image and self-worth. The technique is flexible and can be integrated into regular counselling sessions or as homework, supporting ongoing self-reflection outside the counselling room. Counsellors should pay attention to emotional, behavioural, and cognitive symptoms of low self-esteem and address them together rather than in isolation.

### *Family, Medical and Counselling Settings*

Increased awareness of Bulimia Nervosa and its links to self-esteem is important for families, medical professionals, and counsellors. Early recognition of self-critical thinking and purging behaviour can support earlier referral and intervention. Psychoeducation about self-esteem and cognitive distortions can be shared with clients and families to encourage supportive responses rather than criticism.

### *Bulimic Adults in the Community*

The findings highlight that bulimic adults can benefit from non-judgemental, structured counselling where they are given space to talk, reflect, and experiment with new thinking patterns. The study may encourage more individuals to seek counselling and reduce stigma around discussing eating and body image concerns.

### *Research and Training*

The study demonstrates the value of single-case designs in evaluating specific CBT techniques in real-life contexts. Counselling trainees and practitioners can use this case as a model for integrating structured CBT tools with a strong therapeutic relationship.

## Limitations and Suggestions for Future Research

This study has several limitations, it is based on a single case, so the findings cannot be generalized to all bulimic adults. The time frame was relatively short, which limits understanding of long-term maintenance of changes. The intervention focused mainly on one technique (Thought-Record), although other CBT strategies were present in the background.

## Conclusion

This study focused on a young adult female with Bulimia Nervosa and low self-esteem. Based on the Rosenberg Self-Esteem Scale, Percentage of Non-Overlapping Data, counselling transcripts, Thought-Record worksheets, and MSE observations, the Thought-Record Technique within CBT was found to:

- Increase the participant's self-esteem from low to moderate,
- Reduce the symptoms of low self-esteem, and
- Support a reduction in bulimic behaviour (vomiting) and more positive self-talk.

Overall, the findings suggest that the Thought-Record Technique is a promising and practical intervention for enhancing self-esteem and improving cognitive and behavioural patterns in

bulimic adults, particularly when combined with a strong therapeutic relationship and client commitment.

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# ATTRIBUTES OF A SUSTAINABLE CO-WORKING SPACE - A PRISMA REVIEW

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***Abstract:*** *The transition towards sustainable workspaces has gained momentum in recent years, particularly with the rising popularity of co-working spaces as flexible and shared environments that support wellbeing, collaboration, and environmental sustainability. Despite this growth, there is no research that specifically identifies the physical attributes of a sustainable co-working space. This review addresses this gap by systematically analysing existing literature to uncover the core elements that contribute to the sustainability of co-working spaces. This study aims to define the physical attributes of an environmentally sustainable co-working space by applying an advanced search strategy using the Scopus and IEEE Xplore databases, focusing on publications with keywords such as "sustainable space", "co-working space", "green environment", and their synonyms. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework guided the screening and selection process, which resulted in a final dataset of 55 relevant articles. Through qualitative thematic analysis of the abstracts, four dominant themes emerged: (1) Green Environment, which includes thermal comfort, indoor air quality, acoustic control, and natural light; (2) Green Materials, highlighting the importance of recycled, low-carbon, and environmentally-friendly construction materials; (3) Open Layout, emphasizing flexible and collaborative spatial arrangements that enhance social interaction and space efficiency; and (4) Smart Technology, referring to the integration of IoT systems and data-driven solutions that optimize energy use and user experience. The findings suggest that a combination of these attributes is important in creating high-performance, user-centred, and environmentally responsible co-working spaces. This review provides a foundation for future research and practice in sustainable co-working space design by providing guidance to architects, developers, and policymakers who want to promote healthier and more resilient shared work environments. This is the first study to define the physical attributes of a sustainable co-working space.*

***Keywords:*** *Co-Working Space, Sustainable Space, Green Building*

## Introduction

The landscape of modern work is expanding, fuelled by increasing demands for flexibility, collaboration, and community. This has pushed co-working spaces from a niche concept to a

global phenomenon. These shared work environments offer amenities ranging from flexible desks to private offices, and have become pivotal in supporting diverse professional needs including freelancers, startups, and established corporations that are seeking agile solutions (Ayodele et al., 2022; DuPriest, 2019). Co-working spaces are not only important for its infrastructure, but also for its capacity in fostering innovation, facilitating networking, and cultivating a sense of belonging among its members (Berdicchia et al., 2023; Bouncken et al., 2020). However, as the co-working industry matures, the need for sustainability becomes important, encompassing environmental responsibility, social equity, and economic viability. A sustainable co-working space is not merely an eco-friendly building; it is a holistic ecosystem that supports the long-term wellbeing of its users, the community it serves, and the planet. Understanding the multifaceted attributes that contribute to this sustainability is important for the continued growth and positive impact of the co-working industry, ensuring its relevance and resilience in a constantly-growing professional world.

Existing research on co-working spaces has largely focused on their immediate benefits, such as increased productivity and enhanced social interaction (Bueno et al., 2018; Gerdenitsch et al., 2016). Pioneering studies provided early insights into the collaborative dynamics and spatial configurations of co-working, highlighting its move from traditional office models (Moriset, 2014; Spinuzzi et al., 2019). More recent studies have explored the psychological wellbeing of co-workers and the role of community managers in fostering vibrant environments (Akhavan & Mariotti, 2023; Eves et al., 2018). While these contributions have significantly advanced our understanding of co-working's operational and social dimensions, there is a lack of studies on sustainability attributes. Research into ‘green’ co-working spaces has touched on the attitudes and practices of users, but not the physical attributes of the spaces. This gap is particularly evident in the lack of studies that systematically analyse how the use of sustainable materials and sustainable design contributes to the positive impact of co-working spaces.

Despite the growing recognition of the importance of sustainability, several critical gaps appear within the co-working literature with regards to its sustainable attributes. Firstly, there is no framework for assessing the sustainability of co-working spaces. This lack of guidance hinders the development of best practices. Secondly, while some studies suggest social sustainability through community building, the specific mechanisms and long-term impacts of these efforts towards users are not thoroughly explained. Future research should focus on developing a robust and multi-dimensional sustainability framework specifically for co-working spaces that include not only environmental sustainability, but also social inclusivity and economic resilience. Furthermore, longitudinal studies are needed to understand the long-term impacts of various co-working models on user wellbeing, social interaction, and environmental performance. Recommendations for the industry include adopting transparent reporting on sustainability metrics, investing in renewable energy solutions, and fostering deeper partnerships with local communities. These efforts will not only improve the positive impact of co-working spaces but also ensure its continuous relevance as a cornerstone of the future of work.

## Literature Review

While there has not been a specific framework from literature describing sustainable co-working spaces, some studies describe sustainable aspects in co-working spaces. A summary of the literature review is presented in Table 1. One of the aspects studied is indoor

environmental quality (IEQ), which significantly impacts the health, wellbeing, and productivity of its occupants. Key environmental factors include air quality, temperature, humidity, and lighting. Studies have shown that higher satisfaction with IEQ correlates with better wellbeing and fewer respiratory symptoms among workers (Parhizkar et al., 2023). Continuous environmental monitoring, such as measuring $CO_2$ and particulate matter ($PM_{2.5}$) levels, is important for maintaining optimal IEQ and ensuring a healthy workspace. Additionally, Labib et al. (2022) highlight the incorporation of green building standards like LEED, which emphasize resource efficiency and minimal environmental impact.

Sustainable co-working spaces also focus on fostering a sense of community and social responsibility among their members. This includes promoting sustainable mobility options and encouraging socially responsible behaviours (Oswald & Zhao, 2020). The concept of co-housing, which shares similarities with co-working spaces, supports pro-environmental behaviour by enabling residents to adopt and reinforce sustainable practices collectively (Marckmann et al., 2012). Furthermore, the design and operation of these spaces should consider the wellbeing of occupants, integrating ergonomic workstations and stress-reducing elements to enhance overall productivity and satisfaction (Zvyagina et al., 2019).

From an economic perspective, sustainable co-working spaces aim to balance environmental stewardship with economic viability. This involves creating spaces that attract and retain businesses and skilled workers by offering a high-quality, sustainable work environment (George et al., 2012). Implementing sustainable practices, such as efficient resource use and waste reduction, can also lead to cost savings and improved operational efficiency (Labib et al., 2022). Additionally, the integration of sustainability into the organizational culture, as seen in educational institutions adopting the GRACIAS model (Green Resolution in Academic Campuses for Intellectually Aware Sustainability), highlights the importance of a holistic approach to sustainability that encompasses all levels of management and operations (Chourey et al., 2024).

This literature review highlights the multifaceted nature of environmentally sustainable co-working spaces, emphasizing the importance of environmental quality, community engagement, and economic viability. By integrating these attributes, co-working spaces can create healthier, more productive, and sustainable environments for their occupants.

**Table 1: Summary of Literature Review on Sustainable Aspects in Co-Working Spaces**

| Item | Description | Supporting Abstracts |
|---|---|---|
| Indoor Environmental Quality (IEQ) | Focus on air quality, temperature, humidity, and lighting to enhance health and productivity. | Labib et al. (2022); Parhizkar et al. (2023) |
| Green Building Standards | Adoption of standards like LEED for resource efficiency and minimal environmental impact. | Labib et al. (2022) |
| Community and Social Responsibility | Promotion of sustainable mobility and socially responsible behaviours among members. | Marckmann et al. (2012); Oswald & Zhao (2020) |
| Ergonomic and Stress-Reducing Design | Integration of ergonomic workstations and elements to reduce stress and enhance wellbeing. | Zvyagina et al. (2019) |

| | | |
|---|---|---|
| Economic Viability | Balancing environmental stewardship with economic benefits to attract and retain businesses. | George et al. (2012) |
| Holistic Sustainability Approach | Incorporation of sustainability into organizational culture and operations. | Chourey et al. (2024) |

## Materials and Methods

The study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework for identifiying, screening, and determining eligibility of records. Consequently, ATLAS.ti was employed to perform a qualitative thematic analysis on the final set of documents. The PRISMA flow diagram is shown in Figure 1.

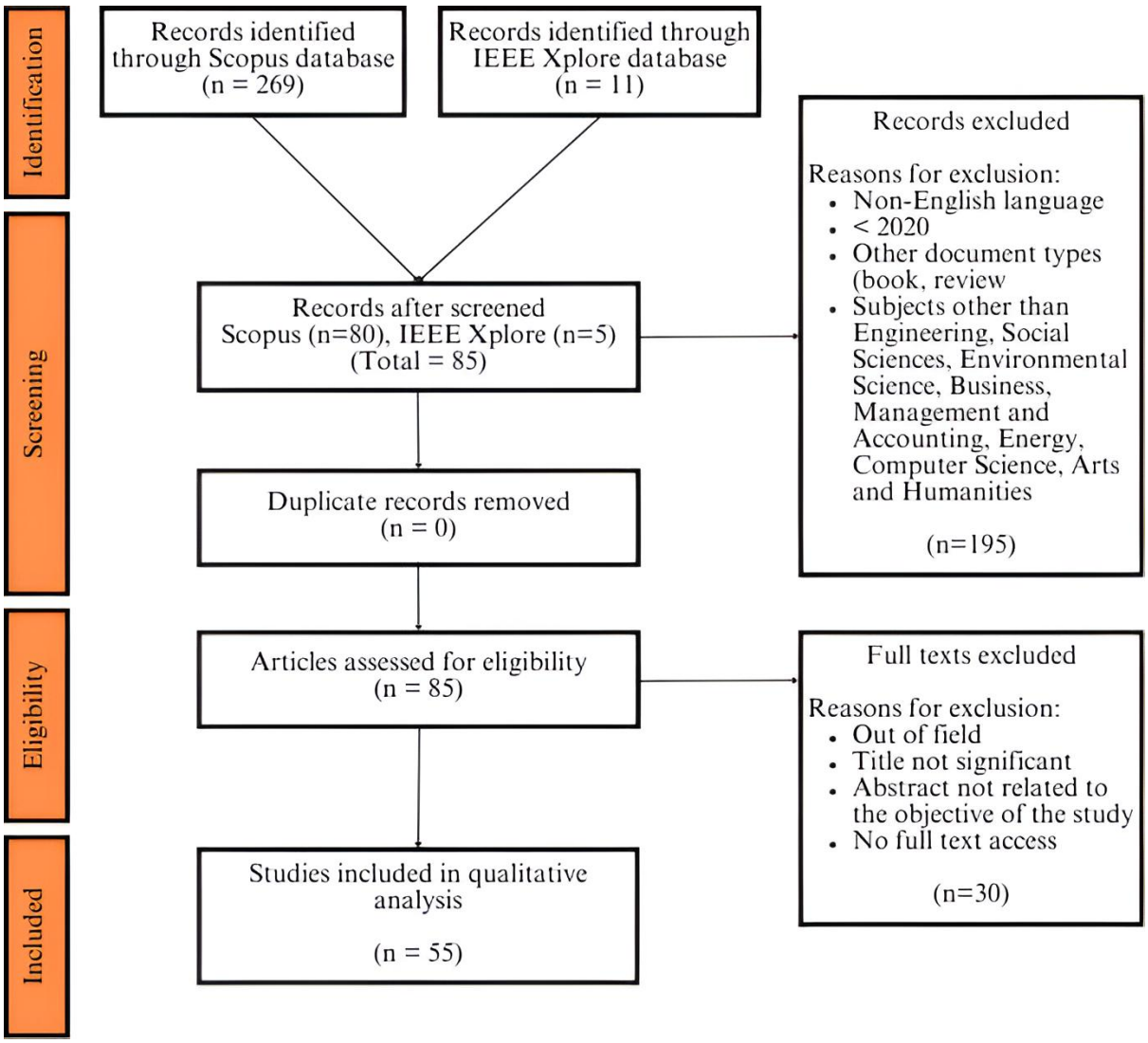



**Figure 1: PRISMA Flow Diagram of the Procedure for Selecting Articles for Qualitative Analysis**

Source: Adapted from Moher et al. (2009)

### *Identification*

According to the PRISMA framework, the Identification stage marks the critical first step in systematically gathering relevant literature (Moher et al., 2009). In this study, comprehensive searches were conducted across two reputable academic databases (Scopus and IEEE Xplore) to ensure a robust foundation of high-quality sources related to sustainable attributes of co-working spaces. As shown in Table 2, the Scopus search was done using a search string combining various terminologies for co-working spaces and sustainability-related concepts, limited to English-language journal articles and conference papers published between 2020 and 2025. The search was further refined by focusing on subject areas relevant to engineering, social sciences, environmental science, energy, business, arts, and computer science. This search yielded a total of 269 records from Scopus. Next, the IEEE Xplore database was employed using an identical keyword strategy. IEEE Xplore is well regarded for its focus on engineering and technological research. This search returned a smaller number of records (n = 11). The search from both databases returned a combined total of 280 records.

**Table 2: Search String Used on Each Database**

| Database | Search string |
|---|---|
| Scopus | TITLE-ABS-KEY ( ( "coworking space" OR "coworking office" OR "flexible workspace" OR "flexible office" OR "cosharing space" OR "cosharing office" OR "cosharing workspace" OR "activity based office" OR "activity based workspace" OR "open plan office" OR "open plan workspace" ) AND ( sustain* OR green OR "eco friendly" OR "environmentally friendly" OR "low carbon" OR "energy efficient" OR sunlight OR "natural light" OR daylight OR recycle OR reuse OR reusable OR reclaim ) ) AND PUBYEAR > 2019 AND PUBYEAR < 2026 AND ( LIMIT-TO ( SUBJAREA , "ENGI" ) OR LIMIT-TO ( SUBJAREA , "SOCI" ) OR LIMIT-TO ( SUBJAREA , "ENVI" ) OR LIMIT-TO ( SUBJAREA , "ENER" ) OR LIMIT-TO ( SUBJAREA , "BUSI" ) OR LIMIT-TO ( SUBJAREA , "ARTS" ) OR LIMIT-TO ( SUBJAREA , "COMP" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "cp" ) )<br><br>Date of Access: July 2025 |
| IEEE Xplore | ( "coworking space" OR "coworking office" OR "flexible workspace" OR "flexible office" OR "cosharing space" OR "cosharing office" OR "cosharing workspace" OR "activity based office" OR "activity based workspace" OR "open plan office" OR "open plan workspace" ) AND ( sustain* OR green OR "eco friendly" OR "environmentally friendly" OR "low carbon" OR "energy efficient" OR sunlight OR "natural light" OR daylight OR recycle OR reuse OR reusable OR reclaim )<br><br>Date of Access: July 2025 |

***Screening***

In the Screening stage of the PRISMA framework, the initially identified 280 records were screened to ensure that only the most relevant and high-quality studies were included in the review. After applying eligibility criteria, a total of 85 articles were retained for further analysis (80 articles from Scopus and 5 articles from IEEE Xplore). A summary of the inclusion and

exclusion criteria is shown in Table 3. The exclusion of 195 records was based on several key parameters, namely language (non-English), publication type (books, reviews), publication year (prior to 2020), and subject area (subjects other than engineering, social sciences, environmental science, business, energy, computer science, and arts and humanities). These criteria were set to ensure alignment with the study's scope, which focuses on interdisciplinary and contemporary research related to sustainable co-working environments. By enforcing these standards, the screening process ensures the relevance, accessibility, and methodological consistency of the selected articles (Phillips & Barker, 2021). The decision to exclude reviews and non-journal articles was to support the aim of this study, which is to analyse original empirical and conceptual research rather than secondary interpretations or theoretical overviews.

**Table 3: Inclusion and Exclusion Criteria in the Screening Process**

| Criterion | Inclusion | Exclusion |
|---|---|---|
| Language | English | Non-English |
| Timeline | 2020 - 2025 | < 2020 |
| Literature type | Journal articles, conference papers | Books, reviews |
| Subject | Engineering, Social Sciences, Environmental Science, Business, Management and Accounting, Energy, Computer Science, Arts and Humanities | Other subjects |

### *Eligibility*

The eligibility stage of the PRISMA framework involved a more detailed examination of the 85 screened articles, focusing on their relevance and alignment with the study's objectives. At this stage, full-text articles were retrieved and assessed based on four primary exclusion criteria: i) content deemed outside the field of sustainable co-working spaces, ii) titles lacking thematic significance, iii) abstracts unrelated to the study's core objective, and iv) full text was not accessible. As a result, 30 articles were excluded, leaving 55 high-quality articles eligible for in-depth analysis.

### *Data Extraction and Analysis*

The final set of 55 articles were downloaded as Portable Document Format (PDF) files. The files were then uploaded onto ATLAS.ti 25 software (Desktop version) for coding and thematic analysis. Each article were scrutinized for descriptions of sustainable physical attributes of a co-working space. These descriptions were then highlighted (in ATLAS.ti, the highlighted segments are termed as 'quotations'). All quotations were then grouped according to their relevant themes (in ATLAS.ti, themes are termed as 'codes'). For example, where segments of the document described the use of recycled building materials, it would be coded as 'Green Resources'. If a segment described open-plan layouts, it would be coded as 'Open Layout'. Overall, four themes emerged from the analysis, namely 'Green Environment', 'Green Resources', 'Open Layout', and 'Smart Technology'.

Additionally, a second set of themes emerged from the analysis. These themes highlighted the impact of the sustainable attributes towards the users, namely 'Mental Health', 'Human Interaction', 'Wellbeing', and 'Productivity'. Similarly, where relevant, the codes (themes) were systematically applied to the appropriate segments of the documents. For example, where segments of the document described the impact towards mental health of office users, the segment would be highlighted and coded as 'Mental Health'.

Following the quotation codings, a pattern analysis was conducted to examine the co-occurrence of codes between the first set of themes (green environment, green resources, open layout, and smart learning technology) and the second set of themes (mental health, human interaction, wellbeing, and productivity).

## Findings and Discussion

Despite minimal research on sustainable co-working spaces, it shows promising growth. Based on the search results, 55 articles were extracted and analysed. Four main themes emerged from the analysis: first, open layouts (25 articles), discussing how spatial configurations, workplace flexibility, and occupancy dynamics influence sustainability in co-working spaces; second, green environment (29 articles), discussing attributes related to the surroundings of a co-working space, including thermal comfort, daylight quality, and biophilic elements; third, green resources (12 articles), discussing sustainable building materials and resources in co-working spaces, including recycled materials and sustainable lighting; and fourth, smart technology (12 articles), discussing digital systems, automation, and intelligent design interventions in co-working spaces, summarized in Table 4. From the 55 articles, 26 articles discussed the impact of one or more themes towards users, which are mental health (10 articles), productivity (13 articles), and human interaction (3 articles). Based on these findings, the relationship between open layout, green environment, green resources, and smart technology with human interaction, mental health, and productivity is visualized in Figure 2. From Figure 2, it can be seen that all the sustainable attributes of a co-working space are interconnected with the impact towards users. These findings collectively underscore the importance of integrated environmental design in co-working spaces to support occupant wellbeing, comfort, and productivity.

**Table 3. Articles Resulting from the PRISMA Method and their Associated Themes**

| Author(s) | Attribute theme | | | | Impact | | |
|---|---|---|---|---|---|---|---|
| | Open layout | Smart technology | Green environment | Green resources | Human interaction | Mental health | Productivity |
| Laiche et al. (2023) | | | ● | | | ● | |
| Cruz, Franqueira and Pombo (2021) | | | | ● | | | |
| Tuniki et al. (2025) | | | ● | | | | |
| Whyte et al. (2024) | | | | ● | | ● | ● |
| Hammes et al. (2022) | ● | | | ● | | | |
| Najafi et al. (2023) | | | ● | | | | |
| Zhang et al. (2025) | | | ● | | | | |
| Yu et al. (2023) | | | ● | | | | |
| Bielskus and Motuzienė (2020) | ● | | | | | | |
| Kucukali (2025) | ● | | | ● | | | |
| Aliparast and Onaygil (2024a) | | | | ● | | | ● |
| Heng (2021) | ● | | ● | | | | |
| Flipo, Lejoux and Ovtracht (2022) | | ● | | | | | |
| Barath and Schmidt (2022) | ● | | | | | | |
| Bressane and de Castro (2025) | | | ● | | | ● | ● |
| Bergefurt, Appel-Meulenbroek and Arentze (2024) | | | ● | | | ● | |
| Bruyninckx (2023) | | | ● | | | | |
| Abdullah and Alibaba (2022) | | | ● | | | | |
| Aksamija and Milosevic (2023) | | | ● | | | | |
| Putri et al. (2022) | | ● | | | | | |
| Abdollahzadeh, Tahsildoost and Zomorodian (2020) | ● | | ● | | | | |
| Al Awadh, Elzeyadi and Nubani (2025) | | | ● | | | | ● |
| Aliparast and Onaygil (2023) | | | | ● | | | ● |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alizadeh Kateshastabadan, Azmoodeh and Mohammadhosseini (2025) | | | | ● | | | ● | |
| Anaraki et al. (2023) | | | | ● | | | | ● |
| Bian et al. (2021) | ● | | | ● | | | | |
| Candido et al. (2021) | ● | | | ● | | ● | ● | ● |
| Cheung et al. (2021) | ● | | | ● | | | | |
| D'Amanzo et al. (2023) | | | | ● | | | | |
| Du and Sharples (2021) | ● | | | ● | | | | |
| Fast and Jansson (2024) | ● | ● | | | | ● | ● | |
| Heng, Lim and Ossen (2020) | ● | | | ● | | | | |
| Huang et al. (2023) | ● | | | ● | | | | ● |
| Ikuzwe, Ye and Xia (2020) | ● | | | | ● | | | |
| Ivaldi et al. (2021) | ● | | | | | ● | | |
| Kent et al. (2022) | ● | ● | | | | | | |
| Kwong (2020) | ● | | | ● | | | | |
| Lowcay, Gunay and O'Brien (2020) | ● | | | ● | | | | |
| Z Luo et al. (2021) | ● | ● | | | | | | |
| Eirini Mantesi, Chmutina and Goodier (2022) | | | | | ● | | | |
| McCunn and Fell (2025) | | | | | ● | | ● | |
| Orel, Mayerhoffer and Chytkova (2025) | | ● | | | | | ● | ● |
| Pan et al. (2025) | | | | ● | | | | ● |
| Aliparast and Onaygil (2024b) | ● | ● | | | | | | ● |
| Hammes, Weninger and Zech (2024) | ● | ● | | | ● | | | |
| Mathur et al. (2025) | | ● | | | | | | |
| Sebayang et al. (2024) | ● | | | | ● | | | |
| Seghier et al. (2024) | | | | ● | | | | |
| Seyedrezaei et al. (2023) | ● | | | ● | | | | ● |
| J Tintiangko and Soriano (2020) | | ● | | | | | | |
| Bian and Hu (2024) | ● | ● | | | | | | |

| | | |

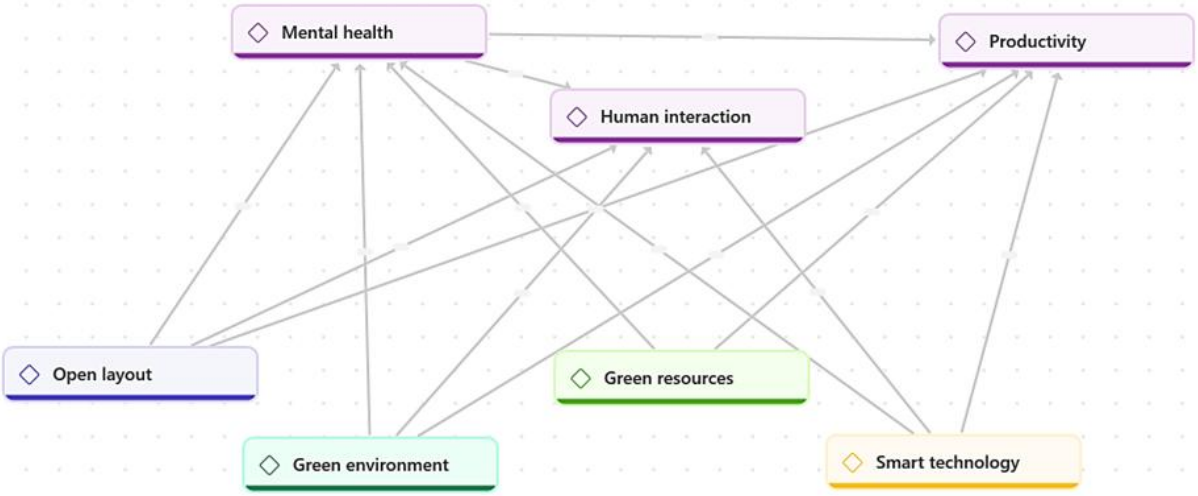



**Figure 2: Network Diagram of Sustainable Co-Working Space Attributes and Impact on Users.**

Source: Generated From ATLAS.ti Software Based on 55 Articles Analysed

***Theme 1: Open Layout***

A significant number of studies discussed open-plan layouts, which is one of the main characteristic of co-working spaces. These studies demonstrate how layout decisions affect energy demand and operational efficiency, as well as shape user experiences, and organizational adaptation.

The literature highlights how open layouts contribute to broader transformations in workspace design and utilization. Fast & Jansson (2024) interpret co-working spaces as 'comfort zones' that reconcile digital saturation with the need for work-life balance, offering users to have social interactions and support emotional wellbeing. Meanwhile, Barath & Schmidt (2022) stress that post-pandemic work flexibility redefined employers' perceptions of work layouts, leading to more flexible usage rather than a decline of physical offices. Complementing these findings, Ivaldi et al. (2021) highlight the role of co-working spaces as social-oriented environments, where the physical layout of co-working spaces are as important as relational and managerial practices in order to foster community. Together, these studies suggest that open layouts are not mere physical arrangements, but also represent strategies that balance organisational needs, individual autonomy, and evolving cultural expectations.

Other studies emphasize the interplay between open layouts, occupancy patterns, and sustainable performance. Candido et al. (2021) found that open layouts in co-working spaces report higher satisfaction, productivity, health outcomes, and collaboration, demonstrating that spatial flexibility combined with ergonomic and biophilic elements enhances user experiences. Similarly, Hammes et al. (2022) show that occupancy schemes strongly influence energy demand in open layouts, while Bielskus & Motuzienė (2020) identify the performance gap caused by discrepancies between actual and assumed occupancy schedules, underscoring the need to consider occupancy planning in sustainable design. Collectively, these findings indicate that open layouts have a potential to optimize both human and environmental outcomes by including adaptive usage patterns, energy efficiency, and health-oriented design principles to support the sustainable evolution of co-working spaces.

***Theme 2: Green Environment***

Based on the analysis, several key findings related to the surroundings of a co-working space emerged, including thermal comfort, daylight quality, biophilic elements, and indoor environmental interactions. Given that they describe sustainable elements in the environment of a co-working space, the attributes are grouped under the 'Green Environment' theme.

A significant number of studies emphasized thermal comfort and adaptive behaviours in response to different climatic conditions. Tuniki et al. (2025) and Zhang et al. (2025) highlighted that occupant perceptions of thermal conditions are strongly influenced by cultural norms, climate zones, and access to personal controls. In colder climates, environmental discomfort is associated with radiant asymmetries and humidity, while warmer climates showed more behavioural adjustments. Seghier et al. (2024) complemented these findings by demonstrating how thermal performance optimization can be paired with daylight predictions to create more energy-efficiency and comfortable workspaces in tropical regions. D'Amanzo et al. (2023) further showed that passive cooling and shading strategies significantly improved thermal comfort and reduced energy demand, especially in open-plan layouts. Yu et al. (2023) identified indoor temperature, direct sunlight glare, and occupant noise as critical discomfort factors through post-occupancy evaluations, and applied a multi-objective optimization model to generate retrofit strategies that enhance comfort while minimizing energy consumption. Similarly, Najafi et al. (2023) conducted simulations using multiple regression and genetic algorithms to investigate how shading and wall materials affect thermal and daylight performance, presenting parametric solutions to improve comfort in workspaces. Huang et al. (2023) proposed an innovative framework that personalizes thermal comfort by recommending flexible workspaces, where occupants can move to different areas within a building throughout the day and choose workspaces that align with their temperature preferences, thus improving comfort without added energy use. Additionally, thermal comfort emerged as a decisive factor influencing work productivity and satisfaction.

Lighting and daylight-related strategies also emerged as crucial in designing sustainable environments that also sustain psychological and physiological comfort. Al Awadh et al. (2025) and Anaraki et al. (2023) discussed how building geometry and partition design impact circadian lighting and visual access to natural light. Their work suggested that spatial configurations could be optimized using simulation-based methods to ensure better lighting outcomes, especially in open-plan workspaces. The influence of daylight on mental alertness and cognitive alignment was also evidenced in the work of Pan et al. (2025), who used occupancy data and spatial metrics to link environmental quality with user preferences and space utilization. Seyedrezaei et al. (2023) expanded on these interactions, illustrating how correlated colour temperature, noise, and temperature levels interactively influenced cognitive performance and comfort, with significant differences based on individual characteristics. Bian et al. (2021) studied skylight-induced visual discomfort in open-plan workspaces, finding that existing daylight evaluation metrics may not apply in core zones and proposing simulation-guided skylight retrofit designs. Heng (2021) examined how integrating shading devices with light pipe systems can distribute daylight more evenly, identifying optimal blind angles to enhance illumination in workspaces. Aksamija & Milosevic (2023) incorporated both daylighting and user-centred spatial adjustments into hybrid office renovations, using computational models and user feedback to improve functionality and daylight access.

The interaction between indoor environment quality (IEQ) factors, particularly temperature, lighting, and acoustics, strongly influences psychological and physiological wellbeing in coworking spaces. Yong et al. (2022) evaluated thermal comfort and air quality in a green-certified workspace, finding high adaptation rates among occupants and adequate ventilation. They also found that thermal comfort influenced work productivity. Laiche et al. (2023) discovered that behavioural and design environments in green workspaces significantly affect quality of life, while Abdullah & Alibaba (2022) showed that optimizing open-plan workspaces to promote natural ventilation reduces reliance on HVAC systems and supports sustainable development. Design innovations also focus on managing lighting and sound; Bruyninckx (2023) traced the historical roots of acoustic masking in open-plan workspaces, noting its role in mediating privacy and interaction. In contrast, personalized approaches such as the system created by Huang et al. (2023) offer alternatives to collective HVAC solutions, emphasizing user mobility and space adaptability. Aksamija & Milosevic (2023) also highlighted the importance of spatial acoustics and lighting for hybrid work settings, balancing team collaboration with individual needs.

In addition, nature-based and biophilic elements emerged as strong contributors to workplace wellbeing. Bressane & de Castro (2025) introduced a fuzzy decision-making framework supporting the integration of green elements such as indoor gardens and green walls, showing improvements in comfort and satisfaction. Similarly, Zamri & Ahmad (2025) associated biophilic design strategies with mental health benefits in coworking spaces, pointing out reduced stress and anxiety levels. The salutogenic design explored by Bergefurt et al. (2024) further demonstrated that simple elements like plants, outdoor views, and colour tones substantially influenced psychological and cognitive responses, offering cost-effective interventions for healthier workspaces. Alizadeh Kateshastabadan et al. (2025) extended this approach by evaluating the acoustic benefits of green walls, highlighting their dual function in reducing noise and supporting mental wellbeing.

***Theme 3: Green Resources***

Many studies discuss the use of sustainable building materials and resources in the development and interior design of co-working spaces, including the use of recycled and reused materials in acoustics and thermal control, and the use of sustainable lighting; these attributes are grouped under the theme Green Resources.

The selection and application of sustainable building materials and resources have a demonstrable impact on both environmental performance and occupant wellbeing. Kucukali (2025), McCunn & Fell (2025), and Whyte et al. (2024) highlight the importance of incorporating natural and recyclable materials such as wood and acoustic materials, which not only reduce environmental impact but also improve workplace experience. The restorative qualities of wood were shown to enhance affective organizational commitment and wellbeing (McCunn & Fell, 2025), while acoustic materials were found to mitigate noise (Kucukali, 2025). Similarly, Whyte et al. (2024) demonstrate how mass timber construction supports sustainability goals while positively influencing comfort, health, and productivity through measurable reductions in stress levels. Collectively, these studies underline the that the integration of sustainable and natural materials addresses ecological concerns and simultaneously enriches the psychosocial and physiological outcomes for occupants.

Other studies have also explored lighting, shading, and energy systems as critical components of sustainable resource management in co-working spaces. Aliparast & Onaygil (2023, 2024), Sebayang et al. (2024), and Ikuzwe et al. (2020) emphasize the role of human-centred lighting and dynamic shading devices in improving visual comfort, circadian rhythm alignment, and daylight distribution, ultimately advancing energy efficiency. For instance, human-centred lighting systems aligned with WELL standards were found to enhance alertness and cognitive performance (Aliparast & Onaygil, 2024a), while shading devices made from reused egg crates improved daylight uniformity in tropical climates (Sebayang et al., 2024). Retrofitted energy-efficient lighting systems further demonstrated the potential to reduce costs and energy consumption while maintaining comfort (Ikuzwe et al., 2020). Complementing these findings, Wang et al. (2024) and Mantesi et al. (2022) revealed that advanced control systems and adaptive operational strategies in HVAC and post-pandemic office usage can significantly reduce energy consumption, reinforcing the synergy between technological innovation and sustainability in building operations. Meanwhile, Cruz et al. (2021) focused on the sustainability of furniture materials in co-working spaces, linking ergonomic design and ecological choices to user satisfaction and multifunctionality. Collectively, these contributions reveal that sustainable building materials and resource strategies, from wood and acoustic panels to advanced lighting, shading, furniture, and HVAC systems, play a role in achieving both environmental responsibility and human-centred performance in co-working spaces.

***Theme 4: Smart Technology***

A lot of the studies explore how digital systems, automation, and intelligent design interventions reshape co-working spaces. The studies also highlight how technology integration plays a pivotal role in creating sustainable co-working spaces.

A major stream of research emphasizes the interplay between digitalisation and hybrid models of co-working. Orel et al. (2025) show how the pandemic accelerated a shift from physical to hybrid co-working practices, demonstrating that effective digital environments maintain both wellbeing and productivity while fostering entrepreneurial ecosystems. Flipo et al. (2022) extend this by exploring rural co-working spaces, highlighting how digital infrastructures reduce territorial inequalities, bridge connectivity gaps, and support professional retraining in marginal regions. Similarly, Tintiangko & Soriano (2020) examine co-working in the Global South, particularly in the Philippines, where digital workers derive aspirational belonging from technology-enabled co-working spaces, reflecting the critical role of connectedness in addressing inequalities. Collectively, these studies highlight that digitalisation in co-working spaces is not only about efficiency, but also about sustaining community engagement, bridging social divides, and creating resilient hybrid models.

Smart lighting and shading technologies also emerge as critical components of sustainable co-working environments. Kent et al. (2022) demonstrate that desk-level illuminance sensors, though effective for daylight harvesting, are vulnerable to energy loss when blocked, calling for more robust monitoring systems. They therefore suggest smart lighting systems for open-plan workspaces. Luo et al. (2021) introduce machine-learning based shading controllers that dynamically adjust blinds to balance visual comfort and thermal efficiency in open-plan workspaces. Similarly, Putri et al. (2022) address excess daylight issues in a co-working meeting room, proposing smart lighting solutions using simulation-based design to optimize visual comfort. These findings converge on the importance of integrating intelligent control

systems that not only enhance comfort but also significantly reduce energy use in co-working spaces.

Human-centric lighting studies further underscore how smart technologies can directly improve wellbeing and performance. Aliparast & Onaygil (2024b) demonstrate that circadian-based smart lighting with adaptable correlated colour temperatures positively influences satisfaction and cognitive performance, while Hammes et al. (2024) highlight how machine learning can refine occupancy-based lighting systems to reduce artificial switch-off times, minimizing energy waste. Likewise, W. Bian & Hu (2024) employ meta-optimisation to fine-tune occupancy-based dimming systems, striking a balance between energy efficiency and processing time. Together, these studies affirm that adaptive lighting strategies are central to both sustainability and user wellbeing in co-working spaces.

Finally, research on user perceptions of automation reinforces the relationship between humans and technology in co-working spaces. Mathur et al. (2025) reveal that while automation enhances productivity, its acceptance depends heavily on how users perceive its impact on inclusivity, flexibility, and overall atmosphere. These insights align with the broader theme that smart technology must be integrated with a human-centred approach to ensure not only efficiency but also acceptance and satisfaction of its users.

## Conclusion

The systematic literature review provides a comprehensive synthesis of the physical attributes that define a sustainable co-working space, emphasizing the shift from traditional office models to holistic and environmentally-responsible workspaces. The evidence demonstrates that sustainability in this sector is not limited to environmental conservation but extends to the physical and psychological wellbeing of the users. By integrating spatial flexibility, resource efficiency, and advanced technological systems, co-working spaces can achieve a balance between environmental responsibility and user satisfaction.

The primary objective of this systematic review was to identify the physical attributes that contribute to the sustainability of a co-working space. The scope of this review focused on peer-reviewed journal articles and conference papers published between 2020 and 2025, ensuring the inclusion of post-pandemic perspectives. The review used the PRISMA framework to determine the elements that define a sustainable co-working space and how they impact the users.

The review identified four main themes, namely Open Layout, Green Environment, Green Resources, and Smart Technology. The analysis revealed that open-plan layouts are important for fostering human interaction and work flexibility. Additionally, occupancy management is an important tool to maintain energy efficiency in such layouts. Within the green environment theme, thermal comfort and natural lighting emerged as important factors for user satisfaction. Within the green resources theme, the analysis found that the use of sustainable resources such as mass timber and recycled materials helped reduce environmental footprints while providing restorative benefits to the co-working space users. Finally, the integration of smart technologies such as machine-learning-based lighting and automated HVAC systems were found to be important to optimize energy consumption and personalizing user experience.

This review offers a novel framework that defines the physical attributes of a co-working space. The analysis proves that a sustainable co-working space requires physical attributes that support open layouts, green environments, green resources, and smart technology. Additionally, this review consolidates five years' worth of previous studies and produces a link between the physical attributes of a sustainable co-working space and the impact towards its users. Therefore, this review expands the theoretical understanding of how sustainable infrastructure serves an important role in workers' productivity and wellbeing.

The findings provide significant implications for architects, facility managers, and policymakers. For practitioners, the evidence suggests that incorporating biophilic elements and natural materials is a cost-effective strategy for improving occupant mental health. System designers are encouraged to prioritize smart lighting that aligns with circadian rhythms to enhance cognitive performance. From a policy perspective, the review supports the adoption of standardized sustainability metrics tailored specifically for shared work environments, which can guide future green building certifications and urban development strategies.

While comprehensive, this review has some limitations. The focus on only two databases and the exclusion of non-English publications may have omitted relevant studies from other databases and in other languages. Additionally, the five-year timeframe focuses on modern trends, which may exclude long-term historical data. Future research should prioritize longitudinal studies to evaluate the impacts of sustainable attributes on users. Another suggestion is to study the economic resilience of various sustainability models across different geographic and cultural contexts to find valuable insights into the global scalability of the co-working phenomenon.

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# FROM CULTURAL DECLINE TO DIGITAL SUSTAINABILITY: A USER-CENTERED MOBILE LEARNING APPROACH FOR ENGAGING MILLENNIALS IN INTANGIBLE HERITAGE

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***Abstract:*** *With the backdrop of rapid digital modernization and generational disengagement, the preservation and transmission of cultural heritage faces increasingly severe challenges. The growing disconnection between Mianzhu Wood Block New Year Paintings and the experiences of millennials raises urgent problems about sustainable preservation and transmission. This study explores how user-centered mobile learning approaches can reduce cultural estrangement and promote long-term learner engagement with cultural heritage. A sequential mixed method was employed in this research including: a systematic literature review (SLR) using CiteSpace, semi-structured interviews with cultural heritage experts, perceptual analysis of millennial users based on the Kano model, and usability testing of a WeChat Mini Program prototype based on PACMAD metrics. Findings indicate that digitization enhances cultural engagement when design moves beyond visual presentation to interpretive storytelling, multimodal interaction, and contextual learning. Kano model analysis shows that cultural explanation and intuitive navigation are Must-be requirements, while community participation, task-based exploration and symbolic comparison are important performance drivers. Attractive features such as gamification and audio guidance improve user satisfaction andmemorability. Usability evaluations further demonstrates that the mini-program is highly learnable. These findings further confirm the Wechat Mini Program's strong potential for widespread adoption. The results also highlight the importance of millennials as a pivotal group for cultural heritage sustainable development. Their digital fluency enables them to drive cultural regeneration.*

***Keywords:*** *Intangible Cultural Heritage (ICH), Mobile Learning, User-Centered Design (UCD)*

## Introduction

In last decades, the protection and inheritance of traditional cultural heritage has become a core issue in discussions on cultural self-confidence and sustainable development in China and even worldwide. The report of the 20th National Congress of China emphasized that building a modern country requires following a path of cultural development with Chinese characteristics and enhancing cultural self-confidence at the same time. It serves as the foundation for building a cultural power (Xi, 2022). Cultural self-confidence refers to a firm belief in one's own cultural values and ideals (Liu, 2023). It is not only related to national identity but also a prerequisite for the long-term sustainable development for traditional cultural practices. Therefore, China's

policy discourse emphasizes the role of excellent traditional culture in contemporary society, citizenship education, and soft-power strategies (Liu, 2023; Zhang, 2023).

Traditional cultural heritage (TCH) comprises both tangible and intangible expressions, including artefacts, sites, performing arts, crafts, and associated knowledge systems (ISPRS et al., 2018; Hou et al., 2022). After the release of the UNESCO Convention for the Safeguarding of Intangible Cultural Heritage in 2003, the digital preservation of ICH has gained global attention as a vital cure to secure cultural resources for both present and future generations (UNESCO, 2003; Hou et al., 2022). Digital technologies can document, visualize, and distribute heritage at a large scale. However, sustainable digital preservation remains challenging because it requires unceasing investment, specialized skills, and proper technological infrastructures (Perera, 2023). Meanwhile, the diverse cultural life in the digital age creates new expectations among receptions. Therefore, it is imperative that preservation and transmission strategies of TCH keep pace with changing media ecology and people's behaviour.

Mianzhu Woodblock New Year Paintings is a typical case within this broader context. It is originated from Mianzhu City, Sichuan Province, which is historically known as the birthplace of bamboo paper. These paintings are among China's four major traditions of New Year paintings, and are widely distributed in Deyang and southwestern China regions (Ting et al., 2023). In 2006, Mianzhu Woodblock New Year Paintings were listed in the first batch of the National Intangible Cultural Heritage List (heritage number VII-11). Thereafter, their core value lies not only in physical artefacts such as woodblocks, pigments, and paper, but also in the techniques, aesthetic conventions, and narrative traditions (China Intangible Cultural Heritage Network, 2006; Ting et al., 2023). However, Mianzhu Woodblock New Year Paintings are now facing a serious trend of decline and even invisibility. There is an increasing tendency that woodblock New Year paintings is shifting from everyday necessities in every household in the past to collections of connoisseurs and researchers (Feng, 2005; Song, 2010). Many Scholars predict that Mianzhu New Year paintings have moved from prosperity toward marginalization, or eventual extinction (Zhou, 2006; Lei, 2014). The demand for Mianzhu New Year paintings is relatively weak when comparing it to other art forms such as traditional Chinese painting, oil painting, watercolour, and lacquer art (Hu & Deng, 2024). With the development of the civilization, people's living standards rise. Many consumers favour high-end, fashionable, or minimalist artworks, perceiving traditional New Year paintings as outdated or stylistically incompatible with contemporary interiors (Hu & Deng, 2024; Ting et al., 2023). This mismatch between the medium and aesthetics has become increasingly severe due to the departure of the older generation of artisans and the decline in the willingness of the younger generation to learn and pass on traditional skills (Xie, 2021) .

The rapid expansion of China's mobile internet ecosystem has brought both challenges and opportunities for addressing these issues. By December 2023, the number of Chinese internet users had reached 1.092 billion, including 326 million rural internet users. At the same time, the penetration rate and usage duration of mobile internet were also steadily increasing (China Internet Network Information Center, 2024). In 2023, the number of monthly active mobile internet users exceeded 122.4 million, and the average monthly usage duration was close to 160 hours (QuestMobile, 2023). In this environment, WeChat has become a core "super application". By the end of 2023, the total number of monthly active users of WeChat and its

related services reached 1.343 billion, which has driven the rapid growth of video accounts, mini-programs, mini-games, and search services (Tencent, 2024).

Especially, the WeChat Mini Programs offer a lightweight and install-free environment that has deeply integrated into users' daily communication activities. They enable instant access, low memory consumption, and can seamlessly integrate with social functions such as sharing, commenting, and group interaction(Lu & Qu, 2024)).

As for traditional arts like Mianzhu New Year paintings, mini-programs offer a potentially powerful tool for both promoting educational engagement and disseminating culture(Cai & Yahaya, 2023 ) Mini-programs carry many functions, including high-definition images, multi-layered narratives, interactive visualizations, mini-games, e-commerce functions, and links to offline experiences. However, their effectiveness as educational technology tools for promoting sustainable cultural development depends on how well they align with user needs, the learning process, and cultural expectations.

Millennials (Generation Y) are a particularly crucial user group. Chinese Millennials possess exceptionally high digital literacy. They are deeply immersed in social media and mobile communications, and their influence is growing as consumers, cultural disseminators as well as the parents of the next generation (Jun, 2020). Meanwhile, they are also the generation that is most vulnerable to the impact of globalized aesthetics, accelerated urbanization, and changing lifestyles that are gradually distancing them from traditional rural cultural customs. Therefore, Millennials face the risk of cultural disconnect while simultaneously being entrusted with a key role in intergenerational cultural transmission. Based on this context, designing effective digital interventions for this group requires not only technological innovation but also a deep understanding of their cognition, motivations, and learning preferences.

Despite increasing research on Mianzhu woodblock prints for the New Year, there are also several gaps, hindering the development of sustainable and educational digital strategies. First, while there is existing research in art history and stylistic analysis (Don, 2009; Deng & Hao, 2024; Huang, 2023; Ren, 2020). Relatively few studies systematically examine how contemporary users (especially millennials) perceive the authenticity, cultural value, and relevance of this cultural heritage. Second, empirical research is lacking on the specific needs and preferences of millennials regarding the digital presentation of cultural heritages, including expectations for content depth, interaction modes, interface design, and visual style (Shan& Wardi, 2025), especially Mianzhu woodblock prints as a typical case. Third, research on the application of WeChat mini-programs in the field of cultural heritage often focuses on conceptual design or promotional effects, lacking user-centered assessments of usability, learning experience, and cultural impact(Song, 2023). Finally, existing digital initiatives often emphasize aesthetic modernization and product innovation, while paying insufficient attention to whether digital engagement truly enhances users' cultural understanding, emotional attachment, and willingness to participate in heritage transmission(Zhang et al., 2025).

Against the research backdrop mentioned above, this study explores how to employ a WeChat mini-program designed based on User-Centered Design (UCD) principles to support millennial users in the sustainable preservation and transmission of Mianzhu New Year paintings. This study employs a mix-method sequentially design containing both qualitative and quantitative reseach method to (1) explore users' perception and understanding of the preservation and

transmission of Mianzhu New Year paintings; (2) identify millennial users' needs and preferences for the digital presentation of this cultural heritage; (3)to design a WeChat mini-program prototype in supporting cultural learning and engagement.

This study combines theoretical insights from User-Centered Design (UCD) and User Experience (UX) research with empirical data on millennial learners, contributing to the fields of educational technology and global sustainable development in three ways. First of all, theoretically, it regards mobile heritage applications as learner-centered interventions, which is capable of transforming cultural alienation into sustained cultural engagement. Secondly, seen from the methodology, it presents a user-centered process that integrates qualitative inquiry, quantitative needs analysis model to inform the design of digital heritage tools. Thirdly, it also provides evidence-based design guidelines for cultural institutions, educators, and developers looking to leverage WeChat Mini Programs and similar platforms to engage younger generations with cultural heritage, thus supporting the long-term vitality of traditional culture in a rapidly changing digital society.

## Literature Review

### *Cultural Decline and Intangible Heritage Sustainability*

The accelerating pace of modernization and globalization has exacerbated the decline of traditional cultural practices, particularly intangible heritage forms that rely on transmission rather than material preservation from generation to generation. Present discussions emphasize that digital preservation is not merely a technical endeavor. Instead, it is closely linked to cultural confidence, institutional and policy support, and the sustainable development needs and awareness of future generations (Hou et al., 2022; Xi, 2022; Liu, 2023; Zhang, 2023). Scholars further point out that despite increasing awareness, digital heritage projects still face numerous challenges, particularly in terms of funding, technical expertise, and personnel shortages (Perera, 2023). Recent research indicates that sustainable preservation requires not only technological strategies but also a systematic shift towards community involvement and the establishment of long-term evaluation mechanisms to ensure the intergenerational transmission of cultural values (Ibrahim et al., 2025; Iliodromitis et al., 2025). These discussions suggest that cultural preservation is shifting from a static to a sustainable model, meaning that participation of generations are required, especially among millennials. They will determine whether traditional culture will remain socially relevant in the future.

### *Mianzhu Woodblock New Year Paintings*

Originating in the Song Dynasty, Mianzhu New Year Paintings are widely recognized as one of the four major types of New Year prints in China. They embodies centuries of artistic techniques and regional folk customs (Simon, 2025). Previous research has emphasized the cultural symbolism of Mianzhu New Year Paintings and their importance to regional identity and cultural economy (Ting, 2023; Liu, 2012). However, recent research indicates that the cultural influence of Mianzhu woodblock prints is declining sharply, gradually shifting from everyday ceremonial items to niche collectibles (Song, 2010; Hu & Deng, 2024). Evidence also suggests that young people's interest in Mianzhu New Year Paintings is declining, their aesthetic values are disconnected from traditional aesthetics, and the emotional connection between the younger generation and this tradition is weakening (Hu & Deng, 2024; Ting et al., 2023). Scholars also point out that existing literature mainly focuses on the artistic

characteristics, color symbolism, and craftsmanship of Mianzhu woodblock prints (Don, 2009), while its deeper cultural connotations and identity mechanisms are rarely studied (Qian, 2023). Overall, these studies suggest that despite a great deal of historical and artistic analysis, little is known about millennials' cultural perceptions, emotional attitudes, or their learning process of this tradition.

### *Digital Preservation and the WeChat Mini-Program Ecosystem*

In recent years, digital preservation has become an important academic and policy directio. It receives significant support from interdisciplinary collaborations and national research funding (Xu et al., 2022; Xu, 2021). Digital innovative tools such as virtual reality (VR), augmented reality (AR), immersive visualization (IV), and web geography information system (Web-GIS) platforms have been widely adopted to improve the accuracy, accessibility, and participation of digital preservation (Yu, 2025; Iliodromitis et al., 2025). In China's mobile-first digital environment, WeChat mini-programs have become an important medium for cultural dissemination. It offers significant advantages, including low memory usage, rapid deployment, and a large user base (Yuan, 2023). Research further indicates that WeChat mini-programs have obvious effects as mobile learning tools (Yang et al., 2019) and are closely related to lifelong education and intercultural learning (Wan et al., 2019; Cui, 2024). The lightweight access, social-network circulation, and integration of multimedia functionalities of the WeChat platform enable it to play a unique role in cultural revitalization within the "micro-era" of digital media cultural participation (Tang, 2020; Xie, 2021). However, despite these abundant application cases, existing research still present a lack of a sustained evaluation of WeChat's cultural impact, user experience effectiveness, and youth participation outcomes in the field of cultural heritage.

### *User-Centered Design in Digital Cultural Contexts*

User-centric design (UCD) offers a structured methodology based on iterative development, participatory interaction, and contextual assessment (Abras et al., 2004; ISO 9241-210, 2019). In the field of cultural heritage digitization, scholars emphasize that UCD not only enhances usability but also supports cultural values, identity, and sustainable transmission (Ciolfi & Bannon, 2020; Parry, 2021). Especially for digital platforms such as WeChat Mini Programs, UCD has proven effective in enhancing cross-device and cross-contact consistency, cultural immersion, and identity (Maldonado, 2023). However, recent literature points out that while design principles have been widely discussed, conceptual frameworks remain fragmented and lack sufficient empirical validation within cultural contexts. In this regard, it suggests a need to systematically integrate UCD into digital heritage interventions to bridge the gap between cultural meaning and digital usability.

### *User Experience, Mobile Learning and Generational Engagement*

Mini-program-based learning experiences can support young users' education, cross-cultural engagement, and lifelong learning processes (Yang et al., 2019; Wan et al., 2019; Cui, 2024). Meaningful digital cultural engagement requires not only functional design but also mechanisms that activate cultural awareness, emotional connection, and community identity (Xie, 2021; Liu, 2023). However, while usability frameworks such as the Nelson-Norman principle provide guidance for interface efficiency, as recent research on mini-programs and

heritage visualization frameworks points out, current research still lacks structured user experience evaluation models for heritage platforms. Therefore, current researches highlight a critical gap between mobile learning functionality and cultural sustainability outcomes.

After a systematic literature review in terms of digital preservation and transmission of cultural heritage taking Mianzhu Woodblock New Year Paintings as an example and existing educations tools, three core gaps are identified. First, current researches primarily focus on the art history and cultural descriptions of Mianzhu Woodblock New Year Paintings. There is a noting insufficient attention to millennials' perceptions and cultural alienation. Second, researches on digital heritage primarily utilizes technology-driven projects, while intervention studies based on user-centered design (UCD) methodology and users' needs and demands remain scarce. These gaps collectively indicate an urgent need for research that integrates millennial cultural perception and understanding, user-centered design-based intervention programs from the perspective of their actual needs and demands, and empirically measured digital sustainability outcomes.

## Research Methodology

This study employs a pragmatic philosophical stance and a sequential mixed-methods research design to explore how user-centered mobile learning interventions can promote the preservation and sustainable transmission of Mianzhu New Year Paintings among millennial learners. Pragmatism provides the most coherent epistemological foundation for this research. It integrates qualitative depth with quantitative generalization and links exploratory cultural insights with measurable learning and usability outcomes (Creswell & Plano Clark, 2018). It is noteworthy that while other philosophical stances such as interpretivism or positivism were considered, neither alone is sufficient to fully achieve these research objectives. Interpretivism lacks generalization, while positivism reduces complex cultural experiences to statistical variables. Therefore, pragmatism offers methodological flexibility and supports a user-centered, hybrid approach strategy as the most effective way to generate actionable knowledge on the sustainability of digital heritage.The research process is thus divided into four interrelated methodological modules.

### *Module one: SLR and Semi-structure Interview*

The first module focuses on understanding and clarifying the context of use. This module comprises two parts: a systematic literature review (SLR) and semi-structured interviews. To establish a fundamental understanding of the research field and clarify the challenges faced by Mianzhu woodblock prints in cultural preservation, the first part of Module 1 is a systematic literature review (SLR). This review follows a structured bibliometric screening process, combining quantitative evidence extraction with qualitative interpretive synthesis. Web of Science Core Collection (WOS) and CNKI (CSSCI-indexed) journals. The WOS search was performed using topic-level Boolean expressions — Cultural Heritage AND (digital OR preserve* OR user-centered OR user-centric)* — covering a 2016–2025 time span, which yielded 595 initial records, all of which met the CiteSpace import criteria and were retained as journal articles for analysis. To capture the Chinese discourse and policy-driven research context, the CNKI search used the terms 文化遗产（主题）+数字化+保护 (Cultural Heritage as Theme+digital+preserve) within the same time window, producing 374 results, of which 369 journal articles were qualified for CiteSpace clustering and co-occurrence analysis. ll

records were imported into CiteSpace for knowledge mapping, including keyword co-occurrence, cluster generation, burst detection, and time-zone evolution visualisation. This quantitative mapping construction helps identify high-frequency themes and research frontiers in the field of intangible cultural heritage digitization, while subsequent manual coding and qualitative reading aid in the semantic interpretation of conceptual patterns. Therefore, the systematic literature review in Module 1 serves as both a quantitative knowledge structure mapping and a qualitative thematic foundation, forming the basis for the analysis. Subsequently, semi-structured interviews were conducted to examine the perspectives of experts.

Semi-structured expert interviews is adopted in this study to explore the perceptions of authenticity, cultural value, emotional attachment/cultural identity, and openness to digital preservation, following established qualitative inquiry methods (Corbin & Strauss, 2015). To ensure the depth and professionalism of the research, six cultural heritage experts were selected through purposive sampling. Subsequently, a thematic analysis was conducted to contextual background themes related to the cultural decline of Mianzhu Woodblock New Year Paintings and intergenerational disengagement, which served as the basis for subsequent design decisions.

***Module 2 : KANO Model Survey***

Building on the qualitative and quantitative research findings from module 1, the second module employed quantitative methods to identify the audience's needs and expectations regarding the digital presentation ofMianzhu Woodblock New Year Paintings. This research then conducted a questionnaire survey targeting Generation Y using established sampling procedures to ensure sample representativeness (Babbie, 2020). According to data from the National Bureau of Statistics of China, the population born between 1980 and 1994 was 330.49 million. The sample size table proposed by Krejcie and Morgan in their 1970 paper is a statistical tool used to determine the appropriate sample size for a specific population in surveys or other types of quantitative research (Krejcie & Morgan, 1970). Therefore, at least 385 samples were required. 400 questionnaires were distributed and 392 valid responses were collected, indicating a response rate of 98%. Reliability and validity tests showed good consistency of the measurement results, with Cronbach's α values of 0.885 and 0.887, and KMO values of 0.949 and 0.946, respectively, indicating suitability for factor analysis. The questionnaire was designed using a KANO model to categorize classify must-be (M), one-dimensional (O), attractive (A), indifferent (I) and reverse (R) quality attributes in the context of digital heritage engagement. KANO evaluation and Better–Worse Coefficient analysis were conducted in SPSS to produce a prioritized UX features list aligned with Garrett's Five Planes.

***Module 3: WeChat Mini Program Prototype***

The third module involved creating a functional design scheme that conforms to ISO 9241-210 standards and Garrett's User Experience Plane. Based on prioritizing the needs and emotional expectations of millennial users, a WeChat mini-program prototype was designed that incorporates interactive, narrative, and participatory features that embody cultural authenticity. Following UCD best practices, five layers of Garrett's User Experience Plane including strategy, scope, structure, skeleton, and surface layers were iteratively refined. Ultimately, a

structured digital intervention integrating artistic elements, pedagogical features, and intuitive navigational structures is formed

**Module 4: PACMAD Evaluation**

The final stage employed a quantitative usability scale to evaluate the prototype, following an evaluation procedure consistent with the "evaluating against requirements" stage of the ISO 9241-210 standard. Thirty participants were recruited based on the natural context and representative user criteria emphasized in PACMAD mobile usability assessment (Harrison et al., 2013). Evaluation tools included measures for effectiveness, efficiency, satisfaction, learnability, memorability, errors, and cognitive load. Internal validity was enhanced through triangulation among the methods, tools, and participant groups, ensuring consistency of data sources and improving the robustness of the evaluation conclusions.

The combination of qualitative contextual inquiry, quantitative prioritization, iterative prototyping, and usability evaluation ensures that each methodological phase informs the next. In this way, this research established internal coherence and cumulative analytical depth. After clarifying user needs, designing digital interventions that match those needs, and empirically evaluating usability and cultural learning outcomes using standardized tools, the empirical results from Modules 1 through 4 is presented orderly. Therefore, the following sections report key findings from interviews, large-scale questionnaires, the design and implementation process, and usability and cultural sustainability assessments of the WeChat Mini Program. It comprehensively demonstrated how millennials engaged with the system and how this engagement shapes their understanding and perception of Mianzhu Woodblock New Year Paintings.

**Findings**

The findings of this study are presented in four integrated analytical segments, each reflecting a distinct stage of the inquiry.

***Findings of SLR***

The WOS knowledge graph demonstrates that cultural heritage, digital heritage, virtual reality, augmented reality, 3D reconstruction, and photogrammetry are at the most central and frequently co-occurring positions. It reflects an international research landscape largely driven by high-fidelity digital preservation technologies. The results indicate a methodological shift from traditional archival digitization toward immersive simulation-based cultural revitalization as indicated in figure 1. Timeline evolution as shown in figure 2 suggests a progressive development from 3D scanning and photogrammetry (2016–2019) to VR/AR and virtual archaeology (2020–2022) and AI-based reconstruction, deep learning-enhanced restoration, and smart cultural heritage environments (2023–2025). These results indicate that global research prioritizes technological capability over experiential or pedagogical engagement. The results also reveals that relatively few scholarship to date examines user psychology, cultural identity, or generational learning mechanisms in cultural sustainability.

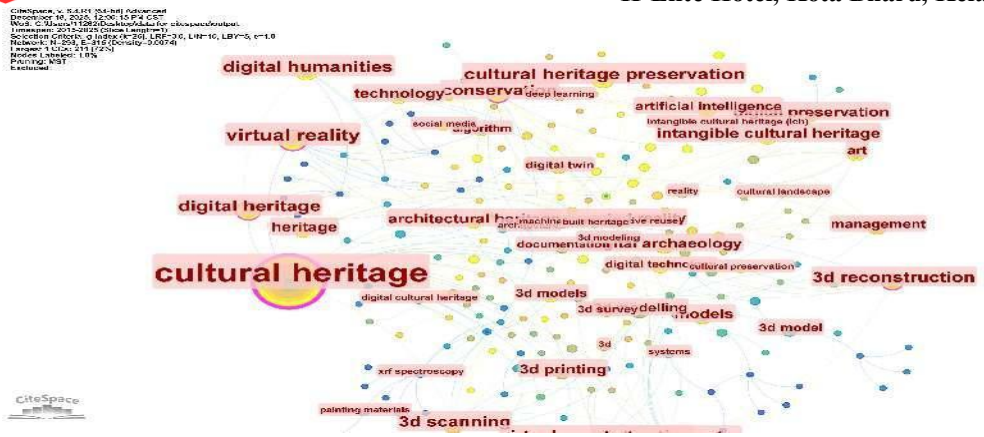



**Figure1 Key Words Co-occurrence Mapping of WOS by Citespace**

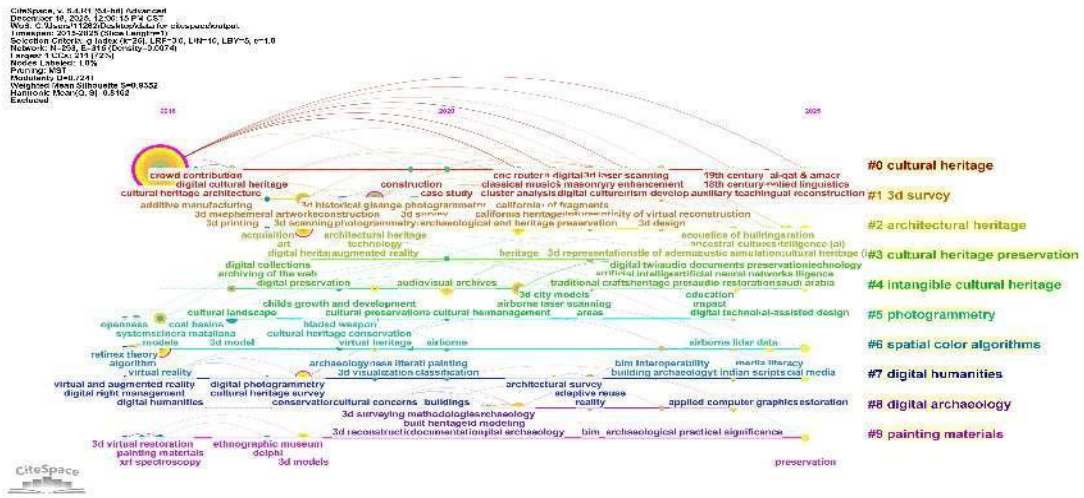



**Figure 2 Key Words Cluster Timeline of WOS by Citescpace**

Meanwhile, the CNKI visualization shows a distinctly culture-ecological knowledge structure. Keywords such as 文化遗产 (cultural heritage), 数字化 (digitization), 数字人文 (digital humanities), 古籍保护 (ancient preservation), 图书馆/博物馆 (libraries/museums) form the densest clusters—revealing a national orientation toward protection framework construction, resource archiving, and cultural safeguarding policy as indicated in figure 3. The timeline of figure 4 shows an evolution from digital resource repositories and documentation toward cultural revitalization, rural heritage, ethnic culture transmission, and education-integrated preservation. Comparing the results with what have been found from WOS database, research in China places stronger emphasis on heritage as a social and cultural system. This system particularly involves communities and traditional settlements. However, similar to the global pattern, Chinese literature analysis shows limited exploration of millennial learners' perception, emotional connection, or identity formation. It verified the necessity of this study by indicating a clear unaddressed gap.

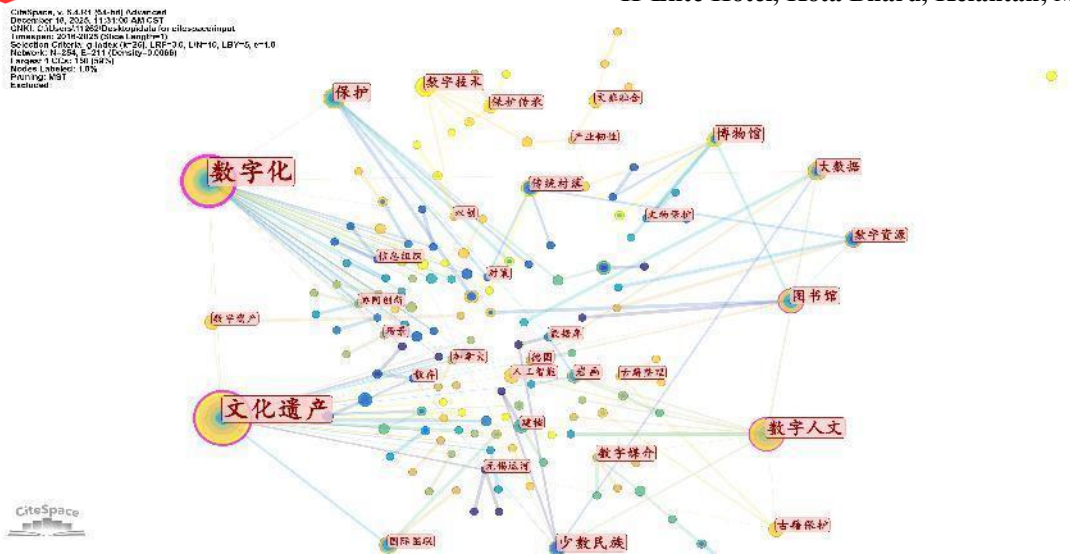



**Figure 3 Key Words Co-occurrence Mapping of CNKI by Citespace**

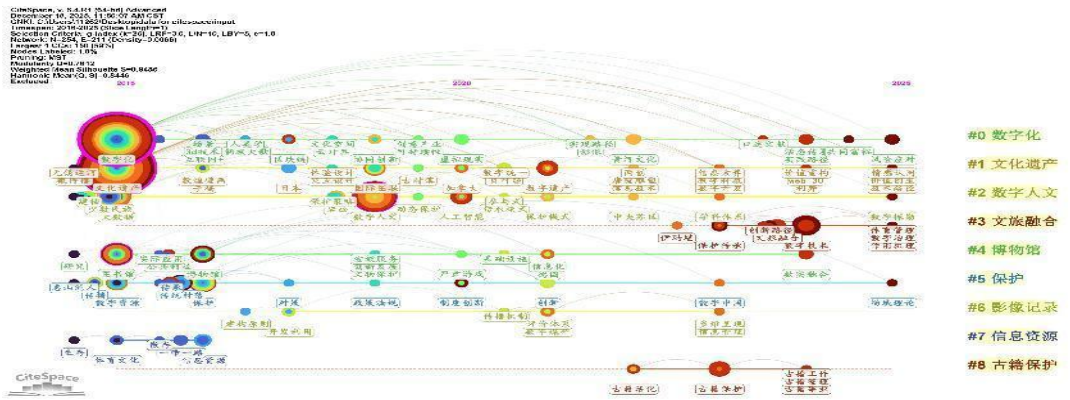



**Figure 4 Key Words Cluster Timeline of CNKI by Citescpace**

Comparing global and Chinese discourse reveals two complementary academic frames. Firstly, the international field largely advances technical-instrumental digital preservation, while China foregrounds policy-based cultural inheritance and institutional safeguarding. Despite different emphases, both knowledge systems share one common absence, which is the user side of heritage sustainability, particularly how younger generations perceive, value, or emotionally engage with intangible cultural heritage. Neither provides sufficient insight into how digital education, mobile interaction, or user-centered experience may reconnect fading cultural forms with millennial learners. Thus, the CiteSpace-based SLR confirms the necessity of this study to foreground perception, meaning-making, and digital learning mechanisms as drivers of long-term cultural sustainability for Mianzhu Woodblock New Year Paintings.

### *Findings of Semi-structured Interview*

Based on the Wilson's (2013) user-centered design interview techniques guidelines, following the establishment of clear inclusion and exclusion criteria and the development, six domain experts were selected for qualitative inquiry, including two intangible cultural heritage inheritors, two art/printmaking educators, one tourism-college lecturer, and one design professional. Each participant contributed professional knowledge, actual experience with

Mianzhu Woodblock New Year Paintings. All respondents informed perspectives on the role of digital technology in cultural sustainability. Responses were transcribed, coded and analysed thematically. Findings reveal four major themes including authenticity perception, cultural value understanding, emotional attachment and identity formation, and acceptance of digital means for transmission.

As for the perceived authenticity in digital transmission, all respondents acknowledged that digital platforms offer new visibility for Mianzhu Woodblock New Year Paintings. However, authenticity emerges as the core evaluative criterion. Heritage inheritors particularly stressed the risk of style distortion and craftsmanship dilution. They argue that digitalization should document original brushstrokes, textures, carving patterns, and pigment characteristics to retain the integrity of the artwork. Educators and designers also noted that interaction and gamification could increase youth engagement only if handled carefully. Excessive modification may cause audiences to perceive the art as "modernized" rather than "traditionally grounded." Thus, digital transmission is not rejected, but must be implemented as preservation-oriented rather than entertainment-oriented.

As for the aspect of cultural value recognition and educational transmission, five out of six interviewees emphasized that digital heritage platforms must not only display images but also translate cultural context into accessible learning experiences. Participants also stated that historical narratives, festival symbolism, and regional folk beliefs must be embedded through multimedia storytelling, curated annotation, and contextual explanations.Instead of focusing only on visual reproduction, experts believed that digital artifacts should function as intellectual gateways which can help users understand values such as auspicious symbolism, community identity, seasonal rituals, and craft lineage. Therefore, the interview findings indicate that cultural education is equally important as digital preservation, and may even determine long-term sustainability outcomes.

Seen from the aspect of emotional attachment and cultural identity formation, all interviews, emotional connection was identified as a necessary driver for future transmission. Participants described digital tools as capable of recreating cultural intimacy through zoom-in detail exploration, oral-history video, workshop simulation, and story-based interaction. Several experts also noted that younger generations do not only lack knowledge. They lack a sense of belonging and affective resonance. Digital immersion may therefore act as a bridge to help millennials internalize heritage values rather than passively observe them. However, experts also acknowledged the irreplaceability of material tactility, which indicates that emotion is enhanced digitally but fully completed only through physical–digital integration.

As for young generations' acceptance of digital means across generations, all participants expressed cautious optimism regarding mobile-based cultural transmission. The level of acceptance depends on multiple variables such as interface intuitiveness, aesthetic quality, information accuracy, interaction depth, and user technical familiarity. Younger audiences were perceived as more receptive to digital platforms especially when features such as social sharing, gamified learning, and visually engaging navigation are included. In contrast, traditional inheritors and elder users emphasised the need for simplified access paths, culturally respectful UI, and guidance-based learning flows. Experts therefore suggest that platform adoption is not only a technological issue but also a matter of intergenerational usability equity.

The interviews reveal an underlying consensus. Digital platforms hold strong potential to support the sustainable transmission of Mianzhu Woodblock New Year Paintings. Meanwhile, effectiveness also depends on authentic representation, cultural-educational depth, and emotion-identity resonance instead of merely digital availability. Heritage sustainability for millennials is therefore less about displaying art and more about designing meaningful cultural learning. This allows digital technology to function as a bridge rather than a replacement for lived cultural experience.

### *Findings of Kano-model Questionnaire*

To further and deeply identify millennial user needs and preferences for the digital representation of Mianzhu Woodblock New Year Paintings, Kano analysis was conducted in this research by mapping satisfaction responses to functional quality attributes. Each design feature was evaluated across the five Kano response dimensions including Attractive (A), One-dimensional (O), Must-be (M), Indifferent (I), and Reverse (R). It makes classification of functional requirements by their influence on user satisfaction. Better-Worse coefficients were subsequently calculated based on the Kano model survey results to quantify attribute sensitivity that enables prioritization for interface development.

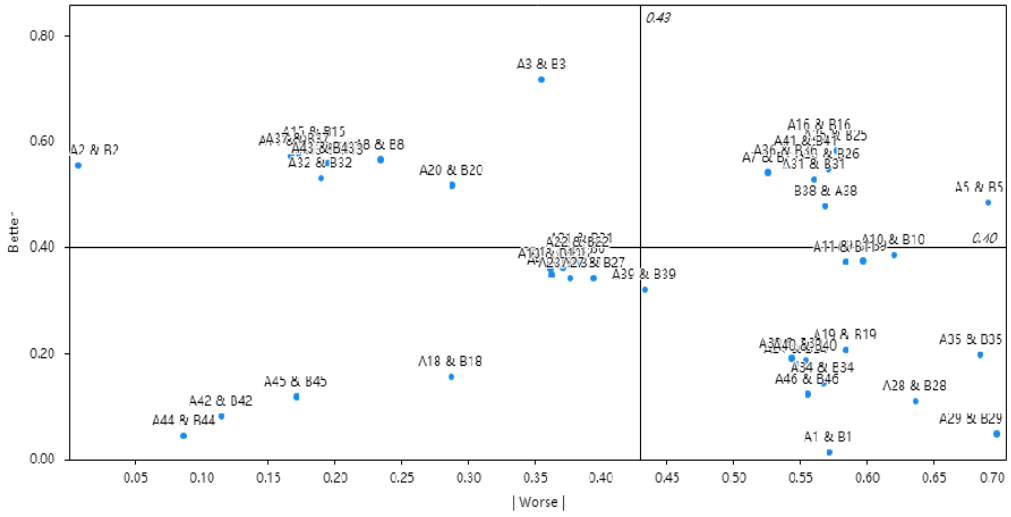



**Figure 5 Better-Worse Coefficient Diagram**

As shown in figure 5, Must-be(M) attributes represent functions users take for granted. Absence of these features generates strong dissatisfaction even if their presence does not significantly elevate satisfaction. The dataset indicates that millennials regard narrative cultural interpretation, intuitive interface interaction, and content clarity as fundamental expectations. One-dimensional(O) attributes demonstrate a linear positive relationship between implementation quality and user satisfaction. These features not merely expected but performance-elevating including community interaction, layered content architecture, dynamic visual feedback, and search optimization. These attributes represent core leverage points to improve platform performance, indicating that users do not want a passive museum-like interface. They expect interactive communication, efficient access, and real-time response feedback, which is aligned with millennial digital engagement habits. Attractive attributes are not expected but significantly enhance satisfaction when present. These represent innovation

space and emotional engagement mechanisms. These results clearly indicate that while heritage content must first be understandable and navigable. Millennials are particularly motivated by playful, emotional, and immersive interaction formats. Gamification, audio-guided learning and visual dynamism may therefore activate cultural curiosity, strengthening engagement and memory retention, which is an essential mechanism for long-term sustainability. Certain features were classified as Indifferent (I), meaning their presence or absence exerts minimal influence on user satisfaction. This indicates that platform success depends on first securing comprehension and usability (M), then strengthening interactive delivery (O), and finally amplifying cultural immersion through gamification and audio-visual storytelling (A). Traditional culture cannot be sustained through preservation alone. It requires emotionally resonant digital experiences that speak in the cognitive language of millennial learners.

***The Findings of PACMAD***

To measure the usability of the WeChat Mini Program from a mobile interaction perspective, the PACMAD framework was applied across seven dimensions including effectiveness, efficiency, satisfaction, learnability, memorability, error rate, and cognitive load. The evaluation sample consisted of 30 users, and reliability measures confirmed strong internal consistency across indicators. Findings demonstrate a generally high level of usability, with an overall PACMAD mean score of 6.3/7 and a Net Promoter Score (NPS) of 87%, indicating that 26 of 30 participants would recommend the application to others.

**Table 1 PACMAD Evaluation Scores of the Prototype**

| Dimension | Mean Score (1–7) | Standard Deviation | Cronbach's α | Composite Reliability (CR) | Top-2 Box % |
|---|---|---|---|---|---|
| Effectiveness | 6.4 | 0.6 | 0.84 | 0.87 | 73 % |
| Efficiency | 6.2 | 0.7 | 0.82 | 0.85 | 70 % |
| Satisfaction | 6.5 | 0.5 | 0.88 | 0.90 | 77 % |
| Learnability | 6.6 | 0.4 | 0.85 | 0.88 | 80 % |
| Memorability | 6.3 | 0.6 | 0.83 | 0.86 | 70 % |
| Errors | 6.1 | 0.8 | 0.80 | 0.84 | 67 % |
| Cognitive Load | 2.1 | 0.9 | 0.79 | 0.83 | 7 % |

Statistically, the PACMAD dimensions indicate that the system is highly learnable, satisfying, and effective, supported by strong reliability and favorable Top-2 Box scores (67–80%). Memorability and satisfaction performed particularly well, suggesting that the platform does more than facilitate task completion—it retains user interest and encourages cultural revisitation, a critical factor in intangible heritage sustainability.

The low cognitive load score (2.1) is especially meaningful. It indicates that users did not experience fatigue or overwhelm when navigating cultural content, which is an essential

requirement for millennial engagement. At the same time, high learnability and effectiveness scores reveal that the Mini Program successfully supports skill acquisition, allowing users to explore, compare, and interpret New Year paintings with confidence. With an NPS of 87%, the platform demonstrates not only usability success but also viral potential, meaning users are intrinsically motivated to share and recommend the heritage content. Therefore PACMAD results confirm that the Mini Program design aligns effectively with mobile learning usability standards and supports sustained cultural participation, validating its potential as a scalable digital solution for intangible heritage preservation.

## Conclusion

This study demonstrates that digital technology guided by user-centred design principles can effectively reduce cultural distancing and stimulate renewed engagement with intangible heritage among millennial learners. Extensive literature acknowledges that traditional art forms decline primarily because cultural knowledge transmission is no longer embedded in everyday life (Smith 2006; Blake 2017). Modernization, migration and lifestyle changes have weakened intergenerational continuity. This change produces what scholars describe as a growing "heritage disconnection gap" (Kurin 2004; Harrison 2013). The interview phase of this study confirms this pattern, which is, cultural inheritors expressed concern that younger generations view Mianzhu Woodblock New Year Paintings as visually appealing instead of contextually remote. However, findings from the Mini-Program evaluation indicate that digital environments can narrow this gap if designs not only to display but also to interpret cultural meaning. High usability scores across PACMAD show that digital tools can reconstruct cultural proximity by enabling users to explore symbolism, compare versions, examine artisan techniques.It also allow users to revisit detailed information with minimal learning effort. This aligns with recent work arguing that digital media does not inherently dilute heritage but also can serve as a cognitive and emotional bridge when thoughtfully mediated (Giaccardi & Fogli 2019; Kenderdine 2021).

Educational technology further amplifies this shift by transforming cultural artefacts from static visual objects into dynamic learning experiences. Prior research emphasises that cultural sustainability depends not only on preservation but also on participatory cultural learning. In this way, users construct meaning rather than merely observe (UNESCO 2015; Hooper-Greenhill 2020). The results of the Kano-model analysis strongly align with this theoretical position. Must-be attributes identified by users primarily concerned cultural comprehension such as story annotation, production-process demonstration and symbol interpretation. This finding indicates that knowledge clarity is a prerequisite for cultural value formation. Once understanding is achieved, users expressed desire for deeper engagement through interactive elements, social sharing, and task-oriented exploration. It further confirmed that participation follows cognitive access. This mirrors findings by Parry (2019) and Liu et al. (2022), who note that digital platforms function most effectively when they enable meaning-making and social circulation rather than passive viewing. Therefore, digital learning environments designed for heritage transmission must balance accuracy and accessibility while structuring interaction as a pathway toward sustained cultural investment.

This study confirms that digitalisation alone cannot save culture, while digitally mediated learning can. When intangible cultural heritage is transformed into an interface that invites exploration, interpretation and emotional connection, it gains the capacity to move forward as

memory, as identity, and as shared future. Sustainable heritage is not preserved by storage, but by participation, and not by observation, but by experience. As global societies accelerate toward digital modernity, designing for cultural sustainability becomes not only a technical ambition but a civilisational responsibility.

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# BEYOND TECHNICAL COMPETENCE: CHALLENGES OF INTEGRATING COMMUNICATION SKILLS IN TVET CLASSROOMS

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**Abstract**: *The integration of communication skills into Technical and Vocational Education and Training (TVET) programmes is increasingly emphasised to enhance graduates' employability, yet its classroom implementation remains complex. Guided by a socio-constructivist learning perspective and integrated skills approaches in TVET, this study examines key education stakeholders' reflections on the challenges of embedding communication skills in TVET settings. A qualitative research design was adopted, drawing on reflective accounts and semi-structured interviews with language teachers, technical teachers, and state education officers. The data were analysed thematically. The findings indicate that challenges occur at learner, pedagogical, and systemic levels. At the classroom level, teachers reported difficulties in sustaining student engagement, managing discipline, and addressing mismatches between students' kinaesthetic learning preferences and literacy-focused communication tasks. Pedagogical challenges included teachers' uncertainty in assessing communication components, particularly oral presentations, within technical subjects. Variations in students' communicative confidence were also evident, with some technically proficient learners demonstrating limited verbal participation. At the systemic level, restricted programme pathways, persistent parental perceptions of TVET as a non-academic route, and limited institutional resources constrained integration efforts. The study highlights the need for clearer assessment frameworks, targeted professional development, and stronger institutional support to enable meaningful integration of communication skills in TVET curricula.*

***Keywords***: *TVET, Communication skills, Challenges, Curriculum*

## 1.0 Introduction

Technical and Vocational Education and Training (TVET) has become a central component of Malaysia's strategy for workforce development and economic advancement. As the country progresses towards a high-income, innovation-driven economy, TVET is increasingly positioned as a mechanism for producing industry-ready graduates and reducing dependence on foreign labour (Amin et al., 2023; Azmi & Salleh, 2021). This shift reflects a growing recognition that a skilled local workforce is essential for sustaining productivity, competitiveness, and inclusive socio-economic growth.

Malaysia's commitment to strengthening TVET is articulated in major national policy documents, most notably the National TVET Policy 2030. The policy emphasises the

development of graduates who are not only technically competent but also adaptable and employable in changing labour market conditions (Dasar TVET Negara 2030, 2024). This direction is reinforced by national development frameworks such as the Twelfth Malaysia Plan, which positions TVET as a key contributor to employability, income generation, and social mobility, particularly among learners from diverse socio-economic backgrounds.

In line with these policy priorities, contemporary TVET frameworks increasingly emphasise the importance of transversal and employability skills alongside technical competence. Among these skills, communication is consistently identified as critical for effective workplace participation. Employers expect TVET graduates to communicate clearly during recruitment processes, collaborate with colleagues, explain technical procedures, and accurately document work processes. These expectations are particularly evident in sectors where safety, service quality, and regulatory compliance depend on precise and responsible communication.

Despite sustained policy emphasis, empirical evidence from Malaysian studies indicates that communication competence remains a persistent area of concern among TVET graduates. While employers generally acknowledge graduates' technical abilities, they frequently report weaknesses in oral communication, clarity of expression, and situational appropriateness (Jamaludin et al., 2020; Ramamuruthy et al., 2021; Bassah & Noor, 2023). Such limitations affect not only employability but also early workplace progression, suggesting that communication challenges are systemic rather than isolated.

In response to these concerns, communication skills have increasingly been embedded within TVET curricula through integrated skills approaches. Rather than being taught as standalone subjects, communication components are commonly incorporated into technical subjects through tasks such as presentations, reports, demonstrations, interviews, and workplace simulations. These approaches are intended to promote authentic learning and align classroom activities with real-world communication demands. In practice, however, embedding communication skills within technically oriented curricula introduces a range of implementation challenges.

At the classroom level, teachers often encounter difficulties related to sustaining student engagement, managing discipline, and addressing variation in learners' communication confidence. Many TVET learners demonstrate strong kinaesthetic learning preferences and perform well in hands-on technical tasks, yet struggle to engage with literacy-based or oral communication activities. This mismatch complicates efforts to foster consistent communication practice, particularly in formal or assessed speaking contexts.

Assessment practices further intensify these challenges. Teachers frequently report uncertainty in evaluating communication components embedded within technical subjects, particularly oral presentations and interactive tasks. Unlike technical skills, which are often assessed using clearly defined performance criteria, communication skills may be perceived as subjective and difficult to standardise. As a result, assessment practices may become inconsistent, reducing the emphasis placed on communication outcomes even when they are formally included in the curriculum.

While existing Malaysian TVET research has contributed valuable insights into employer expectations and graduate employability, comparatively little attention has been paid to the

day-to-day implementation challenges faced in TVET classrooms. Policy intentions and curriculum frameworks are ultimately realised through teaching practices, assessment decisions, and institutional conditions. Understanding these constraints, therefore, requires attention to the perspectives of those directly involved in implementation, including teachers and education officers who mediate between policy directives and pedagogical realities.

This study focuses on TVET classrooms at the secondary school level, where foundational technical and communication skills are first systematically developed. At this formative stage, students begin to internalise occupational identities, workplace norms, and communication practices that shape later learning trajectories. Challenges encountered here may have lasting effects, influencing students' preparedness for post-secondary training, industrial attachment, and eventual employment. Accordingly, the research objective of this study is to identify the challenges in integrating communication skills in TVET classrooms at the secondary school level.

## 2.0 Importance and challenges of the integration of communication skills

Across national and regional TVET systems, employers consistently emphasise communication skills as a critical component of employability. International skills frameworks increasingly position communication alongside technical competence as a foundational requirement for effective workplace participation. The OECD (2017) highlights that modern workplaces demand workers who can explain procedures, collaborate with team members, and communicate accurately with diverse stakeholders. In vocational contexts, communication competence supports not only productivity but also safety, service quality, and regulatory compliance.

Employer-focused research across different regions reflects similar expectations. In the United Kingdom, employer surveys have repeatedly identified communication as one of the most valued transferable skills among vocational and technical graduates, particularly in sectors such as engineering, construction, hospitality, and health services (UK Commission for Employment and Skills [UKCES], 2014). Graduates who struggle to articulate ideas clearly or communicate professionally during interviews are often perceived as less work-ready, regardless of their technical qualifications.

Comparable findings are reported in Australia. National Centre for Vocational Education Research (NCVER) reports indicate that Australian employers value communication skills as part of broader employability skill sets required for effective job performance and career progression (NCVER, 2018). Communication competence is linked to teamwork, customer interaction, and the ability to follow and convey instructions accurately, particularly in apprenticeship and work-based learning contexts. This reinforces the view that communication skills are embedded in everyday vocational practice rather than confined to formal presentations or written tasks.

In East and Southeast Asia, employers also emphasise communication skills. In Singapore, where TVET is delivered primarily through the Institute of Technical Education (ITE) and polytechnics, employer engagement reports highlight the importance of workplace communication for supporting teamwork, service excellence, and customer-facing roles (Ministry of Education Singapore, 2020). Similarly, studies in China report that employers

increasingly expect vocational graduates to demonstrate communication competence that supports coordination, documentation, and problem-solving in technologically advanced workplaces (Guo & Lamb, 2019). These expectations reflect rapid industrial transformation and increased integration of technology into production processes.

Within the Malaysian TVET context, employer concerns regarding communication skills have been consistently documented. Employers acknowledge the technical strengths of TVET graduates but report limitations in oral communication, confidence, and situational appropriateness, particularly during interviews and early workplace integration (Jamaludin et al., 2020; Ramamuruthy et al., 2021; Bassah & Noor, 2023). Similar concerns are reported in Indonesia, where employer studies indicate that vocational graduates often require further development in communication and interpersonal skills to meet workplace expectations, despite adequate technical preparation (Sutrisno & Widodo, 2018).

Taken together, evidence from multiple national contexts suggests that employers' emphasis on communication skills reflects practical workplace demands rather than abstract educational ideals. Communication competence functions as a marker of professionalism, adaptability, and readiness to engage in complex work environments. This provides a strong rationale for embedding communication skills within TVET curricula and for examining how such integration is implemented in classroom practice.

Although communication skills are widely recognised as essential, integrating them effectively into TVET programmes remains a persistent challenge across national contexts. International policy analyses indicate that while transversal skills are frequently highlighted in curriculum frameworks, their classroom enactment remains uneven (UNESCO & ILO, 2022). A key challenge lies in aligning communication outcomes with technically focused curricula, where instructional time is often prioritised for practical skill development and certification requirements.

Learner-related challenges are commonly reported across TVET systems. Research from the United Kingdom and Australia indicates that vocational learners often demonstrate strong practical abilities but lower confidence in formal communication tasks, such as presentations and structured discussions (Satchwell, 2016; NCVER, 2018). When communication activities are perceived as academic or peripheral, student engagement may decline. Similar patterns have been observed in Asian contexts, where TVET learners may prefer kinaesthetic and experiential learning and may be reluctant to participate in extended speaking or writing tasks (Guo & Lamb, 2019).

Pedagogical challenges further complicate integration efforts. Effective communication instruction in TVET often requires collaboration between language specialists and technical teachers. However, studies from Germany, the UK, and Australia suggest that such collaboration is difficult to sustain due to institutional structures, fragmented timetabling, and unclear role boundaries (Grollmann & Rauner, 2007). This division contributes to inconsistent implementation across programmes and institutions.

Assessment is consistently identified as one of the most challenging aspects of communication integration. International research highlights difficulties in developing valid and reliable assessment criteria for communication skills embedded within technical tasks (Billett, 2011).

Where performance descriptors are unclear, assessment practices may vary considerably, reducing transparency for students. UNESCO (2016) notes that the absence of shared rubrics and moderation mechanisms undermines the credibility of transversal skill assessment in TVET systems.

Systemic and institutional conditions also shape integration outcomes. In countries such as Malaysia and Indonesia, fragmented governance structures and overlapping qualifications frameworks can create ambiguity regarding curriculum priorities (UNESCO & ILO, 2022). Even in more centralised systems, such as Singapore and South Korea, communication integration is constrained by curriculum crowding and performance pressures linked to technical certification (Ministry of Education Singapore, 2020; Kim & Lee, 2021). Across contexts, limited professional development opportunities further restrict teachers' capacity to design and implement communication-focused pedagogy.

Despite contextual differences, international evidence points to recurring patterns. Challenges in integrating communication skills in TVET programmes are shaped by learner diversity, pedagogical readiness, assessment complexity, and systemic constraints. These patterns help explain why communication skills are repeatedly emphasised in policy but remain difficult to embed meaningfully at the classroom level.

Taken together, the literature reveals a well-established consensus on the importance of communication competence for TVET outcomes, alongside persistent uncertainty regarding its classroom-level integration. What remains underexplored is how communication integration is negotiated in practice by those responsible for implementation, particularly at the secondary school level. Existing studies tend to privilege either workplace outcomes or post-secondary contexts, leaving a critical gap in understanding how systemic, pedagogical, and assessment-related challenges intersect in secondary TVET classrooms.

By examining the perspectives of language teachers, technical teachers, and state education officers, the present study addresses this gap by mapping communication integration challenges across multiple levels of the education system. In doing so, the study shifts attention from normative prescriptions toward the lived realities of implementation, thereby generating insights relevant beyond the secondary level to inform more coherent and sustainable integration across the TVET continuum.

## 3.0 Research methodology

A qualitative, multi-informant, semi-structured interview design was adopted in this study to obtain detailed insights into the challenges of integrating communication skills in TVET classrooms. This multi-perspectival data collection approach enabled the study to capture the reflections of technical teachers, language teachers, and state education officers on their perceptions and experiences, particularly regarding the challenges of integrating communication skills. Semi-structured interviews enable systematic exploration of common issues while retaining the flexibility to probe context-specific challenges that emerge during implementation (Creswell & Poth, 2018; Kvale & Brinkmann, 2009).

Participants were recruited through purposive sampling. This role-based sampling approach was appropriate because it allowed the study to capture complementary and contrasting

perspectives across classroom and administrative levels. Including multiple participant groups enhanced analytic depth by revealing how communication skills are conceptualised differently across roles: (i) as a foundational competence for meaning-making and interaction, more frequently emphasised by language teachers; and (ii) as a functional tool for completing technical tasks, coordinating teamwork, and demonstrating competence in authentic performance contexts, commonly foregrounded by technical teachers. State education department officers were included to provide insights into implementation at the administrative level, particularly regarding how communication skills initiatives are interpreted, supported, and monitored within schools. Their inclusion also enabled examination of challenges associated with translating policy frameworks into workable school-level practices, thereby complementing classroom-based accounts.

Special attention was given to the demographic profile of teacher participants to ensure representation across gender, career stage, and teaching experience, including both early-career and senior teachers. This variation was considered important given documented challenges associated with teaching Generation Z learners, who often exhibit distinctive learning expectations and technology-mediated communication habits. These characteristics can intensify classroom management, engagement, and teacher-student communication challenges, particularly for teachers whose professional training predates these shifts (Schwieger & Ladwig, 2018; Shorey et al., 2021). Students and employers were deliberately excluded, as the study focused on implementation challenges related to integrating communication skills in TVET classrooms rather than on workplace outcomes.

Interview transcripts were analysed using Braun and Clarke's (2006, 2023) reflexive thematic analysis. Following initial familiarisation and coding, themes were generated and refined through an iterative analytic process. A cross-group comparative analysis was then conducted. Patterns were first examined within each participant group-language teachers, technical teachers, and state education officers-and subsequently across groups to identify convergences and divergences in perspectives. This approach enabled the analysis to capture (i) shared challenges, such as constraints within teaching and learning processes; (ii) role-specific issues, including differences in assessment confidence and disciplinary expertise; and (iii) system-level translation gaps, particularly those arising between policy narratives and their enactment in school-level practice.

## 4.0 Findings

Analysis of interview data identified three interrelated themes that cut across participant groups: (i) learner engagement and classroom management challenges, (ii) uncertainty in assessing communication competence within TVET contexts, and (iii) systemic and perceptual constraints affecting communication skills integration.

### 4.1 Learner engagement, motivation, and classroom realities

Language teachers consistently highlighted challenges related to student engagement and classroom discipline. Students were described as showing strong preferences for younger or more "friendly" teachers who adopt informal interaction styles and incorporate digital or social media-oriented activities. Traditional language classroom practices, particularly reading- and writing-heavy lessons, were perceived as disengaging for students who prefer kinaesthetic and

hands-on learning modes. Teachers, therefore, described the need to employ creative pedagogical approaches to sustain attention and participation during language-focused lessons.

Discipline emerged as a persistent concern. Teachers described limited institutional options for managing disengaged or disruptive students, particularly given students' vulnerable academic positioning within the education system. Participants expressed reluctance to apply punitive measures, noting that exclusion or expulsion was neither feasible nor educationally constructive. In practice, these constraints meant that teachers often navigated engagement challenges with limited formal support mechanisms.

Technical teachers echoed concerns about student characteristics, though from a different vantage point. Several participants described students as generally quiet or reserved, particularly in oral interaction, despite demonstrating competence in technical tasks. Communication difficulties were therefore not always interpreted as a lack of ability, but rather as a mismatch between students' expressive preferences and classroom expectations. Notably, technical teachers observed variation across disciplines: students enrolled in courses such as coding or programming, where mathematical and logical reasoning are emphasised, were perceived as more confident in presenting and articulating ideas compared to students in other technical fields.

### 4.2. Assessment uncertainty and professional confidence

A second dominant theme concerned teachers' uncertainty about assessing communication skills: technical teachers, in particular, reported limited confidence in evaluating students' oral presentations and overall communicative performance. Participants questioned whether their judgments were appropriate, consistent, or aligned with institutional expectations, especially in the absence of clear assessment guidelines. As a result, communication was often treated as a secondary or informal criterion rather than a core learning outcome.

Some technical teachers also set their expectations cautiously, citing students' weak academic backgrounds as a limiting factor. However, this perspective coexisted with recognition that communicative quietness did not necessarily equate to incompetence, especially when students demonstrated strong technical execution. This tension underscores the lack of shared assessment language to distinguish among communicative ability, personality traits, and disciplinary performance.

Language teachers, while more familiar with assessing communication, also faced challenges in aligning communicative assessment with vocational relevance. The absence of integrated assessment frameworks across language and technical subjects contributed to fragmented implementation and inconsistent expectations.

### 4.3 Systemic and perceptual constraints at the administrative level

From the perspective of state education officers (JPN), challenges extended beyond the classroom. A recurring concern involved persistent parental perceptions that TVET pathways are intended for academically weaker students. Such perceptions were seen as shaping student motivation, self-concept, and societal valuation of TVET, indirectly affecting learners' willingness to engage in communication-intensive activities.

Budgetary constraints further limited efforts to address these perceptions. Officers noted insufficient funding for promotional programmes, teacher training, or large-scale initiatives to enhance TVET's public image or strengthen the integration of communication skills. Despite these limitations, JPN officers emphasised ongoing efforts to maintain communication with teachers, gather feedback on implementation challenges, and facilitate informal sharing of best practices across schools.

## 5.0 Discussion

This study examined challenges in integrating communication skills in secondary-level TVET classrooms through the perspectives of teachers and state education officers. The findings reveal that integration challenges are shaped by interacting learner-level, pedagogical, and systemic factors. This pattern is consistent with international TVET literature, which reports that the integration of communication skills is more constrained by implementation realities in classrooms and institutions than by awareness.

### 5.1 Learner engagement and the vocational classroom context

Findings related to learner engagement and classroom management reflect patterns widely reported in vocational education research. Participants described students as preferring informal interaction styles, younger or more approachable teachers, and activities involving digital or social media elements. These preferences echo previous studies indicating that TVET learners often respond more positively to experiential and participatory pedagogies than to literacy-heavy instructional approaches (Satchwell, 2016; NCVER, 2018). In this study, traditional reading- and writing-focused language lessons were frequently perceived as disengaging, particularly for learners with strong kinaesthetic learning preferences.

The findings also highlight that communication difficulties should not be interpreted solely as deficits in ability. Technical teachers observed that some students demonstrated strong technical competence yet remained quiet or reserved during oral interactions. This supports international evidence suggesting that limited verbal participation among vocational learners may reflect expressive preferences, confidence levels, or disciplinary norms rather than communicative incapacity (Guo & Lamb, 2019). Variation across technical disciplines further reinforces this point. Students in fields emphasising logical reasoning, such as coding or programming, were perceived as more confident in articulating ideas, suggesting that disciplinary cultures and task demands shape communicative behaviour.

The discipline-related challenges identified in this study also resonate with broader discussions of learner vulnerability in TVET contexts. Teachers' reluctance to apply punitive measures reflects an awareness of students' academic positioning and limited alternative pathways. Similar concerns have been reported in international literature, where exclusionary discipline is viewed as incompatible with the inclusive and remedial aims of TVET (UNESCO & ILO, 2022). Taken together, these findings indicate that communication integration must be sensitive to learner identities, motivation, and classroom realities rather than relying solely on formal instructional expectations.

### 5.2 Assessment uncertainty and teacher professional confidence

Assessment-related uncertainty emerged as a central pedagogical challenge, particularly among technical teachers. Participants expressed limited confidence in evaluating communication competence, particularly in oral presentations within technical subjects. This finding aligns with international research identifying assessment as one of the most persistent barriers to the integration of transversal skills in TVET (Billett, 2011; UNESCO, 2016). Unlike technical skills, which are often assessed through observable and standardised performance criteria, communication skills are perceived as subjective and difficult to judge consistently.

The tension identified by teachers between recognising students' technical competence and interpreting their communicative quietness further underscores the absence of shared assessment language. Without clear frameworks, teachers may struggle to distinguish between communicative ability, personality traits, and disciplinary performance. This makes it more likely that communication will be treated as a secondary criterion rather than a core learning outcome, reinforcing its marginal status within technical subjects.

Although language teachers demonstrated greater familiarity with communication assessment, they also faced challenges in ensuring vocational relevance. The lack of integrated assessment frameworks across language and technical subjects contributed to fragmented implementation and inconsistent expectations. Similar issues have been reported internationally, where weak collaboration between language and vocational teachers limits the coherence of communication instruction and assessment (Grollmann & Rauner, 2007). Together, these findings suggest that improving communication integration requires not only teacher skill development, but also shared assessment tools and cross-disciplinary alignment.

### 5.3 Systemic and perceptual constraints on communication integration

At the systemic level, findings from state education officers highlight the influence of broader social and institutional conditions on classroom practice. Persistent parental perceptions of TVET as a pathway for academically weaker students were observed to shape learners' motivation and self-concept. This finding aligns with international literature documenting how social stigma associated with TVET can undermine student engagement and confidence, including willingness to participate in communication-intensive activities (OECD, 2017; UNESCO & ILO, 2022).

Budgetary constraints further limited institutional capacity to address these challenges. Insufficient funding for promotional initiatives, professional development, and large-scale intervention programmes constrained efforts to strengthen the integration of communication skills. While officers described ongoing informal support and communication with teachers, these measures were necessarily limited in scope. Similar resource-related constraints have been reported across both centralised and decentralised TVET systems, including in Singapore and South Korea, where curriculum crowding and performance pressures restrict attention to transversal skills despite strong policy support (Ministry of Education Singapore, 2020; Kim & Lee, 2021).

These findings also show that systemic constraints do not operate in isolation. Parental perceptions, institutional resources, and classroom practices intersect to shape how communication skills are valued and enacted. When communication is perceived as peripheral

at the system level, classroom-level integration becomes vulnerable to inconsistency and is more easily deprioritised.

### 5.4 Implications for communication skills integration in TVET

Overall, the findings indicate that challenges in integrating communication skills in TVET classrooms are multidimensional. Learner engagement issues, assessment uncertainty, and systemic constraints reinforce one another, making the integration of communication difficult to sustain without coordinated support. These findings reinforce international calls for clearer assessment frameworks, targeted professional development, and stronger institutional support to integrate transversal skills in TVET (UNESCO, 2016; OECD, 2017).

At the classroom level, communication pedagogy should be aligned with vocational learning preferences and disciplinary practices. At the pedagogical level, shared assessment rubrics and cross-disciplinary collaboration are necessary to enhance teacher confidence and consistency. At the systemic level, efforts to strengthen TVET's public image and to allocate resources strategically are essential for sustaining meaningful integration. Addressing these interconnected challenges is critical for translating policy aspirations into classroom practices that support students' communicative and professional development.

## 6.0 Conclusion

This study examined challenges in integrating communication skills in secondary-level TVET classrooms through the perspectives of teachers and state education officers. The findings indicate that the integration of communication skills is shaped by interacting learner, pedagogical, and systemic constraints. At the classroom level, student engagement and communicative participation were influenced by learning preferences, confidence, and disciplinary cultures. At the pedagogical level, teachers' uncertainty in assessing communication competence limited the consistency and salience of communication outcomes within technical subjects. At the systemic level, persistent societal perceptions of TVET and constrained institutional resources further shaped the valuation and support of communication skills. Together, these findings suggest that communication integration is not a singular instructional issue but a multilayered process shaped by classroom realities, assessment practices, and broader structural conditions.

The study contributes to TVET research by foregrounding implementation-level challenges at the secondary school stage, where foundational communicative and vocational identities begin to take shape. By highlighting the perspectives of those directly involved in classroom practice and administration, the study underscores the need for clearer assessment frameworks, targeted professional development, and coordinated institutional support to enable the meaningful integration of communication skills. Addressing these interconnected challenges is essential for strengthening TVET graduates' communicative competence and enhancing their readiness for further training and employment.

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# A CONCEPTUAL PAPER: FULL-TIME UNIVERSITY STUDENTS' PERCEPTIONS OF BECOMING SOCIAL MEDIA INFLUENCERS

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***Abstract:*** *Social media plays a crucial role in everyday life by enabling users to connect, share information, and exchange content through digital platforms. Influencer advertising has gained significant traction as influencers provide authentic engagement that resonates with followers. In Malaysia, social media influencers have considerable influence on consumer trends and purchasing behaviours. Businesses utilise influencer marketing to enhance brand recognition and sales. Malaysia has a high social media penetration, with over 28 million users spending nearly 3 hours online daily. TikTok has emerged as a leading platform, enabling influencers to set trends that can go viral. In recent years, a large number of students have missed major examinations, believing they could attain success and wealth without formal qualifications after observing the online achievements of influencers. This pattern reflects a global trend, as many young individuals aspire to become influencers owing to the industry's substantial earning potential.*
***Keywords:*** *Students, social media influencers, career*

## Introduction

Social media is in our daily lives. Social media are digital platforms where users build online communities to share information, ideas, messages and all sorts of content (American Psychological Association, 2025). Social media has become a tool that connects users through the exchange of text, images, and videos (Wong et al., 2017).

According to a Statista report (2025), influencer advertising is becoming increasingly important. Influencers serve as spokespersons, providing authentic ways to engage with consumers and followers. This approach has proven effective, especially among young people who favour genuine content. Wong et al. (2017) noted that social media is used to view, share information, as well as to connect with family and friends. They added that studies show it influences behaviour and decisions. Even a simple post can have a significant impact. In addition, Talesara (2025) suggests an encouraging link between influencer credibility and consumer brand trust, indicating that consumers tend to trust brands recommended by credible influencers who demonstrate positive attributions.

Social influencers in Malaysia influence consumer trends and purchasing behaviour. With the rapid growth of digital platforms like Instagram, TikTok, and YouTube, millions of users engage daily and create influential digital personalities. For businesses, utilising these influencers can open new markets, boost brand awareness, and increase sales (MYSense, 2024). Wang and Chan-Olmsted (2024) added that using social media influencers to build a link between the brand and consumers is crucial and effective today.

Meltwater's report on Malaysia's social media statistics shows that in 2024, there were 28.68 million social media users in the country. Additionally, the average daily social media usage was 2 hours and 48 minutes, primarily for maintaining relationships with acquaintances (Howe, 2024a).

In a separate report by Meltwater (Howe, 2024b), TikTok has emerged as the leading social media platform, with users from across the globe. While in Malaysia, it is the avenue for influencers to become trendsetters by engaging with followers through viral challenges, resourceful life hacks, and so forth.

In 2023, more than 10,000 Sijil Pelajaran Malaysia candidates did not sit for their examinations, mainly because students felt that success in life and wealth could be achieved without an education certificate ("Social media influencers among causes of SPM candidates skipping exams", 2024). Such perception was heightened by students' observations of their own social media use. They have seen how successful social media influencers can be, which has fueled their interest in becoming influencers themselves ("Study shows many SPM school-leavers hope to land dream job of becoming social media influencers", 2024). The large number of absentees continued in 2024, the Education Minister Fadhlina Sidek mentioned during a press conference (Yeoh, 2025).

Similarly, research conducted by Adobe (How the influencer dream is shaping young people's goals, 2024) examined youngsters aged 18-30 and parents with children under 18. The research found that 1 in 3 youngsters in the United States want to become influencers on social media platforms such as TikTok, YouTube, and Instagram. In addition, 27% of parents support their children pursuing careers as influencers, while 49% believe children should wait until they are 18. Bhesaniya (2025) noted that the influencer industry is worth 16.4 billion USD and that, depending on the influencers' following, each post could generate between 10,000 and 100,000 USD. According to Fetter, Coyne, Monk, and Woodruff (2023), one reason for aspiring to be a social media influencer is the desire for financial gain.

## Problem Statement

On the surface, being a social media influencer appears easy, glamorous, and capable of earning a good income. However, many are unaware of the gruelling behind-the-scenes routines. Malinksy (2024) stated in her article that social media influencers work seven days a week and, based on her interviews with influencers, their workday can start at 8 am and go until midnight. In Malaysia, the desire among young people to become social media influencers is linked to many students skipping their SPM examinations. It would be helpful to investigate whether full-time university students share similar views. Unlike SPM candidates, university students have already met university entrance requirements and have decided to pursue higher education before entering the workforce.

## Research Objective

1. To examine full-time university students' perceptions of social media influencers.
2. To examine full-time university students' perceptions of who they believe has the greatest desire to become social media influencers.

## Research Question

1. Do full-time university students want to be social media influencers?
2. Do full-time university students perceive their peers as having the greatest desire to become social media influencers?

## Methodology

Quantitative research, particularly a survey questionnaire, will be utilised to investigate the research objectives and questions.

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# ARTIFICIAL INTELLIGENCE IN THE WORKPLACE AND EMPLOYEE WELLBEING: A BIBLIOMETRIC REVIEW

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***Abstract:*** *Artificial intelligence (AI) is increasingly integrated into workplaces, shaping recruitment, performance management, task automation, and health monitoring. While AI adoption offers potential benefits such as reduced routine workload, improved engagement, and enhanced wellbeing, it also raises concerns about stress, job insecurity, and ethical risks. Despite growing attention, the literature on AI and employee wellbeing remains fragmented, with limited systematic efforts to map its development. This study applies a bibliometric analysis of publications indexed in Scopus between 2015 and 2025. Using Bibliometrix and Biblioshiny, the analysis examines trends in publication output, influential authors, journals, institutions, and countries, as well as thematic patterns in the field. Findings indicate a sharp growth in research output, with a small number of highly cited studies exerting disproportionate influence. Institutional and geographical analysis shows concentration in leading universities and research clusters, while keyword mapping reveals persistent focus on AI and human-centred issues. The study contributes by providing an integrated overview of how research in this area has evolved and where gaps remain. Future research should extend beyond fragmented case studies and explore contextual conditions that shape whether AI supports or undermines employee wellbeing.*

***Keywords:*** *Artificial intelligence, Bibliometric Analysis, Employee Wellbeing, Workplace Technology.*

## Introduction

The integration of artificial intelligence (AI) into the workplace has become one of the defining changes in contemporary employment. Organisations increasingly adopt AI-driven tools for recruitment, performance evaluation, task automation, and decision support. These changes go beyond efficiency, raising critical questions about their effects on employees' wellbeing. Existing studies highlight both positive and negative outcomes. On one side, AI reduces repetitive workloads, supports decision-making, and enables new forms of professional growth, contributing to greater engagement and satisfaction. On the other, it introduces risks of technostress, job insecurity, and surveillance, often eroding trust and creating uncertainty about future employment (Meijerink et al., 2021).

Despite this growing interest, the literature remains fragmented. Researchers such as Čaić et al. (2019) and Meijerink et al. (2021) argued that most studies are industry specific and focus

on narrow outcomes, eventually making it difficult to draw general conclusions. Positive outcomes are often studied in isolation, while risks are analysed without considering organisational or cultural contexts. Recent work stresses that AI's impact depends on management practices, industry, and policy frameworks, but there has been little effort to synthesise findings systematically. As a result, the academic conversation lacks an integrated picture of how this area has developed, who the leading contributors are, and which themes dominate the discussion.

This study addresses these gaps by applying a bibliometric analysis of publications from 2015 to 2025, with a focus on AI, workforce transformation, and employee wellbeing. Rather than providing a purely descriptive overview, the analysis examines patterns of growth, influence, and thematic focus. The study is guided by two questions:

RQ1: How has research on AI and employee wellbeing developed over time in terms of publication output, influence, and thematic focus?
RQ2: Which authors, journals, institutions, and countries have been most influential in shaping this field, and what does this reveal about its intellectual and geographical structure?

By addressing these questions, the study contributes to clarifying the state of knowledge, identifying areas of consensus and divergence, and highlighting directions for future research on AI and employee wellbeing.

## Literature Review

### *Positive Impacts of AI on Employee Wellbeing*

A growing body of research highlights how AI can support employees by reducing administrative workloads, enhancing productivity, and enabling new forms of learning and development. Dabirian et al. (2017) emphasise AI's role as an augmentation tool that complements rather than replaces human effort. In customer service, Prentice & Nguyen (2020) show that AI-based systems improve decision quality and performance. In healthcare, Doraiswamy et al. (2020) demonstrates that AI-assisted diagnostics reduce clinician strain while improving patient outcomes. Wang et al (2019) extend this argument by showing that hybrid intelligence fosters innovation and increases employee satisfaction in decision-making.

AI has also been applied directly to wellbeing support. Adaptive learning platforms promote professional growth, consistent with García-Martínez et al. (2023), while Bankins et al. (2024) argue that AI-assisted job redesign strengthens engagement by aligning tasks with employees' skills. Together, these studies show that AI, when deployed thoughtfully, can enhance job satisfaction, learning, and wellbeing.

### *Risks and Challenges of AI in the Workplace*

Despite these benefits, significant risks accompany AI adoption. Automation threatens job stability, particularly for routine roles. Badri et al. (2018) argue that widespread AI-driven automation displaces workers, while Lee et al. (2022) and Nazareno & Schiff (2021) report that such displacement drives anxiety and insecurity. Brougham and Haar (2020) caution that while reskilling is possible, access is unequal, potentially worsening workforce inequality.

Digital strain also emerges as a recurring concern. Cheng et al. (2022) find that AI-enabled monitoring increases cognitive load, encourages constant performance pressure, and blurs boundaries between personal and professional life. Surveillance applications raise ethical questions, with Meijerink et al. (2021) and McClure (2017) documenting biases in AI recruitment tools and Flores-Viva et al. (2023) warning about declining organisational trust when AI is linked to invasive monitoring. Together, these findings show that AI can erode wellbeing through stress, job insecurity, and reduced autonomy.

### *Contextual and Integrative Perspectives*

More recent scholarship stresses that AI's impact on wellbeing is shaped by organisational, cultural, and policy contexts. Brougham & Haar (2020) show that outcomes vary across industries and depend on management practices. Khogali & Mekid (2023) argue that AI contributes positively when embedded within ecosystems that promote upskilling, ethical practices, and employee voice. These findings suggest that AI's effects are not universal but contingent on the conditions under which it is implemented.

Overall, two perspectives dominate the literature. One highlights AI's potential to enhance productivity, learning, and wellbeing; the other underscores risks related to stress, insecurity, and ethics. Current research remains fragmented, with positive and negative outcomes often studied separately. This gap underscores the need for integrative approaches that evaluate both sides systematically, offering guidance for organisations on how to implement AI in ways that balance innovation with employee wellbeing.

## Methodology

### *Data Collection*

Bibliometric data were retrieved from Scopus, which was selected for its comprehensive coverage of peer-reviewed journals across management, psychology, and information systems. The search combined keywords related to "artificial intelligence," "work," "workplace," and "employee wellbeing." Only English-language publications between 2015 and 2025 were included. The final dataset consisted of full records with cited references, exported in CSV format.

### *Dataset Overview*

The bibliometric search returned 568 publications on AI and employee wellbeing, published between 2015 and 2025. The number of publications involdved in the bibliometric was deemed suitable according to Donthu et al. (2021). Annual output has grown steadily, with a notable rise after 2019, reflecting the accelerated integration of AI tools in workplaces and the parallel growth of scholarly attention. The dataset covers contributions from multiple disciplines, including management, computer science, psychology, and sociology, which illustrates the interdisciplinary nature of the topic.

### *Analytical Approach*

Analyses were carried out using the Bibliometrix R package (Aria & Cuccurullo, 2017) and its Biblioshiny web interface. The study applied descriptive bibliometrics to track publication

trends, citation patterns, and influential sources. Network analysis was used to examine co-authorship, institutional collaboration, and keyword co-occurrence, providing insight into the intellectual and social structure of the field.

### *Validity, Reliability, and Limitations*

Reliability was strengthened by using a widely adopted bibliometric tool, reporting parameter settings transparently, and checking stability across different configurations. Limitations include reliance on a single database (Scopus), which may exclude regional studies, and restricting publications to English, which introduces language bias. Bibliometric methods capture structural and thematic patterns but do not provide deep conceptual interpretation, which may require complementary qualitative review.

## Result

### *Publication Trends*

Between 2015 and 2025, research on AI and employee wellbeing exhibited a consistent upward trajectory. The number of publications expanded from three articles in 2015 to a peak of 237 in 2025, reflecting the growing scholarly attention to this field (Figure 1a and 1b). Citation dynamics followed a different pattern, with the highest average citations per year recorded in 2018, reaching a mean of 13.21. The second peak for citation dynamics was observed in 2020. The average citations per year for 2020 is 7.24. These peaks were largely driven by a small group of highly cited publications that introduced influential frameworks on AI in the workplace which shaped the subsequent research and attracting sustained attention (Figure 1c).

**Article Counts by Year**

| Year | | Articles |
|---|---|---|
| 2015 | 4 | 3 |
| 2017 | 5 | 5 |
| 2018 | 6 | 14 |
| 2019 | 21 | 24 |
| 2020 | 21 | 28 |
| 2022 | 28 | 162 |
| 2025 | | 237 |

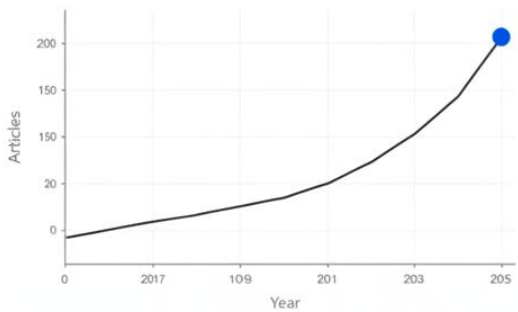



Figure 1a) Figure 1b)

**Figure 1a): Annual Scientific Production (Table)**
**Figure 1b): Annual Scientific Production (Plot)**

### *Productive Authors, Journals, and Institutions*

The analysis identified Mg Herlina Maria Grace as the most productive contributors by publishing 6 articles in the given timespan. This is followed by AM Sherrill Andrew MB, B Kim Byungjik, CW Wiese Christopher William, G Manoharan Geetha, Zhao Hairong and J Lee Julak with 3 publications each. These authors have played a central role in shaping research

on AI implementation and its impact on employee wellbeing. The journals with the highest number of publications were Lecture Notes in Computer Science, International Journal of Environmental Research and Public Health, and Lecture Notes in Network and System (Figure 2a)). These outlets serve as primary platforms for research on AI in organisational settings and employee outcomes.

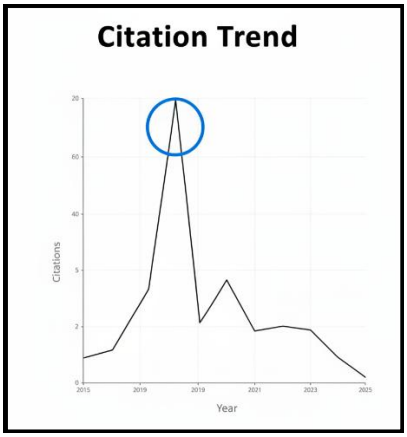



Figure 1c)

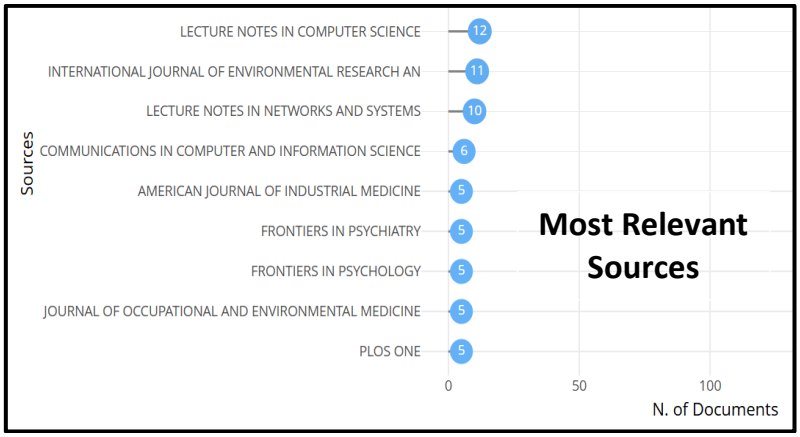



Figure 2a)

| Affiliation | Articles |
|---|---|
| LOVELY PROFESSIONAL UNIVERSITY | 17 |
| AMITY UNIVERSITY | 13 |
| BINA NUSANTARA UNIVERSITY | 13 |
| NOTREPORTED | 11 |
| KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY | 9 |
| CHANDIGARH UNIVERSITY | 8 |
| GRAPHIC ERA DEEMED TO BE UNIVERSITY | 8 |
| NATIONAL UNIVERSITY OF SINGAPORE | 7 |

Most Relevant Affiliations

Figure 2b)

**Figure 1c): Average Citations Per Year**
**Figure 2a): Most Relevant Sources (Plot)**
**Figure 2b): Most Relevant Affiliations**

The institutional analysis in Figure 2b) revealed that research activity was concentrated in a small set of universities. The Lovely Professional University, Amity University, and Bina Nusantara University emerged as the leading contributors in terms of publication output, each producing more than 13 articles during the period of 2015 to 2025. As such, these institutions not only generated substantial output but also played a central role in collaborative networks by linking with partners from contries across multiple regions. Meanwhile, geografically, the majority of publications originated from India, USA, and China, which together accounted for more than half of the total output. The collaboration world map (Figure 3b)) and table (Figure 3a) showed strong cross-country partnerships, with particularly dense links between India and USA. The result also showed an emerging contributions from contries such as Argentina, Azerbaijan, Cameroon, Chille, Colombia, Croatia, Cyprus, Israel, Monaco, Peru and Philliphines. This suggest that the field is gaining traction in developing regions, even though their outputs remain comparatively smaller.

| Country | Freq |
|---|---|
| INDIA | 303 |
| USA | 231 |
| CHINA | 111 |
| UK | 78 |
| AUSTRALIA | 61 |



**Top Countries' Scientific Production**

Figure 3a)

Figure 3b)




Figure 3c)

**Figure 3a): Top Countries' Scientific Production (Table)**
**Figure 3b): Countries' Scientific Production (Plot)**
**Figure 3c): Keyword Co-occurrence Analysis**

***Conceptual Structure and Thematic Patterns***

Keyword co-occurrence analysis (Figure 3c)) revealed a relatively simple conceptual structure, with two dominant clusters. The first cluster centred on artificial intelligence, linking terms such as automation, algorithms, and digital transformation. The second cluster was organised around human, and included terms associated with wellbeing, stress, engagement, and organisational outcomes. The limited number of clusters suggests that research in this area remains thematically concentrated, with most studies framing discussions around the interaction between AI technologies and human factors at work. This highlights the continuing emphasis on balancing technological adoption with employee wellbeing in scholarly discourse.

***Collaboration Networks***

Author-level collaboration networks (Figure 4a)) revealed several tightly knit research groups, often clustered around leading institutions (Figure 4b)). International collaboration in Figure 4c) was strongest between USA and United Kingdom, with multiple co-authored papers reflecting cross-border research partnerships. Country-level analysis demonstrated that developed economies dominated output and collaboration, though contributions from emerging regions including Malaysia have been steadily increasing.

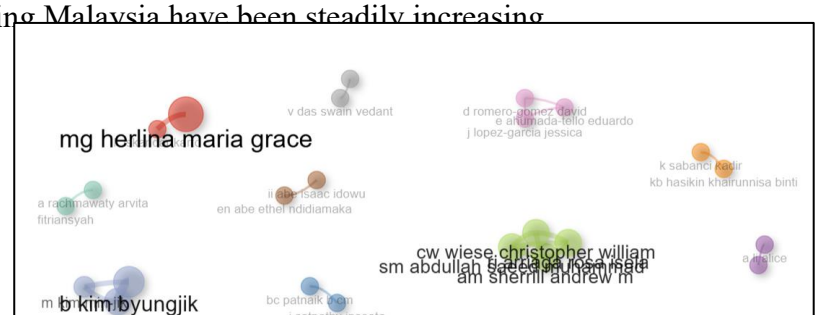


Figure 4a)

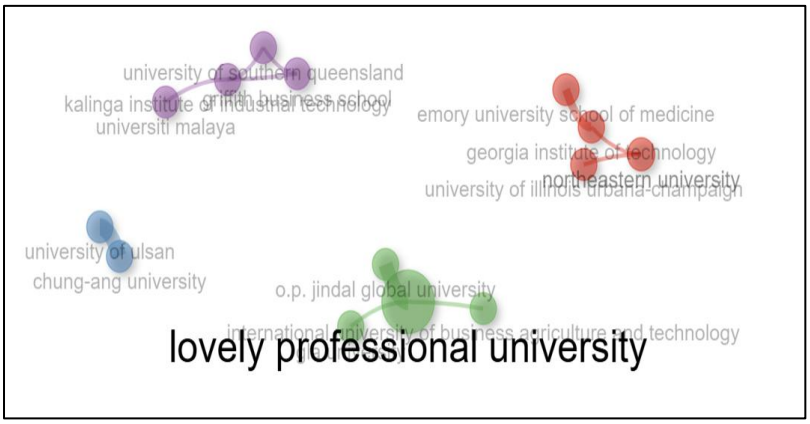



Figure 4b)

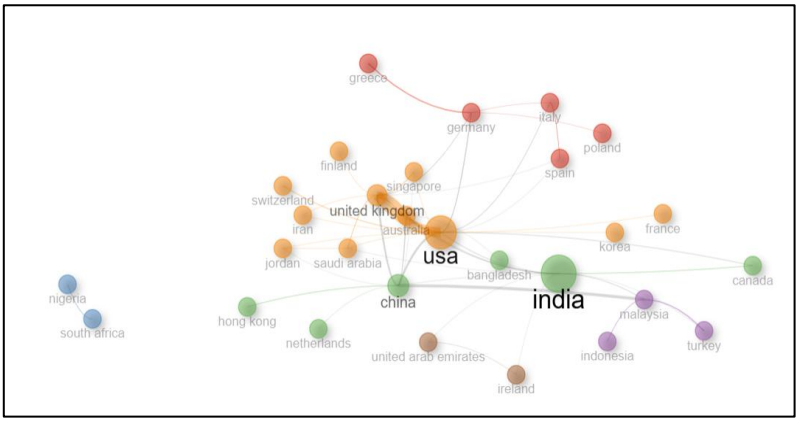



Figure 4c)

**Figure 4a): Author-level Collaboration Networks**
**Figure 4b): Institutional-level Collaboration Networks**
**Figure 4c): International Collaboration Networks**

## Conclusion and Future Recommendations

This study addressed two research questions. For RQ1, the analysis showed that research themes and collaboration patterns in AI and employee wellbeing have developed steadily over the past decade. Publication trends demonstrated a consistent rise in output, reflecting the growing importance of the topic. Keyword co-occurrence revealed that research remains concentrated around two clusters; artificial intelligence and human factors. This indicates that the field is still largely framed through technology adoption and wellbeing impacts.

Collaboration networks further highlighted that a small number of institutions and countries dominate knowledge production, while many remain peripheral. These findings justify that the field is still in a developmental stage, with opportunities for broader thematic integration and stronger international collaboration.

For RQ2, the results identified leading authors, sources, and references that have consistently shaped the field. Citation analysis showed that influential works primarily come from management, psychology, and information systems journals, with highly cited authors bridging technical and organisational perspectives. Institutional and geographical mapping underscored that research activity is concentrated in universities from high-income countries. This concentration suggests that the knowledge base is still uneven, with limited perspectives from developing regions. Addressing this gap will be crucial for achieving a more inclusive understanding of how AI adoption affects wellbeing across different cultural and economic contexts.

Based on these insights, future research should expand thematically beyond the two dominant clusters to explore underdeveloped intersections such as ethical governance, fairness in algorithmic management, and sector-specific wellbeing outcomes. More cross-disciplinary work that integrates organisational behaviour, computer science, and occupational health will enrich conceptual depth. Researchers should also pursue collaborations across regions to diversify perspectives and avoid geographical concentration. Complementing bibliometric evidence with qualitative or mixed-method approaches could further contextualise the findings, helping to bridge structural patterns with current workplace experiences.

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# A NARRATIVE REVIEW OF GENERATIVE AI AND STUDENT COGNITIVE ENGAGEMENT

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***Abstract:*** *The integration of generative artificial intelligence (GenAI), particularly large language models such as ChatGPT, is reshaping educational practice and prompting renewed debate about its effects on students' cognitive engagement. While research on GenAI has expanded rapidly, existing studies remain fragmented across disciplines and often focus on adoption, perceptions, or technical capabilities rather than the cognitive processes involved. This narrative review synthesizes current literature published between 2022 and 2025 to examine these evolving cognitive implications. A search conducted in the Scopus database initially identified 1,550 records, from which 67 studies met the inclusion criteria following a structured screening process. The main aim is to examine how GenAI relates to critical thinking, metacognition, problem-solving, and deeper learning. Based on the diverse empirical and conceptual studies, the review identifies ongoing tensions in the field, including questions about whether GenAI supports or reduces cognitive effort, reshapes self-regulation, or alters learners' engagement with complex tasks. By mapping these emerging discussions, the review offers an integrated perspective on how generative AI is redefining cognitive engagement and highlights areas requiring further research and theoretical clarification.*

***Keywords:*** *Generative Artificial Intelligence, Cognitive Engagement, Critical Thinking.*

## Introduction

The rapid integration of generative artificial intelligence (GenAI) tools, especially large language models like ChatGPT, is transforming education at an unprecedented pace. This shift is widely recognized in recent literature, which documents exponential growth in GenAI research and highlights its disruptive impact on teaching, learning, and assessment practices across disciplines and educational levels (Bahroun et al., 2023). Unlike earlier educational technologies that focused on automating or delivering content, GenAI's ability to generate sophisticated, contextually relevant text, code, and multimedia enables it to act as both a conversational partner and a content co-creator, fundamentally altering the nature of human-AI interaction in learning environments (Yan et al., 2024).

This transformation has sparked significant scholarly and pedagogical debate, particularly around how GenAI reshapes the cognitive dimensions of student learning. Key questions remain unresolved, including the extent to which GenAI supports or reduces critical thinking, problem-solving, metacognition, and knowledge integration which are core components of cognitive engagement and deep learning (Yan et al., 2024). While some studies report that

GenAI can scaffold learning, foster creativity, and provide personalized feedback that enhances engagement and learning outcomes, others report about risks such as overreliance, diminished critical thinking, and threats to academic integrity (Yan et al., 2024).

Despite a growing body of research, most studies are discipline-specific, focus on attitudes or adoption, or evaluate AI systems in isolation, leaving a gap in comprehensive, cross-disciplinary syntheses that directly examine GenAI's influence on students' cognitive engagement (Bahroun et al., 2023). This gap limits the development of evidence-based principles for responsible and effective GenAI integration in education (Bahroun et al.,2023).

This article addresses this gap by presenting a systematic narrative review of the current literature to investigate the multifaceted relationship between generative AI tools and student cognitive engagement in educational contexts. The guiding research question is: How does the use of generative AI influence students' cognitive engagement in educational contexts? By synthesizing findings from different educational settings and research methodologies, this review aims to develop a nuanced perspective. Specifically, it seeks to map the evidence regarding how GenAI can potentially support or reduce cognitive processes such as critical analysis, metacognitive regulation, creative problem-solving, and conceptual understanding.

The review first details its methodology, then synthesizes the literature into key themes: the contested effects on critical thinking, GenAI's role in supporting self-regulated learning, implications for problem-solving and creativity, and the crucial importance of instructional frameworks. The study concludes by discussing implications for educators and researchers, proposing that the future of cognitive engagement in education depends not on resisting AI, but on redesigning learning experiences to leverage its capabilities in ways that augment human intellect.

**Background**

The concept of cognitive engagement is central to understand deep and meaningful learning. Cognitive engagement is defined as the strategic and active mental effort learners utilize to process, monitor, and regulate their learning, often serving as the central mechanism for achieving higher-order academic goals (Sun et al., 2025). It is distinct from passive learning because it demands deliberate resource allocation and sophisticated strategy deployment (Kong et al., 2024; Sun et al., 2025). It is the psychological engine driving the acquisition of expertise. Grounded in constructivist and self-regulated learning (Essien et al., 2024; Kong et al., 2024; Lee et al, 2024) theories, it encompasses a suite of interrelated higher-order processes. Critical thinking which is the ability to analyze, evaluate, and synthesize information allows students to move past rote memorization (Drushlyak et al.,2025; Kong et al., 2024; Remerta Noni Naatonis et al., 2024). Metacognition is defined as the ability to think about one's own thinking (Mizumoto, 2023) which enables learners to plan, track progress, and adapt their approaches (Du et al., 2025; Klar, 2025; Sun et al., 2025); Wu & Thomas, 2025). Problem-solving and creative synthesis represent the application of knowledge and skills to new contexts. For decades, educational research has focused on designing environments either through collaborative learning (Al-Obaydi & Pikhart, 2025; Zhang & Wang, 2025), inquiry-based projects, and scaffolded instruction (Blanka Klimova & Paiva, 2024; Štuikys et al., 2025; Mutanga et al., 2025) that intentionally promote these cognitive activities which resulted in recognizing them as primary predictors of long-term retention, transfer, and academic success.

The integration of technology into education has a long history of aiming to expand these cognitive processes. From early computer-assisted instruction to intelligent tutoring systems (ITS) and adaptive learning platforms, the goal has often been to provide personalized pathways, immediate feedback, and access to information. However, the role of technology has largely been supportive or supplemental (Lee & Juuso Eronen, 2025; Li, 2023; Sánchez-Ruiz et al., 2023; Štuikys et al., 2025). Tools helped students practice, delivered content, or provided corrective feedback based on pre-defined rules and knowledge bases. The core actions of generating original arguments, formulating hypotheses, constructing explanations, and creating complex written work remained solely in the human domain. The cognitive burden of synthesis, creation, and critical evaluation was directly on the learner, with technology acting as a resource or a guide. This division of labor maintained a clear boundary where technology supported cognition but did not substitute its core generative and evaluative functions.

The inclusion of advanced generative artificial intelligence, particularly large language models (LLMs) like OpenAI's ChatGPT, represents a qualitative leap across the aforesaid boundary. Unlike previous technologies, GenAI is not a repository of information or a logic-based problem-solver. It is a generative and responsive model trained on massive quantities to predict and produce language that is coherent, contextually relevant, and stylistically sophisticated (Sánchez-Ruiz et al., 2023; Štuikys et al., 2025). This capability allows it to perform tasks such as drafting essays, explaining concepts, generating code, debating positions, and planning projects which were previously the exclusive territory of human cognition. It does not just support the learning process. In addition, it can also perform key intellectual outputs of that process. This fundamentally changes the traditional student-technology dynamic, positioning the AI not just as a tool, but as a simulated peer, tutor, or co-author. Therefore, this shift forces a re-examination of the nature of cognitive engagement. Now that a machine can generate a competent product, what cognitive work remains necessary for the learner, and how can the interaction be structured to ensure that the original work is not avoided by the learner but enhanced?

This disruptive potential has generated an increase of scholarly interest as shown in the initial search (refer Figure 1). Initial finding shows that literatures has clustered around several ideas: studies examining the technical capabilities of GenAI on academic tasks, surveys investigating student and educator perceptions of its utility and ethics; and philosophical and policy commentaries on academic integrity. While these are valuable, a focused synthesis of empirical and conceptual work that directly investigates the interaction effect of how working with this generative capability changes the internal cognitive and metacognitive processes of the learner is only now emerging. The pre-AI understanding of cognitive engagement provides the essential framework, and also the nature of how GenAI defines the new variable. This review positions itself at this critical intersection. It seeks to integrate different findings to address the core tension: is GenAI primarily a cognitive support that invites intellectual offloading, or can it be leveraged as a scaffold to provoke deeper thinking, reflection, and sophisticated problem-solving? Answering this requires moving beyond the tool's capabilities to analyze the evolving landscape of the engaged mind in the age of generative machines.

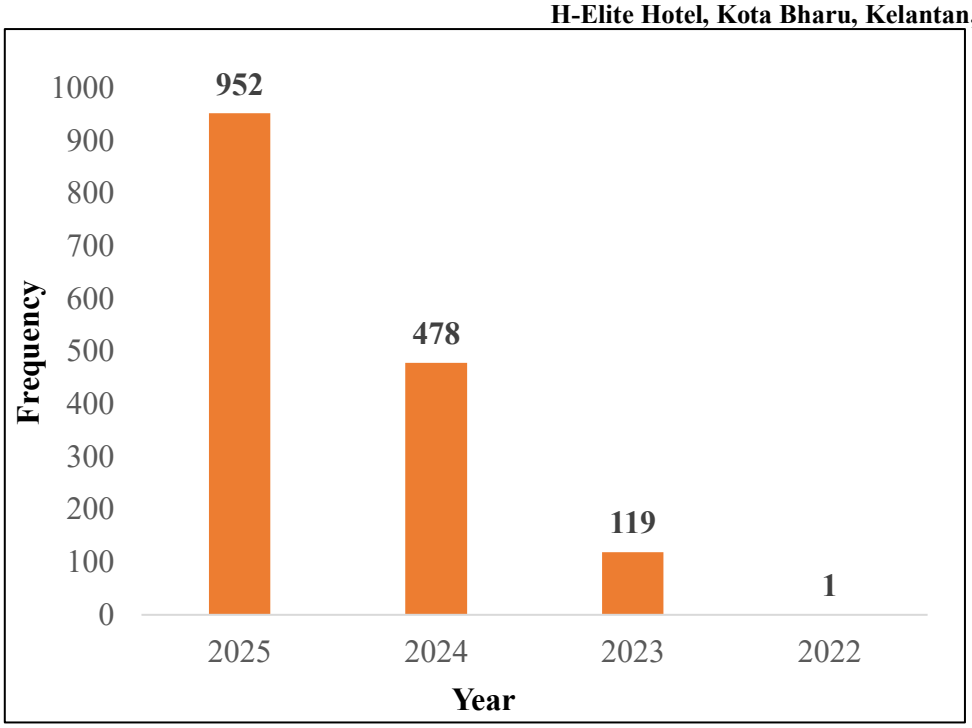



**Figure 1: Initial Search Result of 1550 Articles Based on Year**

## Methodology

This study employs a narrative review methodology. The approach is chosen to identify, select, and synthesize the increasing but fragmented literature on generative AI and cognitive engagement. The process was designed to be systematic and transparent, minimizing selection bias and ensuring a reproducible audit trail from the initial search to the final included studies. The literature search was conducted in Scopus, a multidisciplinary abstract and citation database known for its rigorous curation, to ensure the quality and relevance of identified sources. The search strategy was built around key conceptual clusters related to the research question:

Population/Context: ("student" OR "learner" OR "educat*" OR "classroom") AND
Intervention/Tool: ("generative AI" OR "large language model" OR "LLM" OR "ChatGPT" OR "GPT-") AND
Outcome: ("cognitive engagement" OR "critical think" OR "metacogniti" OR "self-regulated learning" OR "problem solv*" OR "deep learning" OR "higher order thinking").
The search was limited to free to download articles published in English and focused on the period from January 2022 to November 2025. This initial search yielded 1,550 records for screening.

A two-stage screening process was employed to refine the selection. The first stage involved a title and abstract screening against broad inclusion and exclusion criteria. Studies were included if they: (1) primarily focused on the use of a generative AI tool (such as ChatGPT) in a formal or informal educational context; (2) involved school, undergraduate, or postgraduate students as the primary subjects or focus; and (3) made any mention of cognitive, metacognitive, or learning processes. Studies were excluded if they: (1) focused solely on AI technical development, policy without pedagogical discussion, or study not done in educational

contexts; (2) were not peer-reviewed journal articles or conference proceedings (such as editorials without research, books); or (3) were duplicates. This first-stage screening reduced the selection to 473 potentially relevant papers.

The second stage involved a full-text screening for relevance and suitability based on a refined criterion directly linked to the research question. To be included in the final synthesis, a paper's abstract and also full text had to provide empirical findings, theoretical discussion, or a clear conceptual argument specifically about how the generative AI tool influenced, affected, or was theorized to relate to students' cognitive processes. Papers were excluded if their primary focus was on: (1) factors influencing adoption intention without measuring cognitive impact; (2) the AI tool's capabilities in isolation; (3) academic integrity or plagiarism detection without linking to cognitive outcomes; or (4) general attitudes/perceptions of students or teachers without evidence of cognitive influence. This second screening resulted in a final corpus of 67 papers directly relevant to answering the research question.

Key data were extracted into a structured framework for each of the 67 included papers before a thematic synthesis. Extracted information included: bibliographic details, educational context and level, research methodology, specific GenAI tool studied, key findings related to cognitive engagement, and the reported or implied pedagogical design. The synthesis was driven by an inductive-deductive approach. Initial themes were allowed to emerge from the data (inductive), while also being informed by established constructs from the literature on cognitive engagement and educational technology (deductive). The findings were analyzed for patterns and significant gaps that allows for the development of the narrative themes presented in the result sections of this study.

**Results & Discussion**

The first part of the result provides an overview of all the papers involved. The next section addresses the complexities of GenAI integration by focusing on how the tool influences critical cognitive processes, self-regulation, efficiency, creativity, and the subsequent risks of reliance.

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# REWARD AND RECOGNITION'S MODERATING EFFECT ON THE ASSOCIATION BETWEEN LEADERSHIP STYLES AND WORKERS' INCLINATION TO STAY WITH MALAYSIAN MANUFACTURING FIRMS

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***Abstract :*** *This research examines the influence of leadership styles on employees' intention to stay in Malaysian manufacturing firms, highlighting the moderating effect of reward and recognition. The study aims to determine if rewards enhance these connections and how transformational and transactional leadership styles influence retention. Employees of multinational companies (MNCs) in the electrical and electronics (E&E) manufacturing sector in Penang and Kedah were administered structured questionnaires as part of a quantitative methodology. SPSS was employed to analyse the statistics of 132 individuals and to evaluate hypotheses utilising regression analysis and moderation techniques. The findings indicate that workers' propensity to remain is considerably and positively influenced by both transformational and transactional leadership styles. Nonetheless, this association appeared unaffected by reward or acknowledgement. These data indicate that although excellent leadership techniques promote retention, the impact may not be enhanced just by incentives. The study's findings have practical significance for human resource strategy, namely in adjusting leadership methods to improve staff retention. This research examines the dynamics of Malaysia's electronics and electrical manufacturing business, providing insights pertinent to organisational success in capital-intensive industries.*

***Keywords:*** *Transformational leadership; transactional leadership; intention to stay; employee retention; reward and recognition*

## Introduction

Employee retention is a critical issue in today's competitive business environment, particularly in the manufacturing sector, and it plays a vital role in Malaysia's economic transformation. The Electrical and Electronics (E&E) industry, a cornerstone of the manufacturing sector, recorded 28,362 job vacancies in 2021 and secured RM148 billion of the RM195.1 billion in total investments for the sector (MIDA, 2022). Despite these achievements, the industry faces a persistent challenge: high employee turnover. Malaysia's employee turnover rate has risen steadily in recent years, driven by internal and external factors. Externally, Malaysia ranked second (38%) in expected turnover among Asia Pacific countries, following Singapore (46%) and ahead of Australia (35%) (Singapore Business Review, 2018). The COVID-19 pandemic exacerbated this trend, disrupting global employment rates and placing additional pressure on the manufacturing sector (Ibrahim, 2021). As the Ministry of International Trade and Industry (MITI) reported, the manufacturing sector was one of the hardest hits by the pandemic.

Analysts project that employment challenges will persist, making effective management strategies essential for addressing workforce stability (Ibrahim, 2021).

Internally, retaining talent has become increasingly important for organizational success. Organizations must foster employee engagement and enhance their attachment to the workplace (Alias et al., 2018). Leadership plays a pivotal role in this context, as it involves guiding and influencing employee behavior to achieve organizational objectives (Limsila & Ogunlana, 2008). Leaders must address challenges such as labour shortages, evolving worksite protocols, and employee morale, particularly in the wake of the pandemic (Mercer, 2021). Therefore, this research focuses on identifying the internal factors that influence employees' intention to stay within the E&E manufacturing sector, particularly in multinational corporations (MNCs) located in Penang and Kedah.

Employee turnover incurs significant costs for organizations. Beyond the loss of valuable human capital, which is essential for driving innovation and growth (Valenti & Horner, 2019), turnover results in financial and operational burdens. Organizations face substantial expenses related to recruiting, hiring, training, and onboarding new employees (Harris, Lavelle, & McMahan, 2018). Estimates suggest that replacing an employee can cost approximately half of their annual compensation (Voon et al., 2011). High turnover also disrupts productivity, affects customer relationships, and undermines organizational stability (Reina et al., 2018).

Studies indicate that Malaysian employees are more likely to leave their jobs due to low job satisfaction, limited career advancement opportunities, inadequate rewards, and poor leadership (Randstad Euromonitor, 2019). These findings highlight the urgent need for robust retention strategies to address these issues and strengthen organizational success. Effective retention strategies include fostering a sense of belonging, enhancing motivation through rewards and recognition, and aligning leadership practices with employee needs (Maaitah, 2018).

Consequently, this study aims to examine the influence of leadership styles on employees' intention to stay, with a particular focus on the moderating role of reward and recognition. Specifically, the research objectives are to determine whether transformational leadership influences intention to stay, to evaluate the impact of transactional leadership on intention to stay, and to investigate whether reward and recognition moderate the relationship between leadership styles and intention to stay among employees in Malaysia's manufacturing sector.

## Literature Review

### *Intention to Stay*

Intention to stay refers to the commitment and dedication of employees to remain with an organization over the long term while actively contributing to its objectives. Rissanen (2017) defines it as the willingness of employees to engage with their organization and maintain their tenure. Agarwal et al. (2012) suggest that employees who experience a sense of belonging, and engagement develop positive emotions, making them less likely to leave their workplace. Similarly, Aslam and Safdar (2012) and Johari et al. (2012) highlight that the intention to stay can be conceptualized as the opposite of the intention to leave, which serves as a measure of employee retention.

The significance of retention strategies lies in their ability to enhance employees' intention to stay, thereby minimizing the high costs associated with turnover. Turnover-related expenses include recruitment, onboarding, and training, all of which impose significant financial and operational burdens on organizations (Eketu & Ogbu, 2015). Noor et al. (2020) emphasized that organizations must prioritize retaining experienced and talented employees, particularly during crises such as the COVID-19 pandemic, to ensure business continuity. Thus, understanding the factors influencing employees' intention to stay is critical for addressing workforce challenges, especially in the manufacturing industry.

### *Transformational Leadership Style*

Transformational leadership is characterized by a leader's ability to inspire and motivate employees, fostering extraordinary performance and personal growth. Robbins and Coulter (2007) define it as a leadership approach that drives employees toward achieving long-term organizational goals. According to Avolio and Bass (2004), transformational leadership comprises four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Leaders with idealized influence earn respect and admiration from their followers, serving as role models who embody organizational values. Inspirational motivation refers to a leader's ability to instil enthusiasm and encourage employees to exceed expectations while remaining committed to shared objectives. Intellectual stimulation is evident in leaders who foster creativity and innovation by challenging conventional approaches and promoting new ideas. Individualized consideration is demonstrated when leaders act as mentors, addressing employees' unique needs and supporting their personal and professional development in a nurturing work environment.

Transformational leadership is inherently focused on intrinsic motivation and long-term objectives. Such leaders cultivate a trusting and supportive workplace environment that enhances employee engagement and commitment. By prioritizing individual growth and fostering a shared vision, transformational leaders significantly influence employees' intention to stay (Engelen et al., 2015).

### *Transactional Leadership Style*

Transactional leadership, in contrast, emphasizes an exchange-based approach, wherein leaders motivate employees by clearly defining expectations, evaluating performance, and offering rewards or penalties based on outcomes. Bass (1985) described this leadership style as a directive approach that secures alignment between leader and employee objectives to achieve organizational goals. Transactional leadership is underpinned by three components: contingent reward, active management by exception, and passive management by exception. Leaders employing contingent rewards incentivize employees to meet performance targets while issuing criticism for underperformance. Active management by exception involves close monitoring of progress, with leaders intervening promptly to address issues and reinforce performance standards. In contrast, passive management by exception reflects a reactive approach, where leaders intervene only when critical issues arise.

Transactional leaders ensure that employees' efforts are aligned with organizational objectives by establishing structured exchanges and fostering accountability. This leadership approach

not only clarifies roles and expectations but also enhances employee motivation through tangible rewards and performance-based evaluations (Deichmann & Stam, 2015).

***Reward and Recognition***

Reward and recognition are fundamental mechanisms for enhancing employees' intention to stay within an organization. Rewards are typically associated with financial compensation, tangible benefits, or services provided in exchange for employee contributions (Malhotra, Budhwar, & Prowse, 2007). Recognition, on the other hand, refers to formal or informal expressions of appreciation for an employee's achievements, emphasizing their value to the organization (Akafo & Boateng, 2015).

Both monetary and non-monetary rewards play a pivotal role in fostering loyalty and motivation. Organizations that implement structured systems for evaluating and rewarding performance create a stronger sense of attachment among employees (Nathaniel et al., 2010). Additionally, opportunities for career growth, competitive compensation packages, and supportive workplace cultures have been identified as key factors contributing to job satisfaction and retention (Ghosh et al., 2013).

***Transformational Leadership Style and Intention to Stay***

Transformational leadership has been shown to positively influence employees' intention to stay by fostering a sense of trust, motivation, and alignment with organizational goals. Leaders who emphasize long-term growth and shared values encourage employees to prioritize collective success over personal interests (Bass, 1985). Research by Chen and Wu (2017) found that transformational leadership strengthens leader-employee relationships, thereby enhancing employees' intention to remain within an organization. Similarly, Wells and Peachey (2011) observed a negative correlation between transformational leadership and turnover intention, suggesting that this leadership style effectively reduces attrition. These findings support the hypothesis that transformational leadership positively impacts employees' intention to stay.

***Transactional Leadership Style and Intention to Stay***

Transactional leadership also contributes to employees' intention to stay by providing clarity, structure, and tangible incentives. Leaders who define expectations and link rewards to performance outcomes create an environment where employees feel motivated to remain engaged. Sobaih (2020) demonstrated that transactional leadership positively influences retention in the tourism industry, while Ene (2020) reported similar findings in the insurance sector. These studies highlight the effectiveness of transactional leadership in maintaining workforce stability and reducing turnover.

***Reward and Recognition as a Moderator***

Reward and recognition have the potential to enhance the effectiveness of leadership styles in influencing employees' intention to stay. Transformational leaders who acknowledge employees' contributions and provide growth opportunities create a positive work environment that fosters satisfaction and commitment (Avolio & Bass, 2004). Similarly, transactional leaders who reward performance incentivize employees to meet expectations and remain

engaged (Sobaih, 2020). By addressing intrinsic and extrinsic motivators, reward and recognition strengthen the relationship between leadership and retention outcomes.

The study hypothesizes that transformational leadership style positively influences employees' intention to stay, transactional leadership style also positively influences employees' intention to stay, and reward and recognition strengthen these relationships by enhancing their overall impact.

## Methods

To achieve the research objectives, this study employed a quantitative approach to answer the research questions. Consistent with Loganathan (2013), the research utilized a descriptive design, incorporating statistical measures such as frequencies, means, and standard deviations. Hypothesis testing was conducted using correlation analysis to determine the influence of independent variables (transformational and transactional leadership styles) and the moderating variable (reward and recognition) on the dependent variable (intention to stay). The study adopted a cross-sectional design, collecting data at a single point in time, as outlined by Sekaran and Bougie (2013).

The unit of analysis was at the individual level, focusing on non-managerial employees in Electrical and Electronics (E&E) multinational corporations (MNCs) located in Kedah and Penang. A convenience sampling method, a type of non-probability sampling, was employed to target respondents who were readily available, yielding 132 voluntary participants from the identified population.

Kedah and Penang, recognized as industrial hubs in Northern Malaysia, host numerous prominent E&E MNCs. In Kedah's Kulim Hi-Tech Park, key corporations include Intel Kulim, Celestica, Fuji Electric, Integris, First Solar, and Infineon Technologies. Meanwhile, Penang features major industrial areas such as the Bayan Lepas Free Industrial Zone, home to AMD, Intel PG, Plexus, Renesas, Jabil, Osram, and Bosch. Other notable areas include the Perai Industrial Estate and Batu Kawan Industrial Park, which host firms like Flex, Honeywell, Sanmina, and Western Digital.

Data analysis was conducted using IBM SPSS Statistics version 26. Demographic profiles of respondents were analyzed descriptively, followed by an assessment of data quality through factor analysis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were used to confirm the suitability of the data for analysis, with commonalities exceeding the threshold value of 0.50 as per Principal Component Analysis. The reliability of the measurement instrument was tested using Cronbach's alpha, with values between 0.7 and 0.9 considered acceptable, in accordance with Golafshani (2003). Finally, regression analysis was performed to evaluate the hypothesized relationships among the variables.

The primary data collection instrument was a structured questionnaire, adapted from validated sources. Data were collected via an online survey platform, utilizing a five-point Likert scale to measure responses. The questionnaire was divided into four sections. Sections A and B focused on the independent variables, employing the Multifactor Leadership Questionnaire (MLQ Form5X) developed by Bass and Avolio (1995). This instrument measured

transformational leadership with 20 items and transactional leadership with 12 items. The MLQ has been extensively validated in prior research, including studies by Seyal and Rahman (2014) and Visvanathan et al. (2018).

Section C measured the moderating variable, reward and recognition, with four items adapted from Langford (2009). Section D focused on the dependent variable, the intention to stay, using three items also adapted from Langford (2009). Each item across all sections was rated on a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

**Table 1: A Summary Of The Measurement Instruments**

| Variable | Questionnaire Items Adopted from Previous Authors | No of Items | 5 Points Likert Scale |
|---|---|---|---|
| **Transformational Leadership Style** | Adapted from Bass and Avalio (1995) Multi-factor leadership questionnaire (MLQ) | 20 | 1 (Strong Disagree) 5 (Strongly Agree) |
| **Transactional Leadership Style** | Adapted from Bass and Avalio (1995) Multi-factor leadership questionnaire (MLQ) | 12 | 1 (Strong Disagree) 5 (Strongly Agree) |
| **Reward and Recognition** | Adapted from Langford P. H. (2009) | 4 | 1 (Strong Disagree) 5 (Strongly Agree) |
| **Intention to Stay** | Adapted from Langford P. H. (2009) | 3 | 1 (Strong Disagree) 5 (Strongly Agree) |

## Results

### *Demographic Profile of Respondents*

The demographic profile of the respondents revealed that 41.7% were male, while 58.3% were female. The majority of the respondents (28.8%) were aged between 36 and 40, followed by 19.7% between the ages of 21 and 25. In terms of ethnicity, 37.1% identified as Chinese Malaysians, 35.6% as Malay Malaysians, and 27.3% as Indian Malaysians. Regarding marital status, 49.2% of respondents were single, while 50.8% were married.

Job levels of the respondents included 40.9% at the officer level, 31.1% at the executive level, and 28% in other non-managerial positions. Salary levels indicated that 53% of respondents earned RM2,001–5,000 monthly, while 47% earned RM5,001–8,000. Education levels showed that 52.3% held certificates or diplomas, 34.1% held bachelor's degrees, and 13.6% had master's degrees. Most respondents had 1 to 5 years of experience in their current company (76.5%), while 23.5% had worked for 6 to 10 years. Geographically, most respondents were based in Penang, with 29.5% from Perai Industrial Estate, 25% from Bayan Lepas Free Industrial Zone, and 16.7% from Batu Kawan Industrial Park. An additional 28.8% were from Kulim Hi-Tech Park in Kedah.

### *Descriptive Analysis*

The descriptive statistics revealed a total of 132 valid responses. Among the independent variables, transformational leadership style (TFL) had the highest mean score of 4.55 with a standard deviation of 0.25, followed by transactional leadership style (TCL) with a mean score of 4.47 and a standard deviation of 0.29. The moderating variable, reward and recognition (RR) scored a mean of 4.52 with a standard deviation of 0.45. The dependent variable, intention to stay (ITS), scored the highest mean of 4.62 with a standard deviation of 0.47. A lower standard

deviation for TFL indicated that responses were more closely clustered around the mean, while a higher standard deviation for ITS showed greater variability in responses.

**Table 2: Descriptive Statistics**

| Constructs | N | Minimum | Maximum | Mean | Standard Deviation |
|---|---|---|---|---|---|
| **IV: Transformational Leadership Style (TFL)** | 132 | 1.0 | 5.0 | 4.5549 | 0.24610 |
| **IV: Transactional Leadership Style (TCL)** | 132 | 1.0 | 5.0 | 4.4678 | 0.28714 |
| **MV: Reward and Recognition (RR)** | 132 | 1.0 | 5.0 | 4.5208 | 0.45193 |
| **DV: Intention to Stay (ITS)** | 132 | 1.0 | 5.0 | 4.6187 | 0.47344 |

### *Factor Analysis*

The Kaiser-Meyer-Olkin (KMO) values for all variables exceeded the acceptable threshold of 0.50, confirming the adequacy of the sample size for factor analysis. Bartlett's Test of Sphericity showed statistically significant results ($p < 0.05$) for all variables, indicating that the data were suitable for factor analysis.

**Table 3: Kaiser-Meyer-Olkin (KMO) And Bartlett's Test Of Sphericity**

| Variables | Kaiser-Meyer-Olkin (KMO) | Bartlett's Test of Sphericity |
|---|---|---|
| | | p-value (Sig.) |
| **Transformational Leadership Style (TFL)** | 0.809 | 0.000 |
| **Transactional Leadership Style (TCL)** | 0.778 | 0.000 |
| **Reward and Recognition (RR)** | 0.763 | 0.000 |
| **Intention to Stay (ITS)** | 0.727 | 0.000 |

### *Factor Loading Analysis*

The values of factor loading (FL), composite reliability (CR), and average variance extracted (AVE) for each of the construct components are summarized in Appendix 1. Refer to Appendix 1. All constructs have a CR value ranging from 0.887 to 0.975, exceeding the suggested value of 0.7 by Hair et al., (2017). This indicates adequate convergence or internal consistency. The AVE obtained varies from 0.661 to 0.896, while Factor Loading for all items ranges from 0.524 to 0.973. This shows that both measurements are more than 0.5 indicating good convergent validity.

### *Reliability Analysis*

The Cronbach's alpha values for all variables exceeded 0.7, demonstrating high internal consistency and reliability. Transformational leadership style (TFL) had a Cronbach's alpha of 0.844, transactional leadership style (TCL) scored 0.839, reward and recognition (RR) scored 0.924, and intention to stay (ITS) scored the highest at 0.971.

**Table 4: Cronbach's Alpha Value**

| Variables | Cronbach's Alpha Value | Total Items |
|---|---|---|
| **Transformational Leadership Style (TFL)** | 0.844 | 20 |
| **Transactional Leadership Style (TCL)** | 0.839 | 12 |

| | | |
|---|---|---|
| **Reward and Recognition (RR)** | 0.924 | 4 |
| **Intention to Stay (ITS)** | 0.971 | 3 |

### *Regression Analysis*
### *Linear Regression Analysis*

The results of the linear regression analysis indicated that both transformational and transactional leadership styles significantly influenced the intention to stay (ITS). The ANOVA test showed a significance level of less than 0.05, confirming the model's validity.

Table 5 displays the coefficients, where transformational leadership style (TFL) had a standardized beta of 0.454 ($p < 0.001$) and transactional leadership style (TCL) had a standardized beta of 0.192 ($p = 0.045$). The variance inflation factor (VIF) values confirmed the absence of multicollinearity.

**Table 5: Multiple Regression Coefficients on IV**

| | Independent Variable (IV) | Standardized Coefficients Beta | P-Value | Collinearity Statistics VIF |
|---|---|---|---|---|
| **Model 1** | (Constant) | | 0.000 | |
| | TCL | 0.192 | 0.045 | 1.372 |
| | TFL | 0.454 | 0.000 | 1.372 |

### *Moderating Role of Reward and Recognition*

The moderating effect of reward and recognition (RR) on the relationships between leadership styles (TFL and TCL) and intention to stay (ITS) was not significant. As shown in Table 6, the p-values for both moderation models exceeded 0.05, indicating that reward and recognition did not moderate the relationships.

**Table 6: Moderating Effect of Reward and Recognition (RR)**

| Model | Moderator | $R^2$ | $R^2$ Changed | p-Value | Significance |
|---|---|---|---|---|---|
| **TFL*RR => ITS** | Moderator 1 | 0.134 | 0.009 | 0.263 | Not Significant |
| **TCL*RR => ITS** | Moderator 2 | 0.008 | 0.005 | 0.405 | Not Significant |

### *Summary of Findings*

Out of the four hypotheses tested, two were accepted, and two were rejected. Transformational leadership style (H1) and transactional leadership style (H2) were found to significantly and positively influence the intention to stay. However, reward and recognition did not moderate the relationship between transformational leadership style and intention to stay (H3) or transactional leadership style and intention to stay (H4). The results are summarized in Table 7.

**Table 7: Result And Summary of Hypotheses Testing**

| Hypotheses | p-value | Result |
|---|---|---|
| ***H1:*** **There exists a significant positive relationship between transformational leadership style and intention to stay.** | 0.000 | Accepted |

| | | |
|---|---|---|
| ***H2:*** **There exists a significant positive relationship between transactional leadership style and intention to stay.** | 0.045 | Accepted |
| ***H3:*** **Reward and Recognition moderates the relationship between Transformational Leadership Style and Intention to Stay** | 0.263 | Rejected |
| ***H4:*** **Reward and Recognition moderates the relationship between Transactional Leadership Style and Intention to Stay** | 0.405 | Rejected |

## Discussion

This study explored the relationship between leadership styles and employees' intention to stay, focusing on the moderating role of reward and recognition within the Electrical and Electronics (E&E) manufacturing sector in multinational corporations (MNCs) located in Northern Malaysia. The findings revealed that both transformational and transactional leadership styles positively influence employees' intention to stay, as evidenced by the acceptance of hypotheses H1 and H2. These results align with prior studies, such as Chen and Wu (2017), which identify leadership styles as reliable predictors of employee retention.

However, hypotheses H3 and H4, which tested the moderating role of reward and recognition, were not supported due to their insignificance ($p > 0.05$). This indicates that reward and recognition do not moderate the relationship between either leadership style and the intention to stay. Employees in this study demonstrated that they are inclined to remain in their organizations when their leaders exhibit transformational or transactional leadership styles, regardless of the level of rewards and recognition provided. This suggests that leadership that emphasizes empowerment, engaging work opportunities, and sustainable career growth may be more effective than leadership primarily focused on rewards and recognition.

The findings further highlight key leadership behaviors that influence employees' intention to stay. For transformational leadership, the highest factor-loading statements included: seeking diverse perspectives to solve problems, speaking optimistically about the future, instilling pride, expressing enthusiasm for goals, and dedicating time to teaching and coaching. These align with Tafvelin's (2013) findings, which demonstrate that transformational leadership fosters organizational well-being, dedication, and role clarity. Additionally, Weiß et al., (2016) research supports the notion that transformational leaders reduce effort-reward imbalances and enhance workplace satisfaction.

Transactional leadership also proved to be effective in this context. High factor-loading behaviors included: clarifying performance expectations, expressing satisfaction when targets are met, focusing on resolving complaints and errors, and meticulously tracking mistakes. These behaviors align with Sobaih's (2020) study, which emphasizes the significance of reward-based transactional leadership in fostering employee engagement. This study underscores the critical role of effective leadership in the Malaysian E&E manufacturing sector, which is a cornerstone of the country's economy. According to the Malaysia Investment Performance Report (2021), the E&E sector attracted the highest levels of investment, with Penang and Kedah leading the way. With the sector projected to contribute RM120 billion to Malaysia's GDP by 2025 under the 12th Malaysia Plan, fostering employee retention through effective leadership styles is essential for sustaining this growth.

## Implication Of The Study

### *Theoretical Implications*

This research contributes to the Transactional-Transformational Theory of Leadership by examining its application in employee retention within the E&E manufacturing sector. The findings provide a deeper understanding of the mechanisms by which leadership styles influence the intention to stay, with particular attention to the limited role of reward and recognition as a moderator. The study's insights can guide researchers in exploring employee turnover, retention strategies, and leadership styles more comprehensively in future studies.

### *Practical Implications*

The study offers actionable insights for practitioners, particularly in the manufacturing sector, where human capital is integral to economic growth. Managers and HR professionals can use these findings to refine strategies for talent retention, emphasizing leadership behaviors that foster empowerment, career development, and team pride. Recognizing the limited moderating role of rewards, organizations are encouraged to design comprehensive strategies that go beyond monetary incentives, addressing intrinsic motivations and creating meaningful career paths to retain top talent.

## Conclusion

The intention to stay of employees in E&E MNCs based in Penang and Kedah was investigated in this study. The impact of transformational and transactional leadership styles on the intention to stay was statistically significant, demonstrating that leadership styles can improve and enhance the intention to stay. Therefore, the H1 and H2 hypotheses are supported and accepted. Reward and recognition did not moderate the relationship between leadership styles and intention to stay in the moderating analysis. Thus, H3 and H4 are rejected for this study. The study's findings are useful for human resource managers to consider new ideas and tactics for improving procedures and policies in the manufacturing industry. As a result, it is found that both transformational and transactional leadership styles influence an employee's desire to stay, which gradually improves and becomes a stronger retention strategy to combat high turnover in the organisation. As per Kleinman, (2013) the employee's motivation can improve and promote employee retention in the organization through practical leadership skills and styles. Thus, it is essential for leaders or managers to identify their leadership approach to improvise to enhance employees' intention to stay in the organization.

## Limitations And Recommendations For Future Studies

One limitation of this study is the lack of a significant moderating effect of reward and recognition on the relationship between leadership styles and intention to stay. Future research could investigate the potential role of reward and recognition as a mediator rather than a moderator. Studies such as Ng and Salamzadeh (2020) have demonstrated that employee compensation and recognition can mediate the relationship between leadership and retention, especially among younger employees.

Additionally, this study was conducted during a period of significant workforce mobility, exacerbated by the COVID-19 pandemic. According to the Employment Hero report (HR Asia, 2021), 61% of Malaysian workers were planning to change jobs, with millennials (those under 35) leading this trend. Future studies should focus on the millennial generation (Generation Y)

to explore the unique factors influencing their intention to stay. Investigating whether the findings from this study are replicable in other sectors or geographical regions would also enhance the generalizability of the results.

Finally, researchers may investigate how hybrid or remote work models, which have become increasingly prevalent, impact leadership styles and employee retention in the post-pandemic era.

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## Appendix

### Appendix 1: Measurement Model Result

| Construct | Items | Communalities | CR | AVE |
|---|---|---|---|---|
| **TRANSFORMATIONAL LEADERSHIP STYLE (TFL)** | | **Factor Loading** | | |
| **1** | My manager re-examines critical assumptions to question whether they are appropriate | 0.889 | 0.975 | 0.662865 |
| **2** | My manager talks about his/her most important values and beliefs | 0.815 | | |
| **3** | My manager seeks differing perspectives when solving problems | 0.910 | | |
| **4** | My manager talks optimistically about the future | 0.925 | | |
| **5** | My manager instils pride in me for being associated with him/her | 0.911 | | |
| **6** | My manager talks enthusiastically about what needs to be accomplished | 0.933 | | |
| **7** | My manager specifies the importance of having a strong sense of purpose | 0.843 | | |
| **8** | My manager spends time teaching and coaching | 0.930 | | |
| **9** | My manager goes beyond self-interest for the good of the group | 0.633 | | |
| **10** | My manager treats me as an individual rather than just as a member of a group | 0.773 | | |
| **11** | My manager acts in ways that build my respect | 0.714 | | |
| **12** | My manager considers the moral and ethical consequences of decisions | 0.741 | | |
| **13** | My manager displays a sense of power and confidence | 0.800 | | |
| **14** | My manager articulates a compelling version of the future | 0.671 | | |
| **15** | My manager considers me as having different needs, abilities, and aspirations from others | 0.736 | | |
| **16** | My manager gets me to look at problems from many different angles | 0.643 | | |
| **17** | My manager helps me to develop my strengths | 0.771 | | |
| **18** | My manager suggests new ways of looking at how to complete assignments | 0.892 | | |
| **19** | My manager emphasizes the importance of having a collective sense of mission | 0.841 | | |
| **20** | My manager expresses confidence that goals will be achieved | 0.802 | | |

| | TRANSACTIONAL LEADERSHIP STYLE (TCL) | Factor Loading | CR | AVE |
|---|---|---|---|---|
| **1** | My manager provides me with assistance in exchange for my efforts | 0.524 | 0.961 | 0.675891 |
| **2** | My manager fails to interfere until problems become serious | 0.800 | | |
| **3** | My manager focuses attention on irregularities, mistakes, exceptions and deviations from standards | 0.740 | | |

| | | |
|---|---|---|
| **4** | My manager discusses in specific terms who is responsible for achieving performance targets | 0.835 |
| **5** | My manager waits for things to go wrong before taking action | 0.830 |
| **6** | My manager makes clear what one can expect to receive when performance goals are achieved | 0.964 |
| **7** | My manager shows that he/she is a firm believer in "If it isn't broke, don't fix it" | 0.782 |
| **8** | My manager demonstrates that problems must become chronic before taking action | 0.772 |
| **9** | My manager concentrates his/her full intention on dealing with mistakes, complaints, and failures | 0.867 |
| **10** | My manager keeps track of all mistakes | 0.969 |
| **11** | My manager directs my attention toward failures to meet standards | 0.779 |
| **12** | My manager expresses satisfaction when I meet expectations | 0.910 |

| **REWARD AND RECOGNITION (RR)** | | **Factor Loading** | **CR** | **AVE** |
|---|---|---|---|---|
| **1** | I am satisfied with the income I receive. | 0.834 | 0.887 | 0.662508 |
| **2** | I am satisfied with the benefits I receive. | 0.785 | | |
| **3** | I am recognized for my contributions. | 0.817 | | |
| **4** | The rewards and recognition I receive from this job are fair. | 0.819 | | |

| **Intention to Stay (ITS)** | | **Factor Loading** | **CR** | **AVE** |
|---|---|---|---|---|
| **1** | I am likely to be still working in this organisation in 2 years. | 0.973 | 0.963 | 0.895561 |
| **2** | I would like to be still working in this organisation for 5 years. | 0.912 | | |
| **3** | I can see a future for me in this organisation. | 0.953 | | |

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# PERCEIVED GREEN TRAINING AND DEVELOPMENT AND EMPLOYEE RETENTION IN HIGHER EDUCATION INDUSTRY: THE ROLE OF SUSTAINABLE ENVIRONMENT AS MEDIATOR

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***Abstract:*** *This study examined the perception of academicians on the effect of green training and development on employee retention of the higher education industry, taking the mediating function of sustainable environment on the association between those two variables. This study was conducted because there was little attention given to the effects of green training and development and sustainable environment on employee retention, primarily in the Malaysian Private Higher Education Institution (PHEI) perspective. The Social Science Statistical Package (SPSS) and Partial Least Squares Structural Equation Modelling (PLS-SEM) application were used for data analyses involving 118 respondents. The outcomes provided significant findings: First, there were significant effects of green training and development on employee retention as well as on sustainable environment. Secondly, there was a significant influence of sustainable environment on employee retention. Thirdly, green training and development effect on employee retention were indirectly affected by sustainable environment. Further, the study discussed the contributions and recommendations based on the significant findings. In conclusion, green training and development among PHEIs' employees should explain and align with sustainable environment of PHEI organizations. This will finally affect employees' intentions to stay longer and increase retention rate among them in serving the national higher education industry efficiently.*

***Keywords:*** Employee Retention, Green Training and Development, Sustainable Environment, Social Exchange Theory, Private Higher Education Institution.

## Introduction

Employees are the main asset in an organization. High-quality employees are sought after by organizations because they can help to achieve the organization's objectives and optimal work performance (Sulaiman & Hussain, 2018). However, there are questions about the level of organization's ability to retain its employees, especially competent ones, and to what extent is it able to foster employee loyalty to the organization? Previous studies have explained that the percentage of job satisfaction among employees in Singapore and Malaysia is low, at 33 percent (Othman, 2019), which ultimately contributes to the decline in organizational productivity and increased employee turnover rates. With this, organizations need to improve human resource management practices such as offering attractive reward-based compensation systems, benefits and incentives, effective employee training and development practices, effective performance management and creating a conducive and safe work environment as well as the distribution of appropriate and fair rights to employees (Makhbul 2021).

Environmental factors play a significant role in determining the level of work engagement by employees in an organization or a company. In this case, an uncomfortable work environment, a lot of heavy workloads, and colleagues with diverse personalities will cause employees to feel stressed while doing their work (Ab. Latif, Kamisan & Mohd Din, 2018). In addition, a careless and indifferent attitude among employers who assume that the workplace atmosphere and environment are safe and comfortable, as well as a lack of understanding between employers and employees in an organization, have been identified as factors that contribute to the risk of accidents in the workplace (Maruthamuthu, 2015). Factors such as these will impact the turnover rate in an organization if these aspects are not taken into account by the employer and management (Ab. Latif, Kamisan & Mohd Din, 2018).

Retention of employees is related to the actions of employers to retain mainly their skilled and high-performing employees to continue serving the organization in the long term to ensure that the organization's goals are achieved (Erasmus et al., 2015; Zakaria et al., 2019). Employee retention is associated with employee loyalty to their organization which is translated through the maximum period of time employees remain serving their organization (Kossivi et al., 2016). Zakaria et al. (2019) explained that employee loyalty is assessed through the length of their service time contributed to the organization's needs and demonstrates a high commitment to their excellent work performance. The level of employee loyalty to the organization will increase through high job satisfaction such as awards for their work performance, or they are given work or tasks that are appropriate to their field and qualifications and receive guaranteed security while in the organization (Mutiria et al., 2015).

A successful organization is one that can retain its employees where a clear focus needs to be given so that the problem of employee turnover does not occur significantly. Therefore, organizations need to be sensitive and clearly identify factors that can increase employee loyalty to the organization and minimize employee turnover rates, especially among those who are talented and quality (Mutiria et al., 2015). Employee turnover is an employee who leaves the organization either voluntarily or involuntarily or moves to another organization (Abdul Aziz et al., 2019). Employee turnover is a work engagement issue that should not be taken lightly by an organization. This is because high employee turnover in an organization will

reflect that there is a problem occurring in the organization. Generally, the reason for employee turnover is the organization's failure to make a comprehensive strategic employee retention plan. Organizations that fail to provide job satisfaction and weaknesses in the organization's support system such as weak supervisory feedback, limited employee training and development, and low rewards are known to be the cause of employee termination or turnover (Sulaiman & Hussain, 2018). This occurs because employees feel neglected and less motivated to work. To reduce employee turnover, management needs to ensure that the tendency of employee turnover is at a level that is not serious and worrying in its organization (Ab. Latif, Kamisan & Mohd Din, 2018). Thus, green HRM mainly through green training and development is the most strategic tool to realize the employee turnover reduction (Islam et al., 2020; Mohamad & Abdul Majid, 2025).

## Literature Review

### *Employee Retention*

Employee retention is often focused around having enough human resources to carry out organizational tasks effectively. Having skilled and experienced workers is just as utilizing optimum resources as it is about electricity. It is helping to save many aspects of the internal organizational environment mainly. It can enhance meaningful social resources and reduce the loss of organization strategic and natural assets. In reality, employee retention increases the social or human capacity of organization and reinforces its sustainability performance (Mohamad Mazlan & Jambulingam, 2023). Most organizations in the world wanted to set up a sustainable environment for their employee retention strategy mainly who are talented. Focusing on the retention of quality employees by the organization leads to the organizational competitive edge achievement in the market (Gadi & Kee's, 2018). There are undoubtedly praiseworthy initiatives, but there are often flaws in the execution of the creation of a sustainable environment. Organizations in developing and underdeveloped countries have a strong cultural expectation to easily adapt their businesses and industries towards employee retention performance, but they have constraints to set up proper strategies and policies in their respective businesses and industries.

Organizations must have strategies to retain performance-oriented employees in order to minimize the employee turnover level. In retaining the employees, organizations should give employees the appropriate strategies such as career development, conducive working environment, attractive compensations and rewards, support of supervisor and work- life balance. Satisfied employees are highly committed to their jobs and serve the best for the organization (Nawangsari & Sutawijaya, 2019). Importantly, the strategy starts with recruit the suitable and qualified individuals and providing them the right training and development to enhance their loyalty and performance. In consequence, retaining employees is beneficial than employ new ones (Bibi et al., 2018). Applying new hires is a challenging task that needs much time and money (Sharma, 2016). The performance of organization operations can suffer, and the cost of lost opportunities can move up if new employees recruitment is performed throughout the year.

***Green Human Resource Management (Green HRM) and Green Training and Development***

There are several factors that can influence employee retention in PHEIs such as human resource management, leadership, work environment and organizational policies. Green HRM factors are seen to be closely related to employee retention. Issues of termination of PHEI lecturers are seen to be related to the possibility of weaknesses in the organization's green HRM. Often in the matter of sustainability of social criteria variables, the role of green predictor factors is more relevant in influencing it and able to solve the sustainability issues that occur (Li et al., 2020). Therefore, PHEIs green HRM can be an important strategy where green practices in human resource management are able to improve PHEIs in retaining existing Green HRM is centered on the concept of environmental balance in the organization with employees as a whole (Aravamudhan, 2012). More specifically, according to Mandip (2012), green HRM refers to the implementation of human resource management policies towards stimulating the effective use of organizational resources in preserving the environment.

In this study, the measurement of predictor factor of green human resource management focuses on its practice that is seen significantly related to the termination and turnover of employees at PHEIs. The relevant green HRM practice that is meant is green training and development. It refers to a process of constructing education and fostering awareness among

employees and embedding sustainable environment objectives and goals into the organization's bigger future plan (Yusoff et al., 2020). Ullah (2017) defines green training and development as activities to serve as a path for improving employees' green abilities on the relatedness of environmental sustainability. Therefore, this practice involves conducting programs such as seminars, workshops and conferences to equip employees with relevant green knowledge, skills and attitude in contributing to effective and efficient environmental conservation and preservation (Fapehunda et al., 2022). Previous studies such as Bekhit et al. (2023) confirmed the effect of green training and development on employee retention among 70 respondents of human resource managers in the automotive industry in Egypt. In the perspective of a study of new millennial generation employees in a state-owned enterprise in Bali, Indonesia, a study of 90 respondents found that green training had a negative impact on the desire to quit, so they wanted to stay with their current organization (Gunawan Malau et al., 2024).

Meanwhile, according to Jabbour (2016), green training and development can increase employee awareness, perception, knowledge, and skills in supporting environmentally friendly initiatives in the workplace. Green training programs should prioritize activities that give employees the desire to deepen their environmental protection skills and be sensitive to environmental problems because they are necessary in achieving the goals of the ecological system (Jabbour, 2012).

H1: Green training and development has positive and significant impact on employee retention.

***Sustainable Environment***

Apart from green human resource management practices, a sustainable environment and atmosphere is also linked to the issue of employee retention (Malinis & Tan, 2024) which can be happened in the context of PHEI. Unsustainable environments, for example, can cause various effects such as work stress, job dissatisfaction, unfriendly employee relations, low work engagement and can ultimately contribute to employee termination (Padmavathi, 2023). A sustainable environment means efforts towards the use of organizational resources that do not damage the environment while not affecting employee health and at the same time foster an employee-friendly and productive environment. A sustainable environment can be developed by various factors. Clearly, green training and development of human resource management is an important factor in influencing the existence of a sustainable environment in an organization (Mishra, 2017) especially at PHEI organizations. According to Fapohunda et al. (2022), green training and development has been recognized as a real mechanism for tackling environmental challenges. It is also a main element for encouraging the acceptance of environmental preservation in the organization by helping the formation of a win-win situation between management and employees in the long run. In their study that involved 175 employees from WAMPO Nigeria Plc., the result revealed that practicing green training and development leads environmental awareness which finally would affect environmental sustainability. They argued that green training and development is an important tool to foster environmental consciousness among the employees in attaining organizational sustainable development goals.

H2: Green training and development positively and significantly influence sustainable environment.

The role of the sustainable environment mainly through conducive work environment has also been proven to have a positive impact on employee retention through a study by Muturu and Mose (2019). This study involved 316 respondents among supermarket employees in Kenya. The relationships and effects explained are suitable for this study, making the sustainable environment a mediating variable to the effect of green human resource management practices such as green training and development on employee retention in the context of academic staff at PHEI. Its role as a mediator of the study is further strengthened by the study of Lin (2024) which states that green human resource management has emerged as a meaningful field because it focuses on the development of business strategies oriented towards environmental sustainability that can effectively retain skilled workers. For example, employing green training and development in green HRM practices can increase employees knowledge and attitudes towards green behavior where employees are always sensitive to each other and act in an environmentally friendly context, namely maintaining a harmonious, conducive and clean work environment (Sarip et al., 2021). In other words, it is able to create an environment in which extrinsic and intrinsic properties contribute to the sustainability of the organization as a whole.

H3: Sustainable environment has a positive and significant impact on employee retention.

H4: Sustainable environment mediates the effect of green training and development on employee retention.

***Social Exchange Theory***

Investigating the role of green HRM in influencing sustainable environment and employee retention among the staff in PHEI perspective is underpinned by a famous theory namely The Social Exchange Theory (SET) by Blau (1964). Basically, SET emphasizes the norm of reciprocity, which states that one party behaves with good manners and does not harm those who show good (Cropanzano & Mitchell, 2005). This norm predicts that HRM roles, such as recognition, empowerment, investment in human assets and other favors will be returned. Therefore, the valuable HRM practices are anticipated to provide the formation of a dyadic relationship that motivates employees reciprocate with constructive attitudes and behaviors.

Green HRM for this study refers to its practice namely green training and development. According to Islam et al. (2020), green HRM through green training and development mainly could significantly promote employee retention. It assists an organization to inspire the retention among employees. It is an interesting scenario when employees perceive green training and development as a source of cognitive and affective solidification, and motivation through job satisfaction and higher work performance (Jing Xie et al., 2023) including staying longer with their organization. Referring to the concept of SET, when the academicians obtain beneficial green HRM through green training and development with adequate environment-based knowledge transfer, practicing for sustainable environment, make them feel comfortable and grateful at workplace. This can lead to a sort of sense of obligation among them to act back on the resources and benefits received with the plan of continuing with the organization. Indirectly, this would affect the higher commitment and willingness to work longer with the organization.

***Research Framework***

This paper derives a conceptual framework (See Figure 1) from the literature review as discussed above as well as from the theoretical assumption as addressed in Social Exchange Theory by Blau (1964).

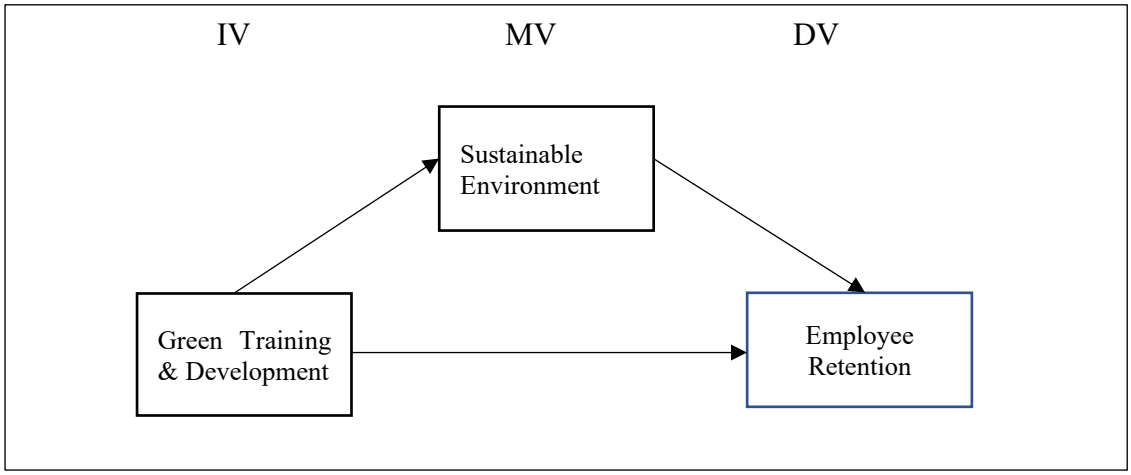



**Figure 1: Conceptual Framework**

## Methodology

### *Research Design*

This study was performed in terms of cause-and-effect study by testing a model in employee retention concentrating academic staff at PHEIs. This employee retention can be affected by antecedent factors, namely green training and development and a sustainable environment. All three aspects are important determinant to the sustainability at PHEIs in realizing the national higher education motive in the context of knowledgeable citizens. As stated by Mohd Ghazali and Ismail (2013), the process of retaining employees is related to a talent management philosophy that allows strong support from the management level.

Research design is a way to collect and analyze accurate data. The statistical methods are used to yield acceptable results and meet targeted goals (Montgomery, 1997). It is the idea where questions produced from theoretical or policy discussions are changed into feasible research projects that give results to the questions. A research design is chosen because it is the main level in a research project to determine the whole research structure (Hall, 2008). This study is a quantitative approach to which a questionnaire is used for a survey purpose. Using individuals as the unit of analysis, questionnaires were distributed to the respondents to gain proper and complete data for further analyses.

This study used the cross-sectional study approach in distributing questionnaires. It is the key principle for data collection that takes a single period of time to evaluate the relationship and effect of green training and development on employee retention. Importantly, this approach can involve literacy factors on employee retention, interview sessions, pilot studies and actual studies based on correct and fair data collection (Cresswell, 2014; Sekaran & Bougie, 2020).

### *Population and Sampling*

The estimated population for this study is 4,684 academicians working at PHEIs in the northern states of the Malaysia Peninsular (Census up to 31 December 2024). Stratified random sampling method (sampling proportion equal to the population for each stratum) was used to collect data on a total sample of 107 academic staff based on the G-Power sampling determination technique. However, an increase of 40% of the sample for each stratum was made to ensure that the questionnaire response reached a minimum of 107 total samples. The sampling frame of this study focused more on academic staff who were knowledgeable, skilled, experienced and experts in the field of higher education.

### *Instrument Development and Data Collection*

The selection of data collection methods is a critical stage to avoid bias and distrust (Connaway & Powell, 2010). This study used a self-administered questionnaire to collect primary data. The researcher will design a set of questionnaires that will be distributed to respondents. The questionnaire was structured by including the demographic profile of the informant and items on each variable. All items use a Five-Point Likert Scale with five (5) answer options starting from 'Strongly Disagree' (1) to 'Strongly Agree' (5). Instrument sources from previous studies were adapted to this study to build a measurement scale for each construct in the study. With primary data, it allows reporting on a situation to be recorded quickly. Without this recorded data, it is difficult to understand a situation even in the simplest phenomenon, and it is difficult to convey facts to others (Walliman, 2011).

### *Analysis Techniques*

Statistical Package for Social Science (SPSS) version 23.0 and Structural Equation Modeling technique through Partial Least Squares (PLS) software were used to analyze data from the questionnaire. Descriptive and inferential analyses were carried out and were suitable for evaluating the study constructs, especially the relationships and influences between the constructs and the usefulness of the data set collected (Creswell, 2014).

## Analyses And Results

### *Descriptive Analysis*

About 200 questionnaires were distributed to the academic staff of PHEIs and the total of final returned were 118, giving 59% of response rate. As suggested by Wu et al., (2022), this study has achieved above the response rate which is above 44.1%. Table 1 illustrates the result of respondents' demographic profiles.

**Table 1: Demographics Profiles of Respondents (N = 118)**

| No | Demographics Profile | Frequency | Percenatage (%) |
|---|---|---|---|
| 1 | **Gender:** | | |
| | Male | 48 | 40.7 |
| | Female | 70 | 59.3 |
| 2 | **Age (Years Old):** | | |
| | 18-30 | 35 | 29.7 |
| | 31-40 | 46 | 39.0 |
| | 41-50 | 26 | 22.0 |
| | 51-60 | 8 | 6.8 |

| | | | |
|---|---|---|---|
| | >60 | 3 | 2.5 |
| 3 | **Race:** | | |
| | Malay | 101 | 85.6 |
| | Chinese | 12 | 10.2 |
| | Indian | 5 | 4.2 |
| | Others | 0 | 0 |
| 4 | **Religion:** | | |
| | Muslim | 104 | 88.1 |
| | Budhist | 9 | 7.6 |
| | Hinduism | 2 | 1.7 |
| | Christian | 3 | 2.5 |
| | Others | 0 | 0 |
| 5 | **Marriage:** | | |
| | Married | 69 | 58.5 |
| | Bachelor/ Single | 49 | 41.5 |
| 6 | **Working Period at the Institution (Years):** | | |
| | < 5 | 52 | 44.1 |
| | 5-10 | 22 | 18.6 |
| | >10 | 44 | 37.3 |
| 7 | **Service Category:** | | |
| | Professor | 1 | 0.8 |
| | Assoc. Proffesor | 2 | 1.7 |
| | Senior Lecturer | 18 | 15.3 |
| | Lecrurer | 74 | 62.7 |
| | Others | 23 | 19.5 |
| 8 | **Appointment Status:** | | |
| | Permanent | 70 | 59.3 |
| | Contract | 39 | 33.1 |
| | Part-Time | 9 | 7.6 |
| 9 | **Higher Qualification:** | | |
| | Doctorate | 12 | 10.2 |
| | Master's Degree | 48 | 40.7 |
| | Bachelor's Degree | 45 | 38.1 |
| | Others | 13 | 11.0 |

***Measurement Model of PLS SEM***

Measurement model test of PLS-SEM analysis is conducted on questionnaire items of the latent variables. Using this model, this study assessed a convergent and discriminant validity tests on all studied variables to prove the appropriate measurement model fit. As shown in Table 2, the factor loading of three studied variables' items; green training and development, sustainable environment and employee retention are above the threshold value of 0.6. The Cronbach Alpha (CA) for all variables are above 0.7. The Composite Reliability (CR) values for all measured variables indicate above 0.7. Importantly, the AVE (Average Variance Extracted) value should be more than 0.5; Green training and development (0.646), sustainable environment (0.708), and employee retention (0.626). These values meet the guideline of determination of items

validity (T. Ramayah e al., 2018). Thus, those results approve the indicator of variables' reliability and consistency.

**Table 2: Validity Test**

| Variables | CA | CR | AVE |
|---|---|---|---|
| **Green Training & Development** | 0.860 | 0.867 | 0.646 |
| **Sustainable Environment** | 0.897 | 0.906 | 0.708 |
| **Employee Retention** | 0.880 | 0.882 | 0.626 |

Table 3 below shows the values for discriminant validity by using the Heterotrait-Monotrait Ratio of Correlations (HTMT). The purpose is to check how far a construct is not correlate from other related tests of different constructs (Hair et al., 2022). As accepted, the cut-off value of HTMT is 0.90 that means the correlation value between variables exceeds 0.90 indicates discriminant validity (Henseler et al., 2015). Table 3 proves the HTMT values generated are free of discriminant validity. This is due to all values are lower than 0.90.

**Table 3: Heterotrait-Monotrait Ratio of Correlations (HTMT)**

| | Employee Retention | Sustainable Environment | Green Training and Development |
|---|---|---|---|
| **Employee Retention** | | 0.787 | 0.634 |
| **Sustainable Environment** | 0.787 | | 0.526 |
| **Green Training & Development** | 0.634 | 0.526 | |

***Structural Model***

Before analyzing regression test for answering hypotheses and other associated tests, this study tested collinearity level using variance inflation factor (VIF). According to Hair et al. (2022), this is the test to evaluate the correct path coefficient estimations between studied variables. For VIF value less than 5.0, it indicates the existing of free multicollinearity issue (Hair et al., 2019). Table 4 illustrates the acceptable VIF value for each variable tested which proves free multicollinearity threat.

**Table 4: Collinearity Test (VIF)**

| | Employee Retention | Sustainable Environment | Green Training & Development |
|---|---|---|---|
| **Employee Retention** | | 1.277 | 1.000 |
| **Sustainable Environment** | 1.277 | | |
| **Green Training & Development** | 1.277 | 1.000 | |

In answering the hypotheses as mentioned before, this study proceeded to bootstrapping analysis to analyze direct and indirect effects between studied variables. Structural Model analysis as depicted in Figure 2 and Table 5 provide the results. Green training and development had an impact on employee retention (β=0.285, p<0.05, t = 2.691) as well as sustainable environment that affected employee retention positively and significantly (β=0.575, p<0.05, t = 5.765). Besides, green training and development had a positive and significantly influences sustainable environment (β=0.466, p<0.05, t = 6.838). Interestingly, it

is found that the relationship between green training and development and employee retention successfully mediated by sustainable environment (β=0.268, p<0.05, t = 4.462). Thus, all the determined hypotheses are accepted.

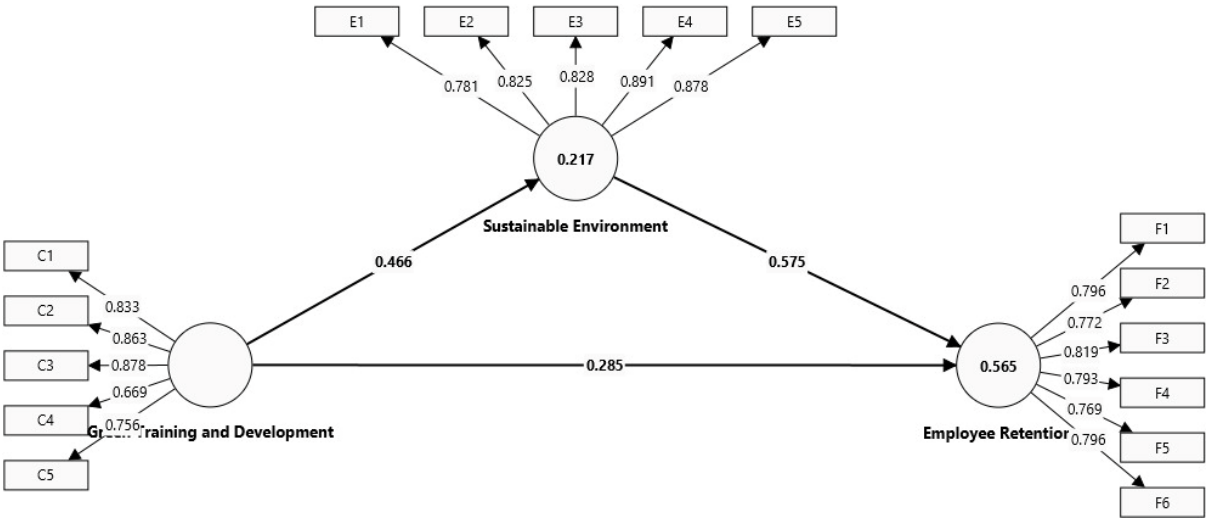



**Figure 2: The Structural Model of PLS-SEM**

**Table 5: Path Analysis Results**

| | β | t | *p* | Results |
|---|---|---|---|---|
| **GT&D>ER** | 0.285 | 2.691 | 0.004 | H1 Supported |
| **GT&D>SE** | 0.466 | 6.838 | 0.000 | H2 Supported |
| **SE>ER** | 0.575 | 5.765 | 0.000 | H3 Supported |
| **GT&D>SE>ER** | 0.268 | 4.462 | 0.000 | H4 Supported |

Note: GT&D = Green Training & Development
ER = Employee Retention
SE = Sustainable Environment

Analyzing both direct and indirect effects gave the $R^2$ result for each path. Figure 2 shows $R^2$ = 0.565 with p = 0.000 for employee retention and $R^2$ = 0.217 at p = 0.001 for sustainable environment. It is found that 56.5% variance of employee retention is explained by green training and development and sustainable environment, besides, 21.7% variance in manifestation of sustainable environment in PHEIs is explained by green training and development. Both $R^2$ values are substantial and weak respectively as suggested by Hair et al. (2022).

## Discussion

The findings of the relationship and impact of green training and development and sustainable environment on employee retention are the fundamentals to achieve the main objective of this study. Green training and development, sustainable environment and employee retention create a sense of success and advantages of improving employees turn over perspective in the PHEIs. Employees retention allows external parties to perceive in a pleasant manner that indicates high performance and competitive advantage performed by the PHEIs by having loyal and committed workforce mainly among the talents. It was found from this study that sustainable environment has a significant effect in mediating the impact of green training and development on employees retention. Having green environment that portrays conducive, save, friendly, cooperative and proper workplace layout would increase the academicians' motivation and their jobs satisfaction which leads to their intention to stay longer in the institutions. In addition, green training and development initiated by the green HRM play significant roles in enhancing employees environmental based skills, knowledge and attitudes towards sustainable environment development.

Consequently, the research established that sustainable environment did act as determinant as well on employees retention as perceived by the academicians. The respondents claimed that there will be a low effect on employees retention if the PHEIs neglect to focus on strategies such as green training and development and also sustainable environment. Highly sensitive to the employees needs and perceptions are the essential implications of green training and development that lead to high sustainability performance and serve the best to the retention of employees. Thus, this contributes to the highly positive academicians' perceptions and acceptance solutions. The results of this study are supported by previous research by Tariq and Altaee (2023) and Ullah (2017) which have proven that green training and development has a direct significant impact on sustainable environment. For the impact of sustainable environment on employees retention, researches by Padmavathi (2023) and Lee et al. (2023) support this finding. While, other findings by Islam et al. (2020; 2022) have proven that green training and development promoted employees retention as well.

## Contributions and Recommendations

The study shares some new ideas in the field of employee retention in the context of PHEI academician. Therefore, it would be significant for future study and higher learning institutions to take consideration from the following discussions. Future researchers should further conduct the study to use more relevant and huge coverage of respondents to improve consistency of the results. In terms of theoretical implication, this study has proven that Social Exchange Theory is applicable to underpin the effect of green training and development on sustainable environment and employee retention. Subsequently, sustainable environment also influences employee retention significantly. The employees will be more comfortable and satisfied if the HRM of organization is mainly able to demonstrate its capability in providing green HRM practices such as green training and development as possible strategy for sustainable organization environment. These are the most influential determinants in this research which have revealed that employee retention among academicians can be successfully yielded through sustainable environment as potential catalyst.

The study also recommends strategies for improving employees retention for PHEIs staff themselves and private higher education providers. Such strategies are the management needs to provide concrete green HRM competencies training and development in terms of HRM

strategic practices mainly green training and development to be equipped by the HRM management and practitioners as a process of training of trainers before they share the skills, knowledge and attitude pertaining environmental awareness and responsibility. Besides, the academicians and other staff also should behave environmentally and portray themselves with those characteristics such as practicing energy preservation at workplace, supporting friendly environment and prioritizing occupational safety and health because this is the determinant basis for having motivated, satisfied, committed, creative and innovative employees who are benefited from the quality green training and development and finally disclose high level of loyalty and retention among them. Apart from that, the findings also may be meaningful as awareness to other related parties such as related organization's functional departments (marketing, finance, student affairs) and the policy makers of higher education providers in giving full support and action to the nurture of green training and development from the efforts of HRM.

## Conclusion

This study fully reached its targeted objectives. Importantly, from the perspective of PHEI academician, the findings revealed that sustainable environment significantly mediate the impact of green training and development on employee retention. This finding was underpinned by Social Exchange Theory. The study proposes that further consideration based on academicians' needs for making them stay longer with PHEIs should be given by HRM and other related functional departments in serving them for their retentions. This will enable green training and development to be performed perfectly to them. Academicians are likely to feel satisfied and committed with their institutions when there are new green concepts, contents and approaches applied in training and development to them. This contributes to the practices and creation of sustainable environment for the PHEI organizations. In principle, those who are involved as management team and policy makers in private higher education industry should be sensitive to and motivated to support the green and sustainability strategies initiated by the HRM. This is because finally, there will be a result of the high employee retention potential among academicians.

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# UNAUTHORISED POLYGAMY OFFENCES: A STUDY IN THE SYARIAH COURTS OF SELANGOR

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***Abstract:*** *Polygamy refers to a marital arrangement that allows a man to have more than one wife at any given time. Within the legal framework of Malaysia, Muslim men are permitted to practise polygamy in accordance with Islamic law. Nevertheless, the law requires that prior authorisation be obtained from the Syariah Court before entering into a polygamous marriage. Failure to comply with this requirement may result in prosecution for the offence of unauthorised polygamy. Statistics indicate that such offences are increasingly prevalent in the State of Selangor. This study aims to elucidate the concept of polygamy from an Islamic perspective and to analyse the legal framework governing polygamy in Selangor. The study also examines the factors contributing to the occurrence of unauthorised polygamy and the resulting implications, and subsequently proposes recommendations for addressing these issues. Methodologically, this research adopts a qualitative approach through document analysis involving books, journals, statutory provisions, and court records. In addition, semi-structured interviews with several syariah legal practitioners were conducted to obtain supplementary empirical insights. The findings reveal that the primary factors contributing to unauthorised polygamy include stringent legal procedures and the inability to obtain consent from the first wife. The study also finds that unauthorised polygamy may give rise to negative implications, such as the risk of unregistered or invalid marriages, infringement of wives' rights, and complications relating to the verification of lineage and the registration of children's births. Accordingly, the study recommends that penalties for unauthorised polygamy be strengthened up to the maximum statutory limit, alongside increased public awareness through education and advocacy programmes to curb the rising number of such cases in Selangor.*

***Keywords:*** *Matrimonial Offences, Unauthorised Polygamy, Syariah Court, Islamic Family Law Enactment, Family Institution.*

## Introduction

Marriage is an act of worship that is strongly encouraged in Islam, to the extent that the Prophet Muhammad PBUH stated that when a person enters into marriage, they have completed half of their religion. It represents one of the religious injunctions that acknowledges and honours the natural disposition (*fitrah*) of human beings to live in companionship (Wan Ismail et al., 2018). From the perspective of Islamic jurisprudence (*fiqh*), marriage refers to a contractual agreement (*akad*) that lawfully permits intimacy and companionship (*istimta'*) between a man and a woman (Al-Zuhaili, 1997), subject to specific pillars (*arkan*) and conditions (*shurut*) (Al-

Husaini, 1990), and effected through the use of prescribed expressions such as *inkah* or *tazwij*, or their valid equivalents (Al-Shatiri, 2020). The obligation and significance of marriage are clearly reflected in the Qur'anic injunction where Allah SWT said:

*O mankind! Fear your Lord, who created you from a single soul, and from it created its mate, and from them both spread many men and women. And fear Allah, through whom you ask one another, and [respect] the wombs. Indeed, Allah is ever, over you, an Observer.*

(Surah An-Nisa, 4:1)

This verse reminds humanity that they originate from a single soul, from which Allah created its spouse, and from the union of both came the proliferation of humankind. It underscores the obligation of *taqwa* (God-consciousness), the preservation of social and familial bonds, and the constant awareness that Allah observes all human conduct. The verse highlights the creation of human beings in pairs as both a divine blessing and a moral responsibility, forming the foundational basis for discussions on marriage in Islam (Suhaizad & Bernard, 2025).

The term *polygamy* originates from the Greek words *polus* (poly), meaning "many," and *gamos*, meaning "marriage," which together denote the concept of multiple marriages (Andi Intan, 2018). Some scholars also trace the concept linguistically to the Arabic terms *ta'addud* (multiplicity) and *az-zawjat* (wives), which collectively signify the practice of having multiple wives (M. Ichsan, 2018). From the perspective of *ijma'* (scholarly consensus), the leading *mujtahid* scholars across the Muslim world have generally regarded polygamy as a permissible and legitimate practice under Islamic law, particularly given that it was practised by the Prophet Muhammad PBUH and his companions (Mahmud Yunus, 1996).

The offence of polygamy without the permission of the Syariah Court constitutes a form of syariah matrimonial crime that arises when a second marriage is contracted without complying with the legal procedures stipulated under the Islamic Family Law Enactments of the Malaysian states. Matrimonial offences under Malaysian syariah law refer to legal provisions that regulate and enforce offences related to marriage among Muslims, including polygamy without court permission, marriage without authorisation from the relevant authority, divorce without lawful procedure, as well as offences relating to the marriage contract and registration of marriage (Suhaizad et al., 2025). These matrimonial offences are categorised as criminal cases under the jurisdiction of the Syariah Courts, where such offences may be prosecuted without the issuance of an arrest warrant and are punishable through court proceedings, typically by the imposition of penalties such as fines or imprisonment.

## Literature Review

### *Polygamy in Islam*

From a historical perspective, polygamy had been practised for thousands of years prior to the advent of Islam (Andi Intan, 2018). Historical evidence demonstrates that polygamy is not an institution exclusive to Islam; rather, it had been practised by various civilisations and societies, including those in Russia, Germany, India, China, Japan, as well as among the Hebrew and Arab communities. Within the Christian tradition itself, there was initially no explicit prohibition against polygamy in the Bible, and it was only after the influence of Greek and Roman cultural norms that monogamy became the dominant marital practice.

In Islam, the permissibility of polygamy is explicitly addressed through divine revelation. Allah SWT said:

*And if you fear that you will not deal justly with the orphan girls, then marry those that please you of [other] women, two, three, or four. But if you fear that you will not be just, then [marry] only one, or those your right hands possess. That is more suitable that you may not incline to injustice.*

(Surah An-Nisa, 4:3)

This verse provides clear guidance to men regarding polygamy, with justice towards wives and vulnerable parties particularly orphans as its central condition. If a man fears that he will be unable to uphold justice when marrying more than one wife, he is instructed to limit himself to a single marriage. The overarching objective of this provision is to prevent oppression and ensure the protection of rights for all parties involved.

With regard to its practical implementation, the polygamous marriages of the Prophet Muhammad PBUH were not motivated by sexual desire, but rather by social, humanitarian, and da'wah-related objectives (Andi Intan, 2018). Among the primary reasons for the Prophet's polygamy were to provide protection and dignity to widows, to elevate the status of women, and to care for women who offered themselves in marriage. Notably, the majority of the Prophet's wives were widows and of advanced age, with the exception of Sayyidah 'Aishah (RA). His marriages also occurred within specific historical contexts, such as in the aftermath of warfare, to safeguard the welfare of women who had lost their husbands (Yayasan Dakwah Islamiah Malaysia, 2018). Although the number of the Prophet's wives exceeded four, these marriages did not occur concurrently and therefore do not contradict the legal limit imposed upon his ummah.

Due to its historical and social dimensions, polygamy has frequently generated controversy and debate from both religious and sociological perspectives. Some scholars and activists reject polygamy on normative, psychological, and gender justice grounds, viewing it as a form of discrimination against women (Umi Salamah, 2019). Conversely, others regard polygamy as a potential solution to certain social problems, such as adultery and prostitution. Within the Islamic framework, polygamy is neither an obligation nor an unrestricted licence; rather, it is a conditional concession (*rukhsah*) subject to stringent requirements aimed at preserving justice and family welfare. A sound understanding of the historical background and underlying objectives of polygamy in Islam is therefore essential to prevent its misuse as a means of merely satisfying personal desires, and instead to ensure its implementation based on responsibility, justice, and wisdom, as exemplified by the Prophet Muhammad PBUH.

Nevertheless, the foundation of polygamy lies in its legal ruling. Sayyid Muhammad Rashid Rida categorised polygamy as *mubah* (permissible), meaning that there is no sin in refraining from it and no inherent reward in practising it (Solahuddin, 2018). However, acts classified as *mubah* may assume a recommended (*sunnah*) status and merit reward if they are undertaken with sincere intention and fulfilled in a manner pleasing to Allah, as may be the case with polygamy. In Islamic law, polygamy is neither prohibited nor encouraged indiscriminately; rather, its permissibility depends heavily on the personal capacity and character of the husband, particularly his ability to manage a marital relationship involving more than one wife an arrangement that inherently requires heightened levels of cooperation, emotional intelligence, and fairness. More importantly, careful consideration must be given to whether such a marriage may result in harm (*mudharat*) to the wives involved.

Islam permits polygamy with the strict limitation that a man may not have more than four wives at any one time (M. Ichsan, 2018). The original legal ruling of polygamy is permissibility (*harus*), not obligation. However, this permissibility is contingent upon the husband's ability to uphold justice among his wives. Polygamy may not be undertaken solely to fulfil lustful desires without sincere intention and moral responsibility. In certain jurisdictions, such as Malaysia, a husband is legally required to obtain prior permission from the Syariah Court before entering into a polygamous marriage, ensuring that all syariah conditions are satisfied. The question of whether polygamy constitutes a sunnah has been clarified by religious authorities, who affirm that polygamy in Islam is a permitted practice subject to specific conditions and justifiable reasons (Mufti of Federal Territory Office, 2016). Although *sunnah* encompasses the words, actions, approvals, and attributes of the Prophet Muhammad PBUH, legal rulings must be assessed in light of their underlying causes (*asbab*) and benefits (*maslahah*), rather than merely the Prophet's actions in isolation.

In the context of social necessity, polygamy may serve as a means of protecting women who require care and security. Conversely, it may become unnecessary or even oppressive if the husband is unable to uphold justice in matters of financial maintenance, emotional support, and physical capability. Allah the SWT further said:
*And among His signs is that He created for you spouses from among yourselves, so that you may find tranquillity in them; and He placed between you affection and mercy. Indeed, in that are signs for a people who reflect.*

(Surah Ar-Rum, 30:21)

This verse emphasises that marriage is not merely a social or reproductive institution, but also a profound source of emotional and spiritual tranquillity. *Mawaddah* signifies love and attraction that foster harmony, while *rahmah* denotes compassion that nurtures forgiveness, understanding, and mutual care. Consequently, polygamy must likewise be practised with these objectives in mind. Given the difficulty of achieving absolute justice, even as exemplified by the Prophet Muhammad PBUH, the legal ruling on polygamy may shift if its practice results in harm or injustice.

## Methodology

This study adopts a qualitative research approach. Primary data were collected through interviews with syariah legal experts, aimed at obtaining in-depth insights relevant to the scope of the study. In addition, secondary data were gathered through library-based research, involving an examination of authoritative sources such as academic books, classical Islamic legal texts, statutory provisions, and other relevant scholarly writings. These include, among others, the Islamic Family Law Enactment (State of Selangor) 2003 and reported Syariah court cases. Various texts on polygamy were reviewed from multiple perspectives, particularly from Islamic jurisprudence, legal frameworks, as well as the factors and implications of polygamy conducted without court authorisation. The data obtained from both primary and secondary sources were subsequently analysed using content analysis and descriptive analysis methods. This study also employed a semi-structured interview method. A total of three syariah legal experts serving in the State of Selangor were interviewed to provide professional and practical perspectives on the issues under investigation.

## Discussion and Finding

### *Polygamy Applications under Islamic Family Law*

The Islamic Family Law Enactment (State of Selangor) 2003 (EUUKIS) mandates that a husband must obtain prior authorisation from the Syariah Court before entering into a polygamous marriage. The application process begins with a formal filing at the State Islamic Religious Department and the Syariah High Court. The applicant is required to submit essential documents, including personal particulars, information regarding the existing wife or wives, reasons for the application, evidence of financial capability, as well as proposed arrangements for maintenance and the rotation of marital rights among wives. Applicants are also obliged to disclose income statements, assets, and liabilities to demonstrate their ability to provide fair and adequate maintenance for more than one wife (Ana Faiza, 2018).

Upon receipt of the application, the Court issues a notice to the existing wife, requiring her attendance to provide testimony or raise objections. Proceedings are conducted in camera, during which the judge evaluates the submitted documents, testimonies of the applicant, the existing wife, and any relevant witnesses. Evidence plays a highly significant role in court proceedings, particularly in applications of this nature (Suhaizad et al., 2024). Moreover, evidentiary rules ensure consistency in procedural standards, prevent procedural ambiguity, and safeguard justice for all parties involved. Robust and structured proof strengthens the Court's confidence in the veracity of the facts presented. Conversely, the absence of clear and systematic evidence exposes judicial decisions to the risk of being influenced by assumptions, weak evidence, or subjective evaluation, thereby undermining the integrity of the proceedings (Suhaizad et al., 2025).

The Court's assessment encompasses the applicant's financial capability, his ability to administer justice among wives, and the grounds advanced for the polygamous marriage. The attendance and cooperation of the existing wife significantly influence the Court's determination. Where the prescribed conditions are fulfilled and the judge is satisfied, authorisation for polygamy is granted, enabling the applicant to proceed with the solemnisation and official registration of the marriage (Basri, 2022). The process generally takes less than three months, subject to the cooperation of the parties involved and the completeness of documentation. Delays often arise due to the applicant's failure to satisfy statutory requirements, difficulties in serving notices, or reluctance on the part of the existing wife to cooperate (Ana Faiza, 2018). Legislative amendments introduced since 2003 have further strengthened women's rights, particularly in relation to matrimonial property, maintenance, and the equitable allocation of marital turns, in order to safeguard family welfare (Basri, 2022).

In Malaysia, although each state enacts its own Islamic family law legislation, the fundamental principle remains uniform: written authorisation from the Syariah Court is required prior to the solemnisation of a polygamous marriage. Section 23 of the Islamic Family Law (Federal Territories) Act 1984 and analogous provisions under the EUUKIS stipulate that no man may marry more than one wife without the Court's approval (Basri, 2022). Applications must be supported by reasonable grounds justifying the necessity or appropriateness of polygamy, alongside comprehensive disclosure of financial capacity, existing commitments, dependants, and the views or consent of the existing wife, where available. While the wife's consent is not an absolute requirement, her views are taken into consideration in the Court's assessment of justice and financial capability (Ana Faiza, Rafeah, & Azri, 2021). This demonstrates that

Islamic family law in Malaysia rigorously regulates polygamy to ensure syariah-compliant justice, prevent abuse, and protect the rights of wives and children. Breaches of these provisions, including polygamy without authorisation, may result in penalties of up to RM1,000 or imprisonment for a term not exceeding six months.

Notification to the existing wife is a critical procedural requirement and is expressly mandated under Practice Direction No. 7 of 2021, which ensures that the wife is afforded the opportunity to attend proceedings and express her views or objections. This requirement enhances transparency and procedural fairness in polygamy applications. The importance of notification and spousal participation is illustrated in the case of *Nor Erman bin Mohd Rusli v Hasnah binti Ismail* [Syariah Court of Appeal of Selangor, Appeal Case No. 2301-A0010-001-0001], where the application for polygamy was rejected partly due to the non-attendance of the existing wife, despite proper service of notice. The Court emphasised that the absence of the wife does not result in automatic approval of the application.

An analysis of cases before the Selangor Syariah High Court between 2009 and 2013 further indicates that objections from interested parties accounted for approximately 4% of the grounds for rejection of polygamy applications (Ana Faiza et al., 2021). This underscores the Court's holistic evaluation of an applicant's capability and justifications prior to granting approval. Empirical findings also reveal that many husbands in Selangor avoid seeking court authorisation due to fear of their wives' reactions, contributing to an increase in unauthorised polygamous marriages. Such practices contravene the law and have led to cross-border marriages in Thailand and Indonesia as a means of circumventing court procedures (Ana Faiza, 2018). This trend reflects not only a lack of legal compliance but also highlights systemic challenges in enforcing polygamy regulations, which ultimately jeopardise the protection of women's rights and the welfare of children within the syariah family law framework.

Although the application process is often perceived as time-consuming, it plays a vital role in safeguarding justice and the welfare of all parties concerned. Statutory provisions and judicial authorisation mechanisms serve to strengthen the protection of women's and children's rights within polygamous institutions (Basri, 2022). The EUUKIS and relevant Practice Directions highlight the necessity of strict compliance with procedural requirements to ensure fairness, financial capability, and family welfare. Cooperation from the existing wife and adherence to procedural obligations remain key determinants in the approval of polygamy applications. Despite the challenges associated with implementation, these regulatory frameworks are essential for governing polygamy in a just and responsible manner (Ana Faiza et al., 2021). Ultimately, effective enforcement and continuous legal refinement are crucial to prevent the misuse of polygamy provisions and to uphold the integrity of the syariah family justice system.

In *HI v MA* [Syariah Court of Appeal of Selangor, Appeal Case No. 10000-011-0051-2018], the appellant filed a polygamy application on 13 October 2017, citing a longstanding relationship and a monthly income of RM9,975. The respondent, being the existing wife, objected to the application on the grounds of potential damage to her dignity, financial concerns, and issues relating to the appellant's sexual conduct. The Syariah Court of Appeal dismissed the appeal and upheld the decision of the Syariah High Court, relying on Section 23 of the EUUKIS, which imposes stringent requirements for polygamy applications, including the obligation to prove justice and the absence of *darar syarie*.

## The Offence of Polygamy without Court Authorisation under the Law

The offence of polygamy constitutes a matrimonial crime under Islamic family law. Sanctions imposed for such offences encompass various forms of matrimonial misconduct, including incitement of a spouse to divorce, obstruction of spouses from cohabiting, and polygamy contracted without the authorisation of the Syariah Court (Ariyall Hikam, 2019). Within the framework of Islamic family law, matrimonial offences include the solemnisation of marriage without court approval, polygamy without the consent of the relevant authority, and spousal abuse (Kamus Undang-undang, 1995). These offences are categorised as non-arrestable offences, whereby the accused must be summoned to court and the offence must be clearly established before prosecution may proceed (Shadli, 2017).

Section 23(1) of the Islamic Family Law Enactment (State of Selangor) 2003 (EUUKIS) expressly provides that a husband shall not enter into a polygamous marriage without prior written permission from the Syariah Court. In addition, Section 124 of the EUUKIS stipulates that polygamy without such authorisation constitutes an offence punishable by a fine not exceeding RM1,000, or imprisonment for a term not exceeding six months, or both.

This offence falls within the category of syariah matrimonial crimes and is classified as a non-arrestable offence (Shadli, 2017). Before criminal proceedings for polygamy without authorisation may be initiated, the parties are required to apply for judicial confirmation of the polygamous marriage. Subsequently, where the marriage has been confirmed by the Court, the accused must first be served with a summons, and the prosecution is required to establish a prima facie case demonstrating a violation of Section 23(1) of the EUUKIS before enforcement under Section 124 may proceed. Accordingly, the Syariah High Court of Selangor has jurisdiction over individuals who commit the offence of polygamy without court authorisation.

Furthermore, Section 129 of the EUUKIS provides for offences committed by a husband who fails to administer equitable treatment to his wife or wives, including matters related to polygamy such as maintenance, rotation of conjugal nights, and other responsibilities arising from a polygamous marriage. This provision reinforces the principle that justice and fairness are central to the lawful practice of polygamy under Islamic law.

A case that clearly illustrates the offence of polygamy without authorisation is *Pendakwa Syarie v AAB & RMI* [Syariah Subordinate Court of Hulu Langat, Selangor, Criminal Case Nos. 10005-166-0036-2021 and 10005-147-0037-2021]. This case involved two accused persons charged with contracting a polygamous marriage without prior permission from the Syariah Court under Sections 124 and 134 of the EUUKIS. On 5 February 2020, the first accused contracted a marriage in Thailand while still lawfully married to an existing wife. Both accused pleaded guilty and sought mitigation of sentence on personal grounds. The Syariah Subordinate Court of Hulu Langat imposed a sentence of a RM1,000 fine and seven days' imprisonment commencing on 14 December 2021, taking into account the mitigation pleas and submissions by the prosecution. The decision was grounded on the Court's proper jurisdiction, the voluntary admission of guilt, and the application of *ta'zir* principles under Islamic law. The Court rejected the request for a reduction of sentence, emphasising the punitive and deterrent objectives of the punishment.

## Factors Contributing to Polygamy without Court Authorisation

Polygamy constitutes a conditional concession permitted in Islam, subject to strict requirements. However, its implementation in Malaysia is governed by state Islamic family law enactments, which require prior authorisation from the Syariah Court before a polygamous marriage may be solemnised. One of the principal factors contributing to polygamy without court approval is the perception that the polygamy application procedure is excessively stringent and burdensome (Norain & Khairul, 2021). Based on interviews conducted, Informant 1 acknowledged the complexity of the application process and the prolonged waiting period for approval. The requirement to submit extensive documentation, attend pre-marital courses, and undergo interviews is often perceived as inconvenient by certain individuals. All three informants agreed that, in order to avoid formal court procedures, familial resistance, and the desire to conceal the marriage from the first wife, many couples opt to marry abroad particularly in Thailand or Indonesia where the procedures are perceived to be simpler and faster.

Nevertheless, Informants 2 and 3 emphasised that these stringent procedures are fundamentally intended to ensure justice and to assess the husband's eligibility before permitting polygamy, rather than to impose unnecessary hardship. There exists a perception among some parties that strict court procedures contradict Islamic law, given that polygamy is fundamentally permissible in Islam. However, this view is misconceived, as the purpose of legal regulation is to prevent the abuse of polygamy that may lead to injustice against wives and children. Judicial intervention is therefore essential to ensure that polygamous marriages are conducted fairly, systematically, and in compliance with both syariah principles and statutory requirements.

In addition, Informant 1 supported the factors highlighted by Informant 2 and further noted that legal costs constitute a major incentive for couples to pursue polygamy without authorisation in Thailand. This is evident from the prevalence of marriage packages advertised on social media in southern Thailand, particularly in Songkhla and Pattani, which typically cost less than RM2,000 and include transportation, accommodation, and marriage certificates. In contrast, the Malaysian process is often perceived as requiring prolonged court proceedings lasting several months. However, this assertion regarding delayed approval was refuted by Informant 3, who considered it outdated. According to Informant 3, nine out of ten polygamy applications generally receive approval within approximately one month, provided that the Court finds the applicant eligible. Informant 3 further observed that most individuals who commit matrimonial offences are, in fact, aware of the risks associated with failing to obtain court permission for polygamy.

Moreover, polygamy without court authorisation is also attributable to weaknesses in the marriage registration system, non-compliance with legal procedures, and socio-economic pressures (Ana Faiza, Rafeah & Azri, 2021). This view was reinforced by Informant 2, who highlighted public non-compliance with the law due to the perception that the penalties imposed are relatively low. Such attitudes contribute to indifference towards legal obligations and result in continued violations of the law, particularly polygamy without court approval. This is substantiated by statistics from the Selangor Islamic Religious Department (JAIS), which reported 1,617 cases of polygamy without authorisation between 2019 and 2023exceeding the number of formal polygamy applications submitted to the Syariah Court, which totalled only 859 cases (Mohd Yunus, 2023). This phenomenon is closely linked to the use of syndicate marriages across the Thai and Indonesian borders, as well as the disregard of

economic capacity and justice requirements stipulated under the EUUKIS 2003 (Norain & Khairul, 2021).

Furthermore, the failure to obtain the consent of the first wife remains a significant factor contributing to polygamy without court authorisation (Norain & Khairul, 2021). Informant 3 emphasised that this issue aligns with Practice Direction No. 7 of 2021, which underscores the importance of notifying existing wives in polygamy authorisation proceedings. Although a wife's consent is not an absolute requirement, the Court nevertheless takes into account her views and testimony when assessing the husband's eligibility for polygamy. Informant 3 further agreed that some husbands choose to marry abroad as an easier alternative due to fear of opposition from existing wives, resistance during court proceedings, and lack of family approval. Such actions are often driven by the desire to avoid domestic conflict or by the perceived need to have offspring.

All three informants also concurred that rejected polygamy applications constitute a further factor prompting couples to contract marriages without authorisation (Norain & Khairul, 2021). The Syariah Court typically rejects applications where the husband fails to demonstrate financial capability, responsibility towards existing family members, or compliance with other prescribed conditions. Following rejection, some couples resort to marrying abroad as a shortcut, without due consideration of the legal implications and long-term consequences for the family. Case studies from the Selangor Syariah High Court between 2009 and 2013 further identify several key factors contributing to the rejection of polygamy applications (Ana Faiza et al., 2021).

**Implications of Polygamy without Court Authorisation**

The implications faced by couples who practise polygamy without obtaining authorisation from the Syariah Court may arise in two primary situations. The first situation occurs when the couple does not approach the Court at all to seek confirmation of the unauthorised polygamous marriage. According to all three informants, this scenario results in more severe harm, particularly with respect to the legal rights and protections of the subsequent wife and children born from the marriage. The second situation involves couples who apply for judicial confirmation of a polygamous marriage contracted without prior court permission, whereby the Judge will determine whether the marriage is valid or otherwise. This process is staged and exclusive in nature; once the marriage is confirmed as valid, the couple will subsequently be prosecuted in the Syariah Subordinate Court under Section 124, and any imposed fine and/or term of imprisonment must be satisfied before official registration at the Religious Affairs Office can be completed.

The most significant implication of contracting a marriage without court authorisation is the substantial risk to the wife's rights, which would ordinarily arise from a legally recognised marriage, but are obstructed due to the absence of valid documentation (Fhirhad & Azizah, 2023). These include the right to *mutʿah* (a form of monetary or property compensation), matrimonial property, maintenance, and child custody. The lack of official registration renders the marriage unrecognised under Islamic family law in Malaysia. Informant 3 emphasised that the subsequent wife faces a heightened risk of losing her entitlement to maintenance and matrimonial property during the subsistence of the marriage, and upon the husband's death, the wife and children may be deprived of their rights to inheritance (*faraid*). Where the couple

fails to seek confirmation and divorce subsequently occurs, the wife's entitlements—such as spousal maintenance, *mutʿah*, and *ʿiddah* maintenance—cannot be legally enforced. This demonstrates that marriages contracted without court authorisation not only undermine the wife's rights but also entail serious legal consequences.

From the perspective of the family institution, the implications of polygamy without authorisation closely resemble those arising from marriages contracted without legal permission, as both forms of legal non-compliance have the potential to disrupt family harmony and stability. Children born from such marriages may face issues of identity and social acceptance, which can adversely affect their psychological development. Informants 1 and 3 elaborated on this issue by highlighting differences in birth certificates for children whose paternal lineage is not legally established. In such cases, the child's birth is registered under Section 13 of the Births and Deaths Registration Act 1957 (Act 299). Specifically, this provision governs cases involving children of illegitimate status, where the father's name may only be recorded upon a joint request by the mother and the individual claiming paternity, with both parties signing the registration record.

In the absence of paternal information or valid marriage documentation, the birth is registered with a Section 13 annotation or without any paternal details, resulting in the child being affiliated solely to the mother's name, "Abdullah," or *Asmaul Husna*, in accordance with the practice of the National Registration Department (NRD) (Adibah et.al., 2023). While this provision ensures that birth registration can proceed regardless of the parents' marital status and safeguards the integrity of civil records, all three informants agreed that it carries long-term consequences. These include societal stigma during school registration, future marriage procedures, and barriers to inheriting the biological father's estate. This underscores the underlying wisdom and objectives of lawful marriage in Islamnamely, the establishment of legitimate lineage, the formation of a stable family unit, and the preservation of dignity. Non-compliance with Syariah principles and statutory law risks exacerbating social problems and undermining the harmony of societal structures.

From a legal perspective, polygamy without court authorisation is neither recognised nor deemed valid, even if it fulfils certain syariah requirements (Norain & Khairul, 2021). Couples engaging in unauthorised polygamy are unable to produce official documentation to validate their marriage. Informant 1 further opined that marriages deemed valid solely from a syariah standpoint but lacking official registration result in the absence of legal protection. Consequently, such couples are exposed to risks of other legal offences, including domestic violence and offences related to *khalwat* or *zina*. All three informants also highlighted the risk of *faraq nikah* (judicial separation) where marriages contracted without court authorisation are rendered invalid due to the appointment of an unqualified guardian (*wali*) or because the marriage was solemnised outside the proper jurisdiction as stipulated under the EUUKIS. In such circumstances, the Court may order the immediate separation of the couple and require the observance of three menstrual cycles of *ʿiddah* before a lawful remarriage may be conducted in accordance with proper legal procedures.

These circumstances clearly demonstrate the grave implications that arise when the matrimonial offence of polygamy without court authorisation is treated lightly by certain segments of society. Overall, the consequences of unauthorised polygamy most significantly affect the subsequent wife, particularly in cases of divorce or the husband's death. In such

situations, the wife lacks a legal foundation to claim her rightful entitlements, notwithstanding the fact that these rights are guaranteed under the EUUKIS through the registration of a valid marriage (Norain & Khairul, 2021).

**Recommendations**

Several recommendations should be given due consideration in addressing the issues arising from polygamy without court authorisation. All three informants agreed that the existing penalties for the offence of unauthorised polygamy should be enhanced to ensure more effective deterrence. Accordingly, legislative amendments are necessary to increase both the quantum of fines and the duration of imprisonment as a firm response to the harm caused by this form of matrimonial offence. Informant 2 opined that, in order to cultivate greater respect for the law and instil a sense of deterrence within society, the current maximum fine of RM1,000 should be revised upwards to RM5,000. In contrast, Informant 3 suggested that a higher and more proportionate maximum fine of RM20,000 would be more effective in curbing such syariah offences. Nevertheless, any increase in financial penalties must be assessed holistically, taking into account the offender's social standing, monthly income, and prior record of syariah offences, so as to ensure that the punishment serves a corrective purpose rather than constituting undue oppression.

In addition, stricter border controls should be implemented to prevent individuals at risk of engaging in unauthorised polygamy from unlawfully exiting the country. Informant 1 proposed that the Malaysian government strengthen diplomatic relations and inter-agency cooperation involving religious authorities, immigration departments, and enforcement agencies of neighbouring countries to monitor suspicious movements. Such measures include restricting solemnisation authority to designated officiants, ensuring that only authorised *jurunikah* are permitted to solemnise marriages involving Malaysian citizens abroad, and mandating notification to the Malaysian Consulate following the conclusion of any such marriage. These measures would serve to curb the practice of unauthorised polygamy conducted overseas. Informant 1 further emphasised the need to regulate and restrict the promotion of "two-in-one" packages combining tourism and marriage, which are increasingly advertised on social media platforms. Collaboration among the Media and Corporate Communications Division under the Department of Information Malaysia, the Ministry of Communications, and the Ministry of Tourism, Arts and Culture (MOTAC) is crucial in addressing the growing phenomenon of cross-border marriages and syndicate-facilitated marriages.

Finally, improvements to the premarital course modules should be prioritised as a means of enhancing public awareness of the legal framework and procedural requirements governing polygamy. The premarital course platform is particularly appropriate for this purpose, as attendance at such courses constitutes a legal prerequisite for marriage under Malaysian law. Informants 2 and 3 suggested that prosecutorial authorities should be actively involved in delivering educational content, particularly in relation to the legal procedures for polygamy prescribed under state legislation, to ensure the long-term effectiveness of these courses. Both informants concurred that the existing premarital course framework requires further review and enhancement to strengthen its impact. Through such reforms, the public would gain clearer understanding of the invalidity of unauthorised marriage documentation, the challenges associated with child registration, and the broader legal implications that may undermine the stability and integrity of the family institution.

## Conclusion

Unauthorised polygamous marriages primarily stem from the perception that court application procedures are overly strict, complex, and document intensive. Consequently, many couples resort to informal or syndicate marriages abroad, particularly in countries such as Thailand and Indonesia, where the processes are perceived to be simpler, faster, and less costly. This tendency is further driven by the desire to conceal the marriage from the first wife and family members in order to avoid domestic conflict. Other contributing factors include weaknesses in the marriage registration system, public non-compliance due to relatively lenient penalties, and the rejection of court applications arising from the failure to demonstrate financial capability and the ability to act justly towards existing wives. Overall, the implications of this matrimonial offence are most severely felt by the subsequent wife, who is deprived of legal protection, including rights to maintenance, *mut'ah*, matrimonial property, and inheritance (*faraid*) when the marriage is not legally registered. Children born from such marriages are also exposed to significant risks, including the issuance of birth certificates without the father's name, which may result in long-term social stigma. These circumstances may give rise to identity-related issues that adversely affect inheritance rights and future marriage processes. Unauthorised polygamy is further regarded as legally invalid and may lead to serious legal consequences, including the risk of judicial separation (*faraq nikah*), exposure to domestic violence offences, as well as potential charges of *khalwat* or *zina*. The absence of official documentation undermines legal recognition and threatens the overall stability of the family institution. To curb the persistence of this issue, several measures are proposed. These include increasing fines and custodial sentences for matrimonial offences, strengthening cooperation between domestic authorities and border enforcement agencies to curb syndicate marriages promoted through social media, and enhancing premarital course modules through the involvement of syariah prosecution authorities. Such initiatives are crucial to raising public awareness of polygamy procedures, the invalidity of foreign marriage documents, and the long-term legal and social implications for families. Collectively, these measures may contribute to more effective regulation and prevention of unauthorised polygamous marriages in the future.

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# FACTORS MOTIVATING PARTICIPANTS TO PARTICIPATE IN SPORTS EVENTS: A CASE STUDY OF SEREMBAN HALF MARATHON

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***Abstract:*** *This study examines the key motivational factors that influence participants' decisions to take part in the Seremban Half Marathon, one of Malaysia's most established community-based running events. As recreational running is becoming increasingly popular, little empirical research has examined Malaysian amateur runners' underlying motives in the context of particular events. This study aims to identify the main extrinsic and intrinsic elements that influence participation and assess the degree to which these factors influence participants' overall involvement with the event. Participants in the Seremban Half Marathon were given a standardized questionnaire to complete, and data was gathered using a quantitative research design. A total of 200 valid replies were collected and subjected to factor analysis, reliability testing, and descriptive statistics. Health-related motivations, social connections, achievement and self-challenge, event attractiveness, and organizational and environmental factors were among the recognized motivational characteristics examined by the instrument. The results show that the best determinants of participation are intrinsic motives, especially self-challenge, personal accomplishment, and the desire to increase fitness and health. Running with friends or belonging to a community are examples of social motivation that also had a big impact. Participants' desire to attend the event was further increased by extrinsic factors, such as the event's reputation, route design, safety, and general atmosphere. The findings support the idea that involvement behavior is significantly influenced by both individual and event related factors. This study offers useful advice for sports event planners, emphasizing the significance of creating events that not only support runners' individual objectives but also improve the event's organizational and experiential elements. Increasing these elements could lead to higher levels of participant loyalty, satisfaction, and long-term participation in upcoming sporting events.*

***Keywords:*** *Participation, Sports Event, Motivation, Half Marathon, Event Management*

## Introduction

Sports events have grown in importance as a part of Malaysia's tourism and wellness industries, drawing both domestic and foreign attendees and encouraging physical activity and healthy lives (Malaysia, 2021)(Portal, 2024). Even though these activities are becoming progressively more common, much is known about all of the factors that affect participation and general interest in sporting events. Participant motivation, which is essential to the success and long-term viability of these events, frequently gets overlooked by event planners in preference for operational and logistical considerations (Thomas Aicher, 2015). The growth of sports tourism

in Malaysia, which includes activities like bicycle contests, triathlons, and half marathons, emphasizes the need for a better understanding of what motivates people to compete. Although there is an absence of empirical research examining these aspects in the Malaysian context, participation is frequently influenced by extrinsic factors like health goals and subjective factors like enjoyment (Mohd Noor, 2019). A deeper comprehension of these elements can help government officials, tourism authorities, and event planners create programs that improve participant happiness, engagement, and overall event success. According to (Wenjing Yan1, 2023), enjoyment has been found to be a major motivator for sports participation, where the pleasure and satisfaction gained from the activity motivate continuous involvement. According to (Yan Shao, 2025), there is an increasing emphasis in society on preserving well-being through active lives, and health-related goals such as physical fitness, wellbeing, and lifestyle change are significant motivators for participation. In order to create event experiences that satisfy participant expectations and maintain long-term engagement, it is essential to comprehend the relative impact of these aspects on motivation. Research in Malaysia has mostly concentrated on the operational aspects of events rather than participant-centered issues, despite the potential of sports tourism to support both public health and economic growth. This study fills this gap by using the Seremban Half Marathon as a case study to investigate how motivation to engage in sporting events is influenced by enjoyment and health objectives. This study narrows its focus to two key motivational factors, namely enjoyment and health goals, and evaluates how these elements contribute to participants' motivation to engage in sports events. The objectives of this study are threefold:

1. To examine the relationship between enjoyment and motivation to participate in sports events, determining whether participants who experience greater enjoyment are more likely to engage actively.
2. To investigate the relationship between health goals and motivation to participate in sports events, assessing whether participants with stronger health-oriented objectives demonstrate higher motivation.
3. To provide insights into how enjoyment and health goals can guide event organizers in designing strategies that enhance participant engagement and overall event success.

## Literature Review

### *Motivation*

Motivation, which comes from the Latin word movere, which means "to move" or "to inspire" (Willy Lens, 2020), is essential to comprehending actions in sports, such as coaching, learning, performance, determination, and competition (Nicholls, 2021). It is a primary area of study in sport psychology since it is essential to the formation of social contexts and behavioral change (Luc G. Pelletier, 1995). Researchers have looked at things including coaching practices, competitive anxiety, and motivations for engaging in physical activity as youth interest in sports grows (John Murphy, 2022). According to early research, the desire for success, social connection, skill development, enjoyment, and fitness are important motivators (Dagny Adamczak, 2025). Both extrinsic such as recognition, sponsorship, and job growth and intrinsic such as fitness, self-actualization, team achievement, and the excitement of competition factors drive sports involvement. Stress relief, social interaction, and health benefits are common motivators for amateur participants. Numerous scales have been developed in order to measure these motivations in a methodical manner. The Motivation Scale for Sport Consumption (MSSC) describes nine constructs, including achievement, escape, drama, knowledge

acquisition, family, and social interaction (Anderson Filipe Rosa, 2024), whereas the Motivations of the Sport Consumer (MSC) Scale identifies twelve major motivators based on Maslow's Hierarchy of Needs (Xuemeng Hao, 2025).

Additional motivators include charitable giving, which promotes social cohesion and a sense of purpose; enjoyment, which highlights fun and companionship; and health objectives pertaining to fitness and illness prevention. Participation is also influenced by organizational objectives related to teamwork and wellness, stress reduction and mental health , and social identity building (Narelle Eather1, 2023). Engagement is further shaped by environmental attractiveness (Guereño-Omil, 2024), self-improvement, escape, and memorable experiences. In general, the most important motivators continue to be enjoyment and health goals. While health objectives highlight the increasing significance of physical well-being, enjoyment represents intrinsic fulfillment. When taken as a whole, these motivators show how sports involvement is holistic and provide event planners with crucial information for creating memorable and captivating sporting events.

**Enjoyment**

Participation in sporting events, such as the Seremban Half Marathon, has long been known to be significantly influenced by enjoyment. Enjoyment is often recognized as an emotional reaction that promotes intrinsic motivation and sustained engagement. It is operationally described as a “positive affective response to the sport experience that encompasses feelings such as pleasure, liking, and fun” (Kihong Joung1, 2024). Positive emotional experiences during exercise promote positive attitudes and encourage continued engagement. The Sport Commitment Model and Competence Motivation Theory are two significant sport-motivation frameworks that incorporate enjoyment, highlighting its theoretical significance (Arthur Ling, 2019). Enjoyment is a major psychological motivator for both initial and recurring engagement since people are more inclined to take part in activities that provide excitement, pleasure, and a sense of achievement. Because enjoyment boosts emotional satisfaction, increases intrinsic value, and improves personal fulfillment, events that generate enjoyable, inclusive environments typically draw larger participation rates . In addition to providing emotional satisfaction, attending sporting activities fosters social connection, stress reduction, and personal growth, all of which support sustained participation. Enjoyable shared experiences foster a feeling of belonging and community, which raises the possibility of attending events again. Additionally, enjoyment allows people to push themselves in a constructive setting, enhancing abilities while lowering performance pressure and failure-related anxiety. This internal enjoyment-driven resilience makes involvement more accessible to a wider range of people by assisting people in overcoming typical obstacles like time limits, exhaustion, or nervousness. Event planners may create meaningful, enticing, and long-lasting sports experiences by taking into account the complex function of enjoyment in addition to elements like health, social connectivity, and competitiveness. The Physical Activity Enjoyment Scale (PACES) is still one of the most popular tools for evaluating enjoyment because of its strong reliability in capturing the joy, fun, and pleasure connected to physical activity (Cheng Chen, 2021).

**Health Goals**

This study focuses on health objectives as a major driving force behind athletes' participation in sporting events, particularly the Seremban Half Marathon. According to (Simon J Sebire, 2008), who developed the Goal Content for Exercise Questionnaire (GCEQ), health-related goals have become a major motivator for those participating in organized sports. Participants now see sporting events as organized means of achieving particular health outcomes, such as improvements in cardiovascular fitness, weight control, muscle strength enhancement, and the management of chronic conditions like diabetes and hypertension, as a result of increased public awareness of the significance of physical well-being. Health objectives include psychological aspects in addition to physical ones. Playing sports improves mental and emotional well-being by lowering stress, easing anxiety and depressive symptoms, and promoting mental clarity and a sense of achievement. In addition to encouraging initial engagement in sporting events, these combined psychological and physical advantages also support long-term participation as people continue to participate in such activities to maintain progress, reach incremental health milestones, and avoid future health risks. Therefore, in order to create programs that support participants' ongoing health journeys, sports event organizers must comprehend how health goals affect both immediate and persistent participation. The General Content Evaluation Questionnaire (GCEQ), is still the most used tool for evaluating health-related motivational content in exercise situations, and health goals show a positive link with sports participation, which is consistent with (Raul Antunes1*, 2017) findings.

## Methodology

The research methodology for this study is structured to examine the influence of enjoyment and health goals on participants' motivation to engage in sports events, with specific focus on the Seremban Half Marathon. The research design, sample strategies, data collection techniques, and analytical methods used to meet the study's goals are described in this section. In order to assess how these motivational elements influence participants' experiences and choices to attend the event, each methodological element is methodically aligned. The objective of the research is to produce empirical insights that improve knowledge of important factors impacting participation in sporting events through an empirical quantitative methodology.

## Research Design

An outline of the methodological framework and techniques used to collect the data needed for this investigation is given in this section. The research design, target population, sampling frame, sampling technique, unit of analysis, sample size calculation, data collection methods, and survey instrument created for this study are all described. In order to answer the research questions and evaluate the developed hypotheses, the data collecting procedure involves systematically collecting and evaluating relevant data related to the study variables. Every methodological element is designed to guarantee validity, reliability, and consistency with the study's fundamental objectives.

## Research Approach

The relationship between enjoyment and health objectives as important motivators affecting Seremban Half Marathon participation is examined in this study. In order to consistently collect numerical data and analyze participant patterns, correlations, and trends, a quantitative

descriptive research design will be used. Self-administered structured questionnaires, which offer a systematic method for measuring the variables of interest and guarantee consistency in replies, will be used to gather data. Participants in marathons make up the target population, which serves as the main analytical unit and provides direct insights into the variables influencing participation in sporting events. This analytical approach makes it easier to produce empirical data that can help event planners understand how participant experiences and motivation are influenced by enjoyment and health objectives.

## Population And Sampling

Participants in the Seremban Half Marathon, who actively participate in the event and are directly impacted by elements like enjoyment and health objectives, make up the study's population. To enable generalization of the results, a sample defined as a subset of the population from which data is gathered to make conclusions about the larger group will be chosen. Using Krejcie and Morgan's (1970) table for sample size calculation, as cited by Bukhari (2021), a total of 200 respondents were selected as the sample size for this investigation. In order to guarantee that the data gathered appropriately represents the experiences, views, and motives pertinent to the research aims, this sample was specially selected from the marathon participants. By concentrating on this specific population, the study may preserve a rigorous methodology and practical viability for data collection and analysis while offering trustworthy insights into the major motivational variables influencing participation.

**Table 1. Sample Size Determination Krejcie and Morgan**

| Population | Sample |
|---|---|
| **420** | **201** |
| **750** | 254 |
| **1000** | 284 |

Source: Adapted From Krejcie And Morgan 1970

## Data Analysis Techniques

The Statistical Package for Social Sciences (SPSS) will be used to analyze the quantitative data gathered from the study instruments. A popular program for social science research, SPSS provides extensive facilities for statistical testing, data management, and analysis. Because of its adaptability, researchers may effectively manage big datasets and tailor analyses to the particular requirements of their study. The data in this study will be examined using descriptive analysis and Analysis of Variance (ANOVA). The data will be arranged, summarized, and presented using descriptive analysis in a way that makes the features of the sample evident, establishing a foundation for additional statistical testing. ANOVA will be used to examine the link between the dependent variable, motivation, and the independent variables, enjoyment and health goals. The nature and intensity of the links between the research variables can be revealed, and the statistical significance of differences can be determined by comparing mean values across variables. The results of these analyses will offer empirical proof of how

participants' motivation to participate in sporting events is influenced by enjoyment and health objectives.

**Demographic Profile of Respondents**

A total of 200 respondents participated in this study through distributed questionnaires. The demographic analysis revealed that 44% were male (n=88) and 56% were female (n=112), indicating a higher participation of female respondents. In terms of age, the majority were 21-25 years (29%, n=58), followed by 26–30 years (27%, n=54), 31 years and above (24.5%, n=49), and 15–20 years (19.5%, n=39). Regarding race, 36.5% were Chinese (n=73), 33% were Indian (n=66), and 30.5% were Malay (n=61), showing a slight predominance of Chinese participants. The occupational distribution showed that most respondents were students (35.5%, n=71), followed by private staff (22.5%, n=45), professionals (17%, n=34), government staff (14.5%, n=29), and businesspeople (10.5%, n=21). These demographics provide an overview of the participants' characteristics for subsequent analysis of motivational factors.

**Table 2.**

| Demographic Profile | Categories | Frequency | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 88 | 44 |
| | Female | 112 | 56 |
| **Age** | 15-20 | 39 | 19.5 |
| | 21-25 | 58 | 29.0 |
| | 26-30 | 54 | 27.0 |
| | 31 and above | 49 | 24.5 |
| **Race** | Malay | 61 | 30.5 |
| | Chinese | 73 | 36.5 |
| | Indians | 66 | 33.0 |
| **Occupations** | Government staff | 29 | 14.5 |
| | Professionals | 34 | 17.0 |
| | Private Staff | 45 | 22.5 |
| | Businessman | 21 | 10.5 |
| | Students | 71 | 35.5 |
| | Unemployed | 0 | 0 |

*Sources: Demographic Profiles of Respondents*

**Descriptive Analysis of Variables**

In the study of descriptive analysis, a general statistical analysis of dependent and independent variable is used. In this study, there are five rated Likert Scale. The maximum value, minimum value, mean, and standard deviation results for each variable were reported in this section.

**Descriptive statistics on motivation to participate in sports events (Seremban half marathon)**

The descriptive analysis for the variables Motivation, Enjoyment, and Health Goals demonstrates consistently strong responses among the 200 participants. For motivation to

participate in sports events, mean scores ranged from 4.58 to 4.78, with standard deviations between .472 and .629, indicating high and favorable motivation across dimensions such as Aesthetics, Education, Entertainment, Escapism, and Re-participation Intention. The highest reported motivation was "I am likely to participate in any running event in the near future: Marathon, Half Marathon or Fun Run" (M = 4.78; SD = .472). For the enjoyment factor, mean values ranged widely from 1.60 to 4.78, with standard deviations from .520 to .907, showing that participants reported strong enjoyment for items such as "I enjoy it" (M = 4.78; SD = .520), while negatively worded items were rated low, as expected (e.g., "I dislike it," M = 1.60; SD = .627). Meanwhile, the health goal factor showed high agreement with mean scores between 4.12 and 4.65, and standard deviations ranging from .499 to .896, indicating strong alignment with physical health motivations. The highest health-related motivation was "To increase my endurance and stamina" (M = 4.65; SD = .499). Collectively, the findings confirm that participants are highly motivated, experience strong enjoyment, and pursue meaningful health goals through involvement in sports events.

**Table 3. Descriptive Analysis on Motivation to Participate in Sports Events**

| Instrument | Items | N | Min | Max | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| **Aesthetics** | B1: I sense harmony with mysurroundings | 200 | 3 | 5 | 4.68 | .530 |
| | B2: I sense a pleasing physicalenvironment | 200 | 3 | 5 | 4.67 | .512 |
| | **B3: I sense a pleasing competition** | **200** | **3** | **5** | **4.58** | **.629** |
| | B4: I appreciate the various entitlement | 200 | 3 | 5 | 4.58 | .588 |
| | B5: I sense a pleasing runningevent theme design | 200 | 2 | 5 | 4.62 | .582 |
| **Educations** | B6: Running stimulates my curiosity | 200 | 2 | 5 | 4.61 | .600 |
| | B7: I share my running experiences with my family andfriends | 200 | 3 | 5 | 4.70 | .511 |
| | B8: Running enhances my philosophy of living | 200 | 2 | 5 | 4.59 | .627 |
| | B9: Running events increase my knowledge | 200 | 2 | 5 | 4.64 | .586 |
| **Entertainment** | B10: I interact with others in the running event | 200 | 3 | 5 | 4.69 | .485 |
| | B11: I feel relaxed physically | 200 | 3 | 5 | 4.70 | .513 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | B12: I feel emotionally stimulated when participating inthe running event | 200 | 2 | 5 | 4.63 | .596 |
| | B13: I have fun at the runningevent | 200 | 3 | 5 | 4.68 | .497 |
| **Escapism** | B14: I can be someone else when competing in a runningevent | 200 | 2 | 5 | 4.60 | .618 |
| | B15: I imagine living in a different time and place | 200 | 2 | 5 | 4.59 | .628 |
| | B16: I feel like I escaped fromreality while participating in arunning event | 200 | 2 | 5 | 4.66 | .595 |
| | B17: I get away from a stressfulsocial environment by participating in a running event | 200 | 2 | 5 | 4.67 | .561 |
| **Re-Participation Intention** | B18: I have an intention to re- participate in the running event | 200 | 3 | 5 | 4.69 | .536 |
| | B19: I have participated in a running event in the past | 200 | 3 | 5 | 4.73 | .478 |
| | B20: I have an attitude towardsre-participation | 200 | 2 | 5 | 4.70 | .530 |
| | B21: I intend to running regularly in running events | 200 | 2 | 5 | 4.68 | .584 |
| | **B22: I am likely to participatein any running event in the near future: Marathon, Half Marathon or Fun Run** | **200** | **3** | **5** | **4.78** | **.472** |

**Table 4. Descriptive Analysis of Enjoyment**

| Instrument Items | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| **C1: I enjoy it** | **200** | **1** | **5** | **4.78** | **.520** |
| C2: I feel bored | 200 | 1 | 5 | 1.64 | .702 |
| **C3: I dislike it** | **200** | **1** | **3** | **1.60** | **.627** |
| C4: I find it pleasurable | 200 | 2 | 5 | 4.76 | .523 |
| C5: It is no fun at all | 200 | 1 | 5 | 1.75 | .763 |
| C6: It gives me energy | 200 | 1 | 5 | 4.76 | .551 |
| C7: It makes me depressed | 200 | 1 | 5 | 1.68 | .713 |
| C8: It is very pleasant | 200 | 2 | 5 | 4.77 | .501 |
| C9: My body feels good | 200 | 1 | 5 | 4.68 | .669 |

| | | | | | |
|---|---|---|---|---|---|
| C10: I get something out of it | 200 | 1 | 5 | 4.24 | .964 |
| C11: It is very exciting | 200 | 3 | 5 | 4.73 | .496 |
| C12: It frustrates me | 200 | 1 | 5 | 1.73 | .861 |
| C13: It is not at all interesting | 200 | 1 | 5 | 1.84 | .907 |
| C14: It gives me a strong feeling of success | 200 | 1 | 5 | 4.74 | .542 |
| C15: I feel as though I would rather be doing something else | 200 | 1 | 5 | 3.94 | .941 |

**Table 5. Descriptive Analysis of Health Goals**

| Instruments | Items | N | Min | Max | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| **Image** | D1: To improve the look of myoverall body shape | 200 | 2 | 5 | 4.51 | .549 |
| | D2: To improve my appearance | 200 | 2 | 5 | 4.49 | .540 |
| | **D3: To be slim so to lookattractive to others** | **200** | **1** | **5** | **4.12** | **.896** |
| | D4: To change my appearance by altering a specific area of mybody | 200 | 2 | 5 | 4.14 | .829 |
| **Health Management** | D5: To increase my resistance toillness and disease | 200 | 3 | 5 | 4.59 | .532 |
| | D6: To increase my energy level | 200 | 3 | 5 | 4.64 | .492 |
| | D7: To increase my overallhealth | 200 | 3 | 5 | 4.63 | .493 |
| | **D8: To increase my enduranceand stamina** | **200** | **3** | **5** | **4.65** | **.499** |

## Reliability Analysis

Based on their mean scores and standard deviations, the reliability analysis for the three primary variables of motivation, enjoyment, and health goals shows that every item exhibits excellent internal consistency and steady measurement performance. All items in the Motivation construct which comprises Aesthetics, Education, Entertainment, Escapism, and Re-Participation Intention recorded high mean values ranging from 4.58 to 4.78 with comparatively low standard deviations (.472 and .629), indicating consistent agreement among respondents and suggesting that statements related to motivation were interpreted reliably. With items exhibiting a distinct polarity between positive and negative remarks, the enjoyment variable likewise showed consistent measurement. While negative items like "I dislike it" and "It frustrates me" had low means (1.60 and 1.84), positive satisfaction items had high means (4.68 and 4.79), indicating proper differentiation and consistent response patterns.

## Correlation Analysis

Based on the mean values and standard deviations of the three variables of motivation, enjoyment, and health goals, the reliability analysis reveals that the assessment items exhibit good stability and internal consistency. All items in the Motivation construct, which includes Aesthetics, Education, Entertainment, Escapism, and Re-Participation Intention, had high mean scores ranging from 4.58 to 4.78 with comparatively low standard deviations (.472 and .629), suggesting that respondents consistently agreed with and reliably interpreted the

statements related to motivation. The enjoyment variable also showed an unique and predictable pattern, with positive items like "I enjoy it," "I find it pleasurable," and "It is very pleasant" reporting high mean values between 4.68 and 4.79 and negative items like "I dislike it," "It frustrates me," and "It is not at all interesting" recording low mean scores between 1.60 and 1.84. The constant gap between positive and negative responses validates the scale's dependability, even if some negative items had slightly greater standard deviations. All items showed high and consistent means ranging from 4.12 to 4.65 with moderate standard deviations (.499 and .896) for the Health Goals construct, which includes Image and Health Management factors. This indicates strong agreement on statements about improved appearance, increased stamina, higher energy levels, and overall health enhancement. The questionnaires used to measure motivation, enjoyment, and health goals are generally dependable and suitable for additional statistical analysis, as evidenced by the consistency of responses across all items and constructs.

**Regression and Coefficient Analysis**

The regression results summarized in Table 6 indicate that Enjoyment, Image, and Health Management collectively contribute to explaining the various dimensions of sport event participation. Across all five models, the R values range from .424 to .467, demonstrating moderate relationships, while the $R^2$ values between .180 and .218 show that the predictors explain 18% to 21.8% of the variance in the respective motivation dimensions. Enjoyment consistently emerges as the strongest and most significant predictor in all models ($p < .001$), with beta values ranging from .254 to .343, indicating that participants who experience greater enjoyment are more likely to perceive higher aesthetic value, educational benefits, entertainment, escapism, and intention to re-participate. Image shows a positive but more variable contribution, reaching significance in the Education and Escapism models ($p = .004$ and $p = .018$ respectively), suggesting that favorable perceptions of event image enhance participants' educational value and escapism experiences. Health Management also demonstrates small but meaningful positive effects, with significance emerging in the Aesthetics, Entertainment, and Re-Participation models, reflecting that those who prioritize health goals tend to value event aesthetics, enjoyment of entertainment activities, and future engagement intentions. Overall, the findings confirm that Enjoyment is the dominant driver of sport event motivation, while Image and Health Management provide secondary yet contextually important contributions, collectively strengthening participants' experiential and behavioral responses.

**Table 6. Regression and Coefficient Analysis**

| Motivation Dimension | R | $R^2$ | Sig. (Enjoyment) | Enjoyment | Sig. (Image) | Image | Sig.(Health Management) | Health Management |
|---|---|---|---|---|---|---|---|---|
| Aesthetics | .427 | .182 | .000 | .343 | .756 | .025 | .044 | .159 |
| Education | .429 | .184 | .000 | .275 | .004 | .232 | .641 | .037 |
| Entertainment | .424 | .180 | .000 | .254 | .127 | .122 | .024 | .180 |
| Escapism | .467 | .218 | .000 | .290 | .018 | .186 | .084 | .134 |
| Re-Participation Intention | .463 | .214 | .000 | .305 | .080 | .138 | .040 | .160 |

**ANOVA Results**

Table 7 presents the ANOVA results for the relationship between the independent variables of enjoyment, health management, and image and the five dimensions of motivation in sports event participation, namely aesthetics, education, entertainment, escapism, and re-participation intention. The results indicate that the independent variables collectively have a significant effect on all motivational dimensions. Specifically, the regression models for aesthetics ($F=14.539$, $p<0.001$), education ($F=14.744$, $p<0.001$), entertainment ($F=14.339$, $p<0.001$), escapism ($F=18.189$, $p<0.001$), and re-participation intention ($F=17.788$, $p<0.001$) were all statistically significant, suggesting that enjoyment, health management, and image explain a meaningful portion of variance in motivation across these dimensions. The findings highlight that participants' enjoyment, health-related perceptions, and self-image collectively influence their motivational drivers, with escapism and re-participation intention showing slightly higher F-values, indicating a stronger explanatory power for these particular dimensions. Overall, the results confirm the significance of these independent variables in shaping motivation in sports event participation.

**Table 7. ANOVA Results for the Effect of Enjoyment, Health Management, and Image on Motivation Dimensions in Sports Event Participation**

| Motivation Dimension | Regression SS | Df (Reg) | Residual SS | df (Res) | F | Sig. (P) |
|---|---|---|---|---|---|---|
| Aesthetics | 8.556 | 3 | 38.448 | 196 | 14.539 | 0.000 |
| Education | 9.778 | 3 | 43.327 | 196 | 14.744 | 0.000 |
| Entertainment | 7.671 | 3 | 34.954 | 196 | 14.339 | 0.000 |
| Escapism | 13.201 | 3 | 47.419 | 196 | 18.189 | 0.000 |
| Re-Participation Intention | 8.997 | 3 | 33.044 | 196 | 17.788 | 0.000 |

**Results of hypothesis testing summary**

Higher levels of enjoyment are linked to better motivational outcomes in sports event participation, according to the regression analysis, which showed a significant positive relationship between the enjoyment factor and participants' motivation across all dimensions, including aesthetics, education, entertainment, escapism, and re-participation intention. On the other hand, none of the evaluated dimensions showed a statistically significant association between motivation and the health goals factor, which includes both Image and Health Management. As a result, the claim that enjoyment has a major impact on motivation is validated, but the claim that health goals have an impact on motivation is not. These results highlight the critical role that intrinsic enjoyment plays in boosting participants' engagement and intention to participate in sporting events, indicating that enjoyment is a more important motivator than health-related factors.

**Discussion and Research Findings**

In this study, the researcher examined the factors motivating participants to engage in sports events, specifically focusing on the Seremban Half Marathon, with data collected from 200 respondents via an online questionnaire. The analysis revealed that enjoyment has a significant

and positive relationship with motivation across all measured dimensions, including Aesthetics (B = 0.343, t = 5.016, p = 0.000), Education (B = 0.275, t = 4.028, p = 0.000), Entertainment (B = 0.254, t = 3.718, p = 0.000), Escapism (B = 0.290, t = 4.338, p = 0.000), and Re-participation Intention (B = 0.305, t = 4.562, p = 0.000), confirming that enjoyment is a key driver of motivation to participate in sports events. Conversely, the health goals factor, categorized into Image and Health Management, did not consistently show a significant influence on motivation across the dimensions. Specifically, motivation by Aesthetics (Image: B = 0.025, t = 0.312, p = 0.756; Health Management: B = 0.159, t = 2.023, p = 0.044), Education (Image: B = 0.232, t = 2.910, p = 0.004; Health Management: B = 0.037, t = 0.466, p = 0.641), Entertainment (Image: B = 0.122, t = 1.533, p = 0.127; Health Management: B = 0.180, t = 2.280, p = 0.024), Escapism (Image: B = 0.186, t = 2.385, p = 0.018; Health Management: B = 0.134, t = 1.736, p = 0.084), and Re-participation Intention (Image: B = 0.138, t = 1.761, p = 0.080; Health Management: B = 0.160, t = 2.068, p = 0.040) indicated inconsistent and mostly non-significant results. Therefore, the hypothesis regarding enjoyment as a motivator is supported, while the hypothesis concerning health goals is not, suggesting that intrinsic enjoyment rather than health-related considerations predominantly drives participants' motivation to engage in sports events.

## Implication of Research

The implications of the research results have been discussed in theoretical and practical terms in this section.

## Theoretical Implications

This study used the Seremban Half Marathon as a case study to examine the relationship between characteristics that encourage participants to participate in sporting activities. Participants' information was gathered in order to investigate how motivation is impacted by enjoyment and health objectives. The results support the multidimensional theory of motivation by showing that participants' motivation is influenced by their enjoyment and health objectives, which is essential for developing positive future intentions. Additionally, the study offers information on how event planners can improve participant motivation and deal with elements that promote sustained participation in sporting activities.

## Practical Implication

The study's findings have implications for increasing sports event attendance. Enjoyment has a major role in boosting participant satisfaction and engagement because well planned, entertaining events are more likely to draw and keep attendance. Health objectives are likewise significant motivators which fitness-oriented people may be drawn in by highlighting the physical and wellness advantages of involvement. Supportive event settings, like hydration stations, fitness evaluations, medical assistance, and health-promoting initiatives, can also boost participation, especially for people with particular fitness or health goals.

## Limitations and Recommendations for Future Studies

It is important to recognize the various limitations of this study. Firstly, the study only looked at Seremban Half Marathon competitors, which restricts the findings' applicability to other sporting events. The results could not accurately reflect the larger population of sports event participants due to differences in event type, participant demographics, and cultural contexts, which could lead to different motivational variables. Second, a standardized online questionnaire was used for data collection, which would have limited respondents' ability to elaborate on their experiences or convey complex ideas. This methodological constraint may have limited the study's capacity to obtain complicated, subjective insights on motivation by affecting the depth and richness of the data. Furthermore, only two independent variables which are enjoyment and health goal were explored in the study, other possible motivational influences, such as social interaction, achievement orientation, or environmental factors, were not taken into account.

Future studies should broaden the scope to include participants from a variety of sporting events, including various scales, forms, and demographic profiles, in order to overcome these limitations. A method like this would improve the findings' external validity and offer a more thorough comprehension of motivational drivers in various circumstances. To provide a more comprehensive study, future research should also take into account other elements that might affect motivation, such as social, psychological, and environmental aspects. It is also advised to use mixed-method approaches, which include qualitative methods like focus groups, interviews, and open-ended surveys. These techniques would provide deeper insights and supplement quantitative data by enabling participants to more freely express their experiences, motives, and perceptions. Lastly, long-term studies might be carried out to monitor changes in motivation over time, offering a dynamic viewpoint on the elements that encourage or hinder involvement in sporting events.

Future research can produce more solid, broadly applicable, and useful findings that support the efficient planning and administration of sporting events by resolving these issues and using a more thorough, multi-method approach.

## Conclusion

Based on a case study of the Seremban Half Marathon, the results of this study offer empirical evidence on the relationship between two independent variables which are enjoyment and health goals and desire to engage in sporting activities. The analysis shows that participants' motivation is significantly and favorably impacted by enjoyment, suggesting that the desire of individuals to interact and participate in an event is greatly influenced by its experience and enjoyable elements. On the other hand, there was not much effect on motivation from the health goals factor, which includes both image and health management dimensions. This suggests that participants' pursuit of health-related outcomes had less of an impact on their involvement in this setting. As a result, just a portion of the research aims have been accomplished the goal pertaining to enjoyment as a motivating element is supported, while the goal pertaining to health goals is not. Overall, by emphasizing the importance of enjoyment as a major motivating factor, this study adds to the body of knowledge on sports event participation and offers guidance to practitioners, researchers, and event organizers looking to increase participant happiness and engagement.

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# RELATIONSHIP BETWEEN DIGITALIZATION AND SAVINGS MOBILIZATION OF MICROFINANCE INSTITUTIONS: AN EMPIRICAL STUDY

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***Abstract:*** *Microfinance institutions are playing an important role in economic growth of the developing countries. However, microfinance institutions need financial as well as social stability for their survival. Savings mobilization is one of the important tools for achieving this goal. In this case, digitalization can play a role in enhancing savings mobilization of microfinance institutions. Therefore, this study aims to examine the relationship between digitalization and savings mobilization of microfinance institutions in low-income, lower middle-income and upper middle-income countries. To fulfil its objective, the study employed panel data with the application of fixed effect and random effect method for estimation. The data was extracted from the MIX Market (Microfinance Information exchange) (mixmarket.org). Moreover, the data on macroeconomic indicators such as GDP growth and inflation were taken from the World Development Indicators (WDI). Similarly, the data concerning macro-institutional quality and digitalization were collected from the World Development Indicators (WDI). The analyses revealed that digitalization has a positive and significant impact on promoting savings mobilization of microfinance institutions in all three groups of income classification countries. However, the magnitude of impact of digitalization on saving mobilization is higher in low-income countries. In addition, the study found that the size of microfinance institutions is significantly positive with savings mobilization in low income and lower middle- income countries while it is insignificant in upper middle -income countries. The findings of this study suggest that digitalization is vital for savings mobilization which enhances financial and social sustainability of microfinance institutions in these countries.*

***Keywords:*** *Digitalization, Savings Mobilization, Microfinance Institutions, Developing Countries*

## Introduction

It's commonly acknowledged in the literature, that MFIs mostly stick to a dual bottom-line approach that incorporates both financial and social objectives (D'Espallier et al., 2013). This proposes that they need to balance their financial sustainability by controlling their income-cost structure together with focus on outreach efforts such as poverty reduction. The performance of microfinance institutions (MFIs) strongly depends on their capability to access capital, with client deposits being a significant source through savings mobilization. The increasing trend of competition and transitions in the financial sector is requiring a rapid application of sustainability-based business model (Alshehhi, et al., 2018). However, such

development can only be experienced with institutional sustainability in the microfinance sector. As a result, MFIs should secure capital flow at low costs to be sustainable in this growing competitive market. Therefore, many MFIs emphasis on savings mobilization to secure adequate capital which leads to maximum outreach to the poor and financial self-sufficiency (Henock, 2019; Khachatryan, et al., 2019). Increasing capital from savings mobilization is redistributed among MFIs' clients as micro-credit which helps to create micro-entrepreneurs who contributes to socio-economic development and community welfare (Birchall, 2013). This is how MFIs promote sustainable development in many developing nations. Therefore, savings mobilization is not only vital for MFIs' outreach and financial sustainability but also supportive in achieving sustainable development goals.

Over the past few years, there has been a steady expansion in digitization within the global financial services industry. This trend is also affecting the microfinance sector, which aims on offering financial services to individuals in developing nations who usually have lesser approach to conventional banking services (Yousif et al., 2013).

Providing financial stability without considerable support from donors casts a significant challenge for this sector. Evidence advocates that information and communication technology (ICT) or digitalization play a crucial role in reducing operational costs, improving the marketing of microfinance products, broadening outreach, and addressing the gaps in financial inclusion overall (Das & Laha, 2021; Yadav, Kanojia & Jain, 2022). According to Sousa-Shields and Frankiewicz (2004), savings mobilization is the most effective and stable capital generating approach, especially for small financial organizations. Previous studies have also identified the importance of savings mobilization for financial self-sufficiency. Increasing savings mobilization boosts the institutional sustainability as the financial conditions of MFIs are improved (Branch & Klaehn, 2002; Ledgerwood, 1998; Ledgerwood, et al., 2013). It is also very important to serve the poor community for longer period (Ahmed, et al., 2018; Hartarska & Nadolnyak, 2007; Khachatryan, et al., 2019). Furthermore, broad worldwide empirical studies on the impact of digitalization on saving mobilization within the microfinance sector are missing, however. existing literature examines the factors influencing internet banking adoption in various developing nations (Hanafizadeh et al., 2014; Toufaily et al., 2009; Raza et al., 2017; Malhotra and Singh, 2007). These studies recommend that established banks with significant loan portfolios or deposits, aiming to reduce operational expenses, frequently choose to provide internet banking services.

This study is the first attempt to investigate determinants of saving mobilization in the microfinance sector. Therefore, the study focuses on how using digital technology affects saving mobilization in microfinance institutions with internal (size of institutions) and external (macroeconomics and macro-institutional) environment. Our study encompasses global income distribution countries, comprising 80 MFIs from low-income nations, 182 from lower-middle income nations, and 262 from upper-middle income nations.

## Literature Review

The fundamental theory closely associated with our study is the institutionalist approach, highlighting the financial sustainability of microfinance institutions (MFIs). Advocates of this theory concentrate on the long-term viability of MFIs to effectively serve deprived people. They argue that without these institutions financially sustaining themselves and covering both

operational and funding expenses, they won't be able to deliver persistent support to the poor over time (Brau 2014; Meyer 2002; Morduch 2000; Woller 1999).

***Savings Mobilization of Microfinance Institutions***

Like banks, MFIs also require sustained source of capital to serve as many untapped poor possible in the society (Ahmed, et al., 2018) and ensure financial sustainability (Khachatryan, et al., 2019). However, major impediments for MFIs' in achieving dual objectives are the limited availability of capital (Khachatryan, et al., 2019); on the other hand, high transaction costs. Hence, the product line of MFIs is diversified (Zamore, 2018) to address these issues and savings mobilization is offered for their clients. It is comparatively easy obtaining, reasonable and the most comprehensive approach of generating funds for MFIs (Al-Azzam, 2019). Additionally, such capital source helps lending operations expansion that also benefits wide range of clients. It also enhances MFIs capacity to deliver credit service to the poor and tackle high costs of capital (Hartarska, et al., 2010). Offering savings products can be the key to institutional sustainability and limit dependence on external subsidies (Hartarska & Nadolnyak, 2007). Savings mobilization also increases available resources that can be invested in productive activities for sustainable community development (CGAP, 2005; Elser, 1999; Fiebig, 1999). Since institutional sustainability is crucial for MFIs, they must secure the most stable funding source. There are ongoing debates whether subsidies or savings mobilization would be a better financing instrument (Al-Azzam, 2019). MFIs that strive to reach large portions of the poor in a sustainable manner must limit their dependency on subsidies after a certain period (Cull, et al., 2018; Karlan, et al., 2014). Once MFIs can generate funds from their innovative and stable products line, such as offering savings, they should give-up depending on subsidies (Helms, 2006).

***Savings Mobilization and Digitalization***

Microfinance institutions repeatedly face considerable operating expenses, covering administrative expenses, staff wages, and provisions for loan losses. These prominent expenditures may hinder their capacity to widen services to low-income individuals and communities, as well as to advance affordable financial solutions. Previous research has indicated that such high operating costs can destabilize the sustainability of microfinance institutions and diminish their capability to deliver economical financial services to low-income groups (Armendariz & Morduch, 2010). Digitalization has the potential to impact MFI performance by cutting costs and increasing financial outcomes.

The digital revolution offers swift, responsive, and distinguished financial and social services to low-income people in a way that never did in the past. Microfinance institutions are normally dependent on donor funds and operate with narrow profit margins. As per GSMA Association's projections from 2019, digital technologies stand out as a pivotal tool capable of driving savings mobilization and fostering financial inclusion across all demographic segments.

The continuous digitization of public services impacts various facets of human endeavors. The swift proliferation of digital technology generates more value within the global economy. Research signifies that the adoption of ICT or digitalization plays a significant role in reducing operational costs, improving the promotion of microfinance products, broadening outreach,

and ultimately addressing the gaps in financial inclusion (Das & Laha, 2021; Yadav et al., 2022)

***Saving Mobilization and Macroeconomic Indicators***

Microfinance performance is interdependent with the performance of the macroeconomic environment. Berthemely and Varoudakis (1996), Luintel and Khan (1999), Lewis (2013) and Greenwood and Jovanovic (1990) maintain economic growth and financial development occur in a collaborative style, where growth in real income promotes the financial sector first and when the growth in the banking sector takes place due to increase in return on savings and increase in capital accumulation ultimately provide impetus to the economic growth. In this perspective, many empirical studies such as, Ahlin, Lin and Maio (2011) explain this expansion of microfinance business in this way intrinsically microfinance institutions like to prefer high-growth economies with the relatively rich client. Many economists state inflation as the continuous increase in the price of goods and services in the market during a period. Choi and Boyd (2001) link the relationship between inflation and credit rationing through saving. According to them the movement in inflation leads to movement in the supply of funds in the market as when the inflation level is high, it impacts the supply of saving due to a fall in return on saving. A decline in savings returns negatively affects the efficient allocation of funds and initiates credit rationing, subsequently causing a reduction of available funds in the market, in this manner neglecting many individuals with low incomes. On the other hand, when inflation is low, this trend reverses, making more funds accessible to many impoverished individuals. As reported by Ahlin, Lin and Maio (2011) that inflation has a bad impact on the lending objective of MIFs. Financially, unanticipated inflation leads to a lower real rate of return of an MFI, increasing the cost of funds together and put impacts borrower incentive for delay and default.

***Saving Mobilization and Macro-Institutional Factors***

According to Banerjee, Banerjee and Duflo, (2011) and Armendariz and Morduch (2010) microfinance are acclaimed as an important tool to fight against poverty and financial exclusion. However, with the popularity of its objective to improve the welfare of the people, this industry is still facing different challenges. One of the challenges faced is assessing the quality of the macro-level institutions within which microfinance institutions operate (Chikalipah, 2017). A lack of customer protection, weak enforcement of laws, bureaucratic corruption, high levels of loan borrowing and delinquencies, complex administrative procedures, and fraudulent activities jointly generate an unfavorable business environment for the development and effectiveness of the microfinance industry (Barry & Tacneng, 2014; Giné & Karlan, 2014; Schicks, 2013; Ayittey, 2012). All these above researchers conclude in a common understanding that macro-institutional factors significantly influence the operational activities of microfinance institutions (MFIs). In relation to empirical research, as highlighted by Fisman and Svensson (2007), it's essential to examine the impact of both macroeconomic and macro-institutional factors on microfinance performance. Hence, they propose the idea that high levels of corruption hamper the growth of small and medium-sized enterprises globally.

***Saving Mobilization and MFI-Size***

In continuation with the discussion of external factors, the evaluation of internal factors is also a matter of concern for MFIs performance. Internal factors refer to variables that are specific to the firm and under the influence of the firm's management, exhibiting variation over time, such as financing structure, credit risk, cost efficiency, social outreach, and firm size, as outlined by Hall & Rosenberg, (2009). Size of firm is used as the natural logarithm of total assets (ln TA), used to control diseconomies or economies of scale. Moreover, this measure acknowledges the influences of variations in technology, investment prospects, and diversification within microfinance institutions (Daher & Saout, 2015).

## Materials and Methods

### *Data Sources and Variables Description*

In this study, microfinance institutions are drawn from low income, lower-middle income, and upper-middle income. This selection is based on the availability of well documented and audited data of MFI from 2010 to 2019, sourced by MIX Market (Microfinance Information exchange) (mixmarket.org). An electronic web-based platform for the exchange of data and standards covering MFIs with the prime objective to "enhance and maintain clarity in the microfinance institution during data collection and analysis". Mix Market provides a database of nearly 2000 MFIs around the world, found in the series of world development indicators and maintained by the World Bank. Moreover, macroeconomic indicators such as GDP growth and inflation were taken from the World Development Indicators (WDI) (http://data.worldbank.org/indicator) for the corresponding period. Data concerning macro-institutional quality and digitalization were similarly collected from the World Development Indicators (WDI).

### *Key Dependent Variables*

The objective of this study is to investigate the factors influencing savings mobilization. The study uses the deposit-to-total-assets ratio as a proxy for savings mobilization, acting as a dependent variable. The deposit-to-total-assets ratio was obtained from the MIX Market standard indicators.

### *Key Independent Variables*

In this study, we investigate the impact of digitalization on the saving mobilization of microfinance institutions in lower-income, lower-middle income, and upper middle-income countries of the world. Thus, the independent variable digitalization refers to number of internet users/hundred Individual. This measure provides a standardized measure of internet usage relative to the population size is a common way to compare digital technology adoption rates across different regions or countries. The higher the rate, the greater the proportion of the population using digitalization. The proxy of digitalization is taken from the World Bank. The macroeconomic variables are used as the independent variables and obtained from the World Development Indicator (WDI) database, provided by the World Bank. The indicators used for the estimation are inflation, GDP growth Data related to macro- institutional factors is taken from the World Governance Indicators (WGI) by (Kaufmann, Kraay & Materazzi, 2009) that are produced and collected by The World Bank and based on a large extent of a survey taken from citizens and experts in development.

### *Control Variables*

To prevent potential bias, the study incorporated control variables with the use of logarithm of MFI asset size as a control variable for institutional characteristics, and asset size is collected from MIX Market (mixmarket.org).

### *Empirical Model*

The study uses three different balanced panel regression analysis models with a ten-year time (2010-2019), comprises of 80 MFIs from low- income, 272 MFIs from lower middle- income and 162 MFIs of upper middle- income countries across the world. The panel data is comprised of both time and cross-section characteristics (Zhang,2017). In this panel data fixed effects model and random effect techniques are applied, after following the criteria of the test for specification bias of Hausman test. The functional form of panel-regression analysis is adopted from (Wooldridge, 2015)

$$Saving\ Mobilization = f\{Digitallization\} \quad 3.1$$
$$Saving\ Mobilization = f\{Macroeconomic, Macro-institutional \sim External\ Factors\} \quad 3.2$$
$$Saving\ Mobilization = f\{Assets\ size \sim Internal\ Factors\} \quad 3.3$$

*Combining equations 3.1, 3.2 and 3.3 in a equation, and hence equation 3.4 was used for estimation of results.*

$$Saving\ Mobilization = f\{Digitallization, Macroeconomic, Macroinstitutional, Asset\ size,\} \quad 3.4$$

### *Model Specification Tests*

The study uses pre-estimation method for correct model selection, the model should indicate the e proper determination of relationships and parameters in the model (Lomax and Schumacker,2012). The selection of preferred model is depicted in Table 1, which shows the selection of ordinary least square (OLS), random effects (RE), and fixed effects (FE) models. The general procedure we used to search for the best model is composed of five steps.

First, we checked whether the pooled ordinary least square (POLS) model or the random effect model (REM) is preferable, by applying the Breusch Pagan Lagrange Multiplier test. Our results preferred the random effect model. Second, we used the Hausman test to decide between fixed effect model (FEM) and random effect model (REM). The rule of thumb for selection between FEM and REM, if the chi-square probability in the Hausman test output was below 0.05, we preferred the fixed effect; otherwise, we chose the random effect (Lotto 2018). In this study, we found that the fixed effect is suitable for low and upper-middle-income countries, while the random effect is preferred for lower-middle-income countries during estimation. Additionally, we tested for autocorrelation between error terms using the Wooldridge test and for heteroskedasticity to ensure constant variance among error terms. All pre-estimation tests are presented in Table1.

**Table 1: Pre-estimation Tests**

| **Breusch and Pagan (LM) test for Random Effects** | | | |
|---|---|---|---|
| | $\chi 2$ | Prob>$\chi 2$ | Preferred Model |
| Low income | 1823.99 | 0.000 | Random Effect |
| Lower middle- income | 7855.04 | 0.000 | Random Effect |
| Upper middle- income | 4877.05 | 0.000 | Random Effect |
| **Hausman Specification Test** | | | |

| | $\chi 2$ | Prob>$\chi 2$ | Preferred Model |
|---|---|---|---|
| Low income | 72.44 | 0.000 | Fixed Effect |
| Lower middle- income | 8.82 | 0.1842 | Random Effect |
| Upper middle- income | 37.56 | 0.000 | Fixed Effect |

**Modified Wald test for Groupwise Heteroskedasticity**

| | $\chi 2$ | Prob>$\chi 2$ | Ho=No Heteroskedasticity |
|---|---|---|---|
| Low income | 30104.82 | 0.000 | Reject Ho |
| Lower middle-income | N/A | N/A | N/A |
| Upper middle- income | 94079.60 | 0.000 | Reject Ho |

**Wooldridge test for Autocorrelation in Panel Data**

| | F-Test | Prob>F | H0: No first-order autocorrelation |
|---|---|---|---|
| Low income | 17.45 | 0.000 | Reject Ho |
| Lower middle- income | N/A | N/A | N/A |
| Upper middle- income | 85.779 | 0.000 | Reject Ho |

Lastly, we apply Karl Pearson Correlation coefficients to judge multicollinearity among independent variables. The highest coefficient observed was 0.264, indicating that the pairwise correlations between variables are not substantial, indicating that multicollinearity is not an issue. Multicollinearity was found when the value of coefficient of correlation between two predictors goes over 0.80 (Damodar, 2004).

**Table 2: Matrix of Correlations**

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| (1) LTA | 1.000 | | | | | |
| (2) DIG | 0.257 | 1.000 | | | | |
| (3) GDPG | -0.036 | -0.240 | 1.000 | | | |
| (4) CPI | -0.031 | 0.192 | -0.205 | 1.000 | | |
| (5) PSAT | -0.031 | -0.090 | 0.264 | -0.084 | 1.000 | |
| (6) REQ | 0.029 | 0.013 | 0.232 | -0.282 | 0.665 | 1.000 |

## Empirical Results and Discussion

The panel data consists of one dependent variable, deposit to total asset ratio (DTA), and six independent variables digitalization (DIG), Macroeconomics variable such as GDP growth rate (GDPG) and inflation rate, (CPI). Furthermore, institutional quality variable consists of index of political stability (PSAT) and index of regulatory quality (REQ)) and while MFI specific variable consists of the size of the MFI institution measured by log of total assets (L TA). Descriptive statistics of three sample of study are shown in Table 3.

**Table 3: Descriptive Statistic**

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Low-Income Countries** | | | | | |
| MFIs | 800 | 40.5 | 23.107 | 1 | 80 |
| Year | 800 | 2014.5 | 2.874 | 2010 | 2019 |
| DTA | 800 | 42.385 | 25.339 | .33 | 106.07 |

| | | | | | |
|---|---|---|---|---|---|
| DIG | 800 | 8.18 | 6.886 | .45 | 34.253 |
| GDPG | 800 | 4.535 | 4.522 | -36.392 | 14.362 |
| CPI | 800 | 6.666 | 7.559 | -3.233 | 63.293 |
| PSAT | 800 | -1.089 | .843 | -2.996 | .661 |
| REQ | 800 | -.762 | .413 | -1.852 | .186 |
| LTA | 800 | 15.936 | 1.637 | 11.869 | 20.567 |
| **Lower Middle-Income Countries** | | | | | |
| MFIs | 2620 | 131.5 | 75.647 | 1 | 262 |
| Year | 2620 | 2014.5 | 2.873 | 2010 | 2019 |
| DTA | 2620 | 41.869 | 24.405 | .04 | 102.99 |
| DIG | 2620 | 18.954 | 15.02 | .22 | 70.35 |
| GDPG | 2620 | 5.542 | 2.456 | -8.685 | 23.412 |
| CPI | 2620 | 5.642 | 3.923 | -1.47 | 29.507 |
| PSAT | 2620 | -.766 | .74 | -2.81 | 1.176 |
| REQ | 2620 | -.517 | .373 | -2.245 | .404 |
| LTA | 2620 | 16.92 | 2.013 | 11.219 | 22.815 |
| **Upper Middle-Income Countries** | | | | | |
| MFIs | 1430 | 72 | 41.294 | 1 | 143 |
| Year | 1430 | 2014.5 | 2.873 | 2010 | 2019 |
| DTA | 1430 | 53.125 | 26.405 | .02 | 94.33 |
| DIG | 1430 | 44.992 | 15.501 | 5.329 | 81.201 |
| GDPG | 1430 | 3.33 | 2.482 | -3.83 | 11.2 |
| CPI | 1430 | 3.544 | 3.085 | -1.418 | 59.22 |
| PSAT | 1430 | -.446 | .417 | -2.007 | 1.038 |
| REQ | 1430 | -.156 | .573 | -1.324 | 1.032 |
| LTA | 1430 | 17.669 | 2.236 | 8.665 | 22.446 |

**Table 4: Regression Results**

| | **Low-income countries** | **Lower Middle-Income countries** | **Upper middle-income countries** |
|---|---|---|---|
| VARIABLES | DTA | DTA | DTA |
| | | | |
| DIG | 0.449** | 0.0988*** | 0.143*** |
| | (0.213) | (0.0228) | (0.0464) |
| GDPG | 0.331* | 0.0845 | 0.195 |
| | (0.189) | (0.0955) | (0.159) |
| CPI | 0.130 | -0.260*** | 0.101 |
| | (0.0793) | (0.0782) | (0.0905) |
| PSAT | -3.352 | 2.636*** | 3.011* |
| | (2.457) | (0.868) | (1.783) |
| REQ | -1.384 | 0.146 | 6.882** |
| | (7.442) | (1.684) | (2.916) |
| Ln TA | 3.688* | 2.541*** | 0.373 |
| | (1.917) | (0.309) | (0.736) |
| Constant | -27.14 | 0.0990 | 41.51*** |
| | (28.49) | (5.492) | (12.38) |

| | | | |
|---|---|---|---|
| Observations | 800 | 2,620 | 1,430 |
| R-squared | 0.648 | 0.723 | 0.760 |
| Number of MFIs | 80 | 262 | 143 |

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

This study found the digitalization is statistically significant in promoting saving mobilization in all three group of countries based on income classification has a positive and statistically significant coefficient at 5% in low-income countries and 1% in lower and upper middle-income countries across in the estimation. This result indicates the significance of digitalization on saving mobilization of microfinance institutions. The magnitude of impact of digitalization on saving mobilization is higher in low-income countries. The findings of digitalization with saving mobilization are justified with the statement of GSMA Association (2019), which suggest that digitalization is one of the key tools that can activate the savings mobilization. In addition, the macroeconomics indicators used in this study such as GDP growth have a significantly positive relationship with saving mobilization in low-income countries at 1% significant level. However, GDP growth is positive but insignificant in lower and upper-middle income countries. On the other hand, inflation measured by CPI% is significantly negative with saving mobilization in lower middle-income countries at 1% significant level, however, insignificant in low-income and upper middle-income countries. In summarizing overall macroeconomics findings, the study results follow basic macroeconomic principles. Where increase in income increases the saving while increase in expected or unexpected inflation impedes aggregate savings. In relation to macro-institutional indicators, political stability is significantly positive with saving mobilization in lower and upper middle- income at 1% and 10% significant level respectively. The results indicate that political stability boosts the saving mobilization. Our result justifies the findings of Barry & Tacneng, (2014) and Schicks, (2013).

However, the impact of political stability on saving mobilization is insignificant in low- income countries. In line with political stability the regulatory quality also has significantly positive with saving mobilization at 1% significant level, but insignificant in low-income and lower middle-income countries. In summarizing the macro-institutional factor, a good macro-institutional environment favorable for saving mobilization. In relation to microfinance institution specific characteristic factor, the size of MFI measure by log of total assets is significantly positive with saving mobilization in low income and lower middle- income countries at 10% and 1% significant level. This finding indicates the size of MFI contributes to the saving mobilization. However, this finding is insignificant in upper middle -income countries.

## Conclusion

The findings of this study suggest that digitalization is vital for saving mobilization which results in the achievement of financial sustainability vis a vis social objective of microfinance institutions. Besides digitalization, external factors such as macroeconomic and macro-institutional environment and internal factors such as size of MFIs also contribute to the saving mobilization of microfinance institutions. This study focuses on data based on income classification provided by the world bank, therefore, the study recommends for the determination of digitalization and saving mobilization nexus at specific country or regional level.

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# DEVELOPING THE 8S TAZKIYAH-BASED MARITAL COUNSELLING FRAMEWORK

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***Abstract:*** *Marital instability has become an increasing concern across many Muslim societies, with rising divorce rates and relational distress, indicating the need for counselling models that are spiritually grounded and culturally congruent with Muslim societies. Although Islamic scholarship offers a rich reservoir of virtues such as ikhlāṣ (sincerity), ṣabr (patience), shukr (gratitude), shūrā (consultation), sakīnah (tranquility), ṣidq (truthfulness), khidmah (service), and Saʿādah (well-being/flourishing), these concepts remain thematically dispersed and have not been systematically integrated into a unified therapeutic framework for marital counselling. Likewise, while tazkiyah al-nafs (self-purification) is central to classical Islamic psychology, it remains under theorized within contemporary marital counselling practice. This study addresses these gaps by developing the 8S Tazkiyah-Based Marital Counselling Framework through a grounded content analysis of the Qurʾān, ḥadīth, classical texts, modern Islamic psychology literature, and empirical research on Muslim marital counselling. The analytical procedure involved textual coding and thematic categorization of classical and contemporary sources. The resulting model integrates three components: (a) Tawḥīdic epistemology as the overarching worldview; (b) tazkiyah al-nafs as the core psychospiritual mechanism; and (c) eight virtue-based processes–Ikhlāṣ, Ṣabr, Shukr, Shūrā, Sakīnah, Ṣidq, Khidmah, and Saʿādah–that collectively guide intrapersonal and interpersonal transformation within marriage. The framework contributes to Islamic psychology by offering a structured, spiritually anchored virtue model and providing practitioners with an evidence-informed tool for marital interventions. This study demonstrates how Islamic virtues, when systematically conceptualized, can form a cohesive therapeutic pathway to strengthen marital relationships and enhance family well-being in Muslim contexts.*

***Keywords:*** *Tazkiyah-based Framework, Islamic marital counselling, Tazkiyah al Nafs, Islamic psychology, Virtue-based Therapeutic Model*

## 1.0 Introduction

Marital instability has emerged as a pressing social and spiritual concern across many Muslim societies, as reflected in rising divorce rates and increasing relational distress. In Malaysia, official statistics indicate sustained strain on marital stability, with 63,338 divorce cases recorded in 2022 and 57,835 in 2023, demonstrating persistently high dissolution rates despite a marginal decline (Department of Statistics Malaysia [DOSM], 2024). At the global level, demographic data further confirm that several Muslim-majority countries experience elevated divorce trends, signaling structural challenges that affect family cohesion (United Nations Department of Economic and Social Affairs [UN DESA], 2023). These patterns point not only to social change but also to deeper issues related to emotional regulation, communication, and the erosion of spiritual foundations within marital relationships (Hamdan, 2008; Badri, 2018). As Muslim families navigate economic pressures, shifting gender norms, and increasing

exposure to secular therapeutic discourses, there is an urgent need to re-examine the psychological and spiritual foundations of marriage within the Islamic tradition.

In Islam, marriage (*nikāḥ*) is framed as a sacred covenant (*mīthāq ghalīẓ*) and a divinely instituted source of *sakīnah* (tranquility), *mawaddah* (affection), and *raḥmah* (mercy) (Qurʾān 30:21; 4:21). Classical Islamic scholarship consistently presents marriage as a moral and spiritual institution through which ethical character (*akhlāq*) is cultivated and emotional maturity refined. Central virtues such as *ikhlāṣ* (sincerity), *ṣabr* (patience), *shukr* (gratitude), *shūrā* (consultation), *ṣidq* (truthfulness), khidmah (service), and *Saʿādah* (well-being/flourishing) are repeatedly emphasized as foundations of marital harmony and spiritual excellence (al-Ghazālī, 2004; Ibn Qayyim al-Jawziyyah, 1996; al-Qaradāwī, 2004). Despite their prominence, these virtues are often discussed independently and lack systematic integration into a coherent therapeutic structure that can guide counselling practice (Haque, 2004; Hamdan, 2008). Consequently, much religious guidance in marital contexts remains exhortative, offering moral counsel without operationalized psychospiritual processes capable of facilitating sustained relational change (Rothman & Coyle, 2018).

A central factor contributing to this limitation is the under-theorization of *tazkiyah al-nafs* (purification of the self) in contemporary counselling practice. Classical scholars such as al-Ghazālī and Ibn Qayyim regard tazkiyah as the foundation of moral behavior, emotional regulation, and relational balance, viewing the refinement of the self as a prerequisite for ethical interaction (al-Ghazālī, 2004; Ibn Qayyim al-Jawziyyah, 1996). However, modern Muslim marital counselling programs rarely position tazkiyah as a structured therapeutic mechanism. Instead, spiritual components are often treated as supplementary or symbolic additions rather than the core process driving psychological and relational transformation (Badri, 2018; Awaad & Ali, 2022). This has widened the gap between Islamic anthropology, which conceives human beings as integrated moral, emotional, and spiritual entities, and counselling models grounded in secular assumptions about selfhood and well-being (al-Attas, 2001; Abu-Raiya, 2012).

Existing marital education initiatives in Muslim-majority contexts further illustrate this gap. For example, In Indonesia, the BP4 premarital program integrates Qurʾānic instruction with basic communication skills but lacks a structured virtue-based therapeutic sequence (Sari & Pramono, 2018). In Malaysia, state-mandated premarital courses emphasize *tawḥīd*, *fiqh al-usrah*, and general interpersonal guidance but primarily function as educational rather than therapeutic interventions (Hamjah & Akhir, 2014). In several Gulf contexts, Sharīʿah court mediation prioritizes legal reconciliation and moral admonition, often with limited incorporation of systematic psychological or virtue-based counselling processes (Al-Zahrani, 2020). While these initiatives reflect genuine concern for family stability, they remain constrained by fragmented approaches and insufficient integration of Islamic psychological theory (Hamdan, 2008; Badri, 2018).

Simultaneously, reliance on Western psychological frameworks presents additional challenges. Although cognitive-behavioral, humanistic, and systemic approaches offer valuable techniques, their underlying assumptions regarding autonomy, moral neutrality, and emotional expression may conflict with the Islamic worldview (Haque, 2004; Rothman & Coyle, 2018). Attempts to "Islamize" such models through superficial scriptural references risk epistemological incoherence and limited therapeutic effectiveness (Badri 2018). Scholars in Islamic psychology, therefore, argue for counselling frameworks that emerge organically from

Islamic epistemology rather than being retrofitted onto secular paradigms (Hamdan, 2008; Abu-Raiya, 2012).

Against this backdrop, a clear research gap emerges: the absence of a unified Qurʾānic-based marital counselling model that systematically integrates classical Islamic knowledge, contemporary Islamic psychology, and *tazkiyah al-nafs* as a psychospiritual mechanism for marital conflict resolution. No existing framework coherently operationalizes *ikhlāṣ*, *ṣabr*, *shukr*, *shūrā*, *sākinah*, *ṣidq*, *khidmah*, and *saʿādah* into interlinked therapeutic processes that progress from intrapersonal purification to interpersonal relational excellence (Badri, 2018; Rothman & Coyle, 2018).

To address this gap, the present study develops the 8S Tazkiyah-Based Marital Counselling Framework, a structured virtue-based model grounded in Tawḥīdic epistemology, with *tazkiyah al-nafs* as the core psychospiritual mechanism and eight Qurʾānic virtues guiding therapeutic practice. Using qualitative content analysis of Qurʾānic verses, Prophetic traditions, classical Islamic psychological texts, and contemporary empirical literature, this study seeks to offer a culturally congruent, spiritually anchored, and clinically relevant counselling framework for Muslim marriages (Krippendorff, 2019; Elo et al., 2014).

The significance of this study lies in its contribution to Islamic psychology, marital counselling, and Muslim family well-being. By systematically integrating classical spirituality with contemporary therapeutic design, the proposed framework offers a coherent pathway for strengthening marital resilience, fostering emotional intimacy, and restoring *Sakinah-centered* relationships in contemporary Muslim societies (Badri, 2018; Rothman & Coyle, 2018).

## 2.0 Literature Review

### *2.1 Marriage in the Islamic Worldview*

In the Islamic worldview, the concept of marriage *(nikāḥ)* is more than a legal agreement or civil union. However, it embodies a sacred covenant (mīthāq ghalīẓ) that unites two souls in a spiritual, moral, and social partnership between husband and wife. It serves as the foundation of the family unit, which is highly valued in Islamic cultures. The Qurʾān states, "*And among His signs is that He created for you mates from among yourselves that you may find tranquility in them, and He placed between you affection and mercy*" (Q 30:21). This verse establishes *sakīnah* (tranquility), *mawaddah* (affection), and *raḥmah* (compassion) as the three foundational elements of marital life. Classical exegetes such as Al-Ṭabarī (2001), Al-Qurṭubī (2003), and Ibn Kathīr (1998) explain that *sakīnah* is inner repose bestowed by divine harmony, *mawaddah* denotes enduring love grounded in righteousness, and *raḥmah* reflects mercy that sustains companionship. This triad establishes marriage not only as a source of emotional fulfillment but also as a means of spiritual purification, aligning intimacy with acts of worship in the process.

Prophetic traditions reinforce the sanctity of marriage by linking it to the completion of one's faith and moral discipline. The Prophet ﷺ said, "*When a servant marries, he has completed half of his faith*" (Al-Nasaʾī, 1998). Thus, the family unit is conceptualized as a formative environment for cultivating *akhlāq karīmah* (noble character), with scholars such as *Al-Ghazālī* (2004) portraying the marital home as a madrasah where spouses learn patience (*ṣabr*), gratitude (*shukr*), humility, and cooperation (*taʿāwun*). Yūsuf al-Qaradāwī (2004), further

situates marriage within the broader framework of Tawḥīd (divine unity), safeguarding the higher objectives shariah (maqāṣid) of lineage (*ḥifẓ al-nasl*), dignity (*ḥifẓ al-ʿird*), wealth (*ḥifẓ al-māl*), and the self (*ḥifẓ al-nafs*), which underscores the multidimensional role of marriage in Islamic ethics and law.

*Seyyed Hossein Nasr* (2010) expands this understanding by framing the marital bond as part of a "metaphysical ecology of compassion," where individual virtue contributes to cosmic harmony. This contrasts with secular marital theories that prioritize emotional satisfaction or contractual arrangements, emphasizing the inseparability of marital stability from spiritual intention and divine order. Al-Hidabi (2024) identifies the deterioration of this spiritual foundation, particularly through neglect of *tazkiyah al-nafs* (self-purification), as a root cause of marital discord among Muslims, highlighting the critical role of ongoing spiritual refinement in sustaining marital harmony in Islam.

Despite this rich intellectual heritage, the literature reveals a conceptual gap: while Islamic scholars extensively discuss virtues such as ikhlāṣ (sinceressness), ṣabr (patience), shukr (gratitude), sakīnah (tranquility), shūrā (consultation), ṣidq (truthfulness), and khidmah (service), *Islāḥ al-Nafs* (self-reform), no existing framework systematically integrates these virtues into a structured marital counselling model grounded explicitly in *tazkiyah al-nafs*. This gap highlights the need for a virtue-based, spiritually anchored counselling approach rooted in the Islamic worldview. In response to this gap, the present study proposes the 8S *Tazkiyah*-Based Marital Counselling Framework, which seeks to translate Qurʾānic and Prophetic virtues into practical therapeutic components to strengthen marital relationships.

### *2.2 Concept of Tazkiyah al-Nafs*

*Tazkiyah al-Nafs* occupies a central position in Islamic spirituality, representing the purification, rectification, and elevation of the human soul. Rooted linguistically in the Arabic term *zakā*, which denotes cleansing, growth, and flourishing, *tazkiyah* encompasses the removal of moral impurities and the cultivation of virtue. The *Qurʾān* underscores the importance of this purification, asserting that success is achieved through the purification of the soul, while failure results from its corruption: "*He has succeeded who purifies it, and he has failed who corrupts it*" (Qurʾān 91:9–10). Classical Islamic scholars, notably *al-Ghazālī*, conceptualize *tazkiyah* as a lifelong discipline (*riyāḍat al-nafs*) aimed at harmonizing cognition (*ʿaql*), emotion (*qalb*), and conduct (*ʿamal*) in alignment with divine guidance, thus emphasizing the comprehensive nature of spiritual development

Within the Islamic intellectual tradition, the self is understood to progress through three distinct spiritual states: *nafs al-ammārah* (the commanding soul inclined toward base desires), *nafs al-lawwāmah* (the self-reproaching soul engaged in self-criticism and striving for improvement), and *nafs al-muṭmaʾinnah* (the tranquil soul at peace through the remembrance of God) (Ibn Qayyim al-Jawziyyah, 1996). These states reflect the underlying intrapsychic dynamics that influence emotional regulation, conflict resolution, and interpersonal behavior, all of which are foundational to relational stability, including marital contexts. The prophetic example of Muḥammad ﷺ, characterized by patience, gentleness, and emotional attentiveness, serves as a practical model for ethical interaction and spiritual purification in marital relationships (al-Nasa'ī 1998).

Contemporary Islamic scholarship approaches *tazkiyah* predominantly from epistemological, educational, and civilizational perspectives rather than from a clinical therapeutic model. Syed Muhammad Naquib al-Attas emphasizes *adab*, the discipline of the body, mind, and soul, as essential to Islamic education, positing that inner purification is a prerequisite for genuine knowledge acquisition (al-Attas 1991, 2001). Similarly, Ismail Raji al-Faruqi situates *tazkiyah* within the broader project of Islamization of knowledge, advocating for the removal of *jahili* (ignorant) assumptions to realign all aspects of life, including family relations, with *tawḥīd* (al-Faruqi, 1982). Scholars such as Wan Mohd Nor Wan Daud (1998) and Zainiy Uthman (2008) further extend this philosophical grounding by highlighting *tazkiyah* as foundational to the development of *insān kāmil*, or holistic human perfection, underscoring its role in moral and spiritual maturation

In contrast, contemporary Muslim psychologists explicitly integrate *tazkiyah* into therapeutic discourse. Badri (2018) conceptualized *tazkiyah* as a psycho-spiritual reconstruction process that involves moral discipline, self-reflection (*muḥāsabah*), and behavioral reform. Awaad and Ali (2022) described it as an integrative mechanism that combines cognition, affect, and spirituality, forming the core element of Islamically integrated psychotherapy models. Similarly, Haque (2004) and Rothman and Coyle (2018) emphasized spiritual purification as a pathway to psychological resilience, emotional regulation, and overall well-being among Muslim clients. These perspectives collectively acknowledge *tazkiyah* as a multidimensional process with significant implications for relational ethics and human flourishing, although it is not universally formalized as a clinical or therapeutic framework.

Taken together, these classical and contemporary perspectives offer a comprehensive intellectual foundation for understanding *tazkiyah* as a multidimensional process of moral, emotional, and spiritual refinement. However, although the literature acknowledges the therapeutic relevance of virtues such as *ikhlāṣ, ṣabr, shukr, shūrā, ṣidq, sakīnah,* and *khidmah*, no existing model systematically organizes these virtues into a structured marital counselling framework grounded explicitly in *tazkiyah al-nafs.* This conceptual gap provides the basis for the present study, which seeks to develop the 8S *Tazkiyah*-Based Marital Counselling Framework by translating these core virtues into interconnected therapeutic components that promote marital well-being and spiritual flourishing.

### *2.3 Islamic Marital Counselling and Psychology*

Islamic counselling and psychology represent a distinctive paradigm that integrates theological, ethical, and psychological principles to promote mental well-being aligned with divine purposes. Rooted in classical Islamic scholarship, early thinkers such as al-Rāzī and Ibn Sīnā conceptualized psychological disturbance as an imbalance between the intellect (*ʿaql*) and spirit (*rūḥ*). Their holistic view emphasized that healing requires both medical intervention and spiritual refinement, a perspective that continues to inform contemporary Islamic psychological thought (Badri 2018). This approach fundamentally challenges Western mind–body dualism by asserting that human well-being arises from the integrated functioning of cognition, emotions, behavior, and spirituality.

Modern Islamic counselling models have evolved by adapting classical insights into a structured therapeutic framework. Hamdan (2008) introduced a counselling process based on Qurʾānic stages of transformation *tawbah* (repentance), *muḥāsabah* (self-reflection), and

*tazkiyah* (purification) which correspond to key mechanisms of marital resilience, including emotional regulation, honesty, forgiveness, and self-awareness. Similarly, Erhamwilda (2009) highlighted the role of spiritual consciousness as an internal regulator that stabilizes emotional responses and aligns behavior with ethical values, underscoring the centrality of spirituality in therapeutic change.

Empirical studies in Muslim-majority contexts further validate these theoretical foundations. In Indonesia, the *Badan Penasihat Pembinaan dan Pelestarian Perkawinan* (BP4) integrates *Qurʾānic* education with communication and conflict resolution skills in premarital counselling. Sari and Pramono (2018) demonstrated that BP4's spiritually grounded modules significantly enhance marital readiness, empathy, and prosocial communication. In Malaysia, premarital Islamic counselling is mandatory for Muslim couples under state religious authorities, where modules typically integrate tawḥīd (oneness of God), akhlāq (moral conduct), family fiqh (Islamic jurisprudence), communication skills, and emotional regulation strategies. Research indicates that spiritually anchored courses enhance marital preparedness and strengthen couples' psychological resilience by grounding relational skills in Islamic values (Hamjah & Akhir, 2014). These findings illustrate that counselling approaches grounded in spirituality yield deeper and more sustainable relational outcomes than secular ones.

Recent progress in Islamic psychology emphasizes *that tazkiyah al-nafs* (purification of the self) is a pivotal mechanism for therapeutic transformation. Awaad and Ali (2022) conceptualized *tazkiyah* as an integrative process that harmonizes cognition, emotions, and spirituality in Muslim clients. Badri (2018) identified *taqwā* (God-consciousness) as the ultimate curative force in the context of psychotherapy. Collectively, these perspectives frame Islamic counselling as *tarbiyah rūḥiyyah*, a developmental, virtue-based process aimed at refining character, nurturing moral consciousness, and restoring alignment with divine guidance.

Despite these advances, a notable conceptual gap remains. Existing Islamic counselling frameworks often refer to individual virtues such as ṣabr (patience), shukr (gratitude), ikhlāṣ (sincerity), sakīnah (tranquility), and shūrā (consultation). However, no current model systematically integrates these virtues into a structured marital counselling framework explicitly grounded in tazkiyah al-nafs. Addressing this gap, recent scholarship proposes the 8S Tazkiyah-Based Marital Counselling Framework, developed through grounded content analysis of Qurʾānic, Prophetic, and classical Islamic psychological sources, aiming to provide a comprehensive virtue-centered approach to marital therapy.

### *2.4 Comparative Perspectives and Theoretical Gap*

Existing knowledge of marital counselling frameworks within Muslim contexts reveals significant diversity in structure, institutional backing, and methodological approaches. However, a common theoretical deficiency persists across these models. Existing initiatives in Indonesia, Malaysia, the Gulf region, and parts of Africa demonstrate efforts to incorporate Islamic principles into marital guidance; however, these remain fragmented and lack a cohesive *Qurʾānic*-based psychological framework that integrates spiritual purification (*tazkiyah al-nafs*) with relational therapy.

In Indonesia, *the Badan Penasihat Pembinaan dan Pelestarian Perkawinan* (BP4) exemplifies an institutionalized premarital education system that combines Qurʾānic teachings with communication and conflict resolution skills. Empirical studies suggest that coupling spiritual instruction with interpersonal skill development improves marital readiness and empathy (Sari and Pramono, 2018). Malaysian premarital courses, conducted by state Islamic religious authorities, emphasize foundational Islamic concepts such as *tawḥīd* and *fiqh al-usrah*, alongside communication skills. However, these programs function more as value-based education than as structured therapeutic systems, lacking a unified conceptual framework linking spiritual virtues to psychological processes (Hamjah & Akhir, 2014). Meanwhile, Gulf region Shariah court mediations prioritize legal and moral guidance but show limited integration of psychological assessments or virtue-based interventions (Al-Zahrani, 2020). African contexts, such as Nigeria's National Islamic Marriage Council, rely heavily on community elders and religious leaders and offer culturally relevant but methodologically unsystematic guidance without empirical evaluations.

This comparative evidence highlights an epistemological tension within Islamic counselling practices: the oscillation between adopting Western psychological methods superficially framed in Islamic terminology and traditional moral exhortation, devoid of structured therapeutic rigor. Scholars advocate for an Islamic counselling paradigm grounded in *Tawḥīdic* epistemology, where revelation (*waḥy*) and reason (ʿ*aql*) jointly inform evidence-based therapeutic design (Hamdan, 2008; Hamjah & Akhir, 2014). The critique warns against the mere "Islamization of language," which risks reducing counselling to moral preaching rather than a comprehensive psychospiritual discipline.

The primary theoretical gap identified is the absence of a systematic framework that operationalizes Qurʾānic virtues such as sincerity (*ikhlāṣ*), patience (*ṣabr*), gratitude (*shukr*), consultation (*shūrā*), truthfulness (*ṣidq*), tranquility (*sakīnah*), service (*khidmah*), and self-reform (*tazkiyah*) into therapeutic constructs. Existing models treat these virtues as conceptually dispersed rather than as integrated components of a structured counselling approach.

To address this gap, the proposed 8S *Tazkiyah-based* Marital Counselling Framework aims to translate these eight virtues into interconnected counselling competencies by offering diagnostic and prescriptive tools that guide individuals from inner purification to ethical marital conduct. This approach aligns with *maqāṣid al-sharīʿah* by emphasizing family stability, dignity, and emotional well-being, thereby addressing the epistemic, methodological, and practical shortcomings of current Muslim marital counselling paradigms.

## 3.0 Conceptual Framework

The conceptual framework for this study synthesizes the key gaps identified in the literature review and organizes them into a coherent structure that explains how Islamic concepts, spiritual mechanisms, and virtue-based processes interact to support marital wellbeing. The review in Sections 2.1–2.4 revealed the absence of an integrated *Qurʾānic*-based counselling model explicitly grounded in *tazkiyah al-nafs* and systematically organized around core Islamic virtues, despite strong recognition of their relevance in classical scholarship and contemporary psychological literature. This conceptual framework is based on three interconnected foundations: (a) *Tawḥīdic* epistemology as the meta-theoretical worldview, (b) *tazkiyah al-nafs*

as the central psychospiritual mechanism, and (c) the 8S *Tazkiyah*-Based Marital Counselling Framework as the applied virtue-based sequence. The integration of these elements provides a structured, spiritually anchored, and theoretically robust basis for understanding Muslim couples' dynamics.

### *3.1 Tawḥīdic Epistemology as the Meta-Theoretical Foundation*

Tawḥīd, the central principle of Islamic theology, frames human relationships including marriage as spiritually purposeful and morally structured. As discussed in Section 2.1, the *Qurʾān* conceptualizes marriage as a sanctuary of *sakīnah, mawaddah*, and *raḥmah* (Qurʾān 30:21), placing relational harmony within the framework of the divine moral order. This worldview situates marital behavior within a holistic understanding of the human person, where cognition, emotion, behavior, and spirituality are interdependent rather than compartmentalized. Islamic epistemologists, notably al-Attas (1991, 2001) and al-Faruqi (1982), emphasize that authentic knowledge is derived from the integration of revelation (*waḥy*) and reason (*ʿaql*) grounded in *adab,* or right conduct toward Allah, self, and others. This holistic unity stands in sharp contrast to secular counselling models that often separate psychological, emotional, and behavioral domains or prioritize autonomous self-fulfillment (Rothman & Coyle, 2018). Islamic psychology critiques such reductionism, noting that it neglects the moral and spiritual dimensions of human functioning (Badri 2018; Haque 2004). *Tawḥīdic* epistemology thus provides the ontological coherence necessary for an Islamic marital counselling model by asserting that therapeutic intervention must nurture both psychological health and moral-spiritual development.

The teleological nature of *Tawḥīd* further shapes the goals of counselling. Instead of focusing primarily on satisfaction or emotional expression, Islamic counselling seeks alignment with divine guidance and the fulfillment of *maqāṣid al-sharīʿah*, especially the preservation of family, dignity, and emotional well-being (al-Qaradāwī, 2004). Hamdan (2008) argues that therapeutic change becomes an act of worship (*ʿibādah*) under this paradigm, requiring sincerity of intention and ethical orientation. Thus, Tawḥīd establishes the meta-theoretical basis upon which *tazkiyah al-nafs* and the 8S Virtue Sequence operate.

### *3.2 Tazkiyah al-Nafs as the Core Psychospiritual Mechanism*

Section 2.2 underscored that *tazkiyah al-nafs* is one of the most comprehensive constructs in Islamic spiritual and psychological thinking. Linguistically rooted in purification and growth, *tazkiyah* involves cleansing the soul of destructive traits and cultivating virtuous qualities. Classical scholars such as *al-Ghazālī* (2004) conceptualized it as the harmonization of intellect, emotion, and behavior with divine guidance, achieved through practices like *muḥāsabah* (self-examination), *muraqabah* (self-vigilance), and *riyāḍat al-nafs* (disciplining the self). Ibn Qayyim (1996) described the internal transformation that occurs as the nafs transitions from the commanding self (*ammārah*) to the self-reproaching (*lawwāmah*) and eventually the tranquil (*muṭmaʾinnah*), indicating psychological maturation.

Modern Islamic psychology affirms that *tazkiyah* is a powerful therapeutic process. Abu-Raiya (2012) demonstrated that spiritual purification enhances emotion regulation and resilience. Awaad and Ali (2022) argue that *tazkiyah* integrates cognitive, affective, and spiritual processes, providing a holistic alternative to secular paradigms that are often fragmented.

Kaplick and Skinner (2017) highlight that Islamic psychology offers a morally anchored approach to well-being, filling gaps in Western value-neutral therapies. These insights align with empirical findings from Indonesia and Malaysia, indicating that spiritually grounded marital and premarital programs significantly improve communication, empathy, and readiness (Hamjah & Akhir, 2014; Sari & Pramono, 2018).

*Tazkiyah* operates at two levels in marital relationships. At the intrapersonal level, it moderates destructive impulses such as anger, pride, and resentment, which are key antecedents of marital breakdowns. At the relational level, it cultivates virtues such as empathy, forgiveness, patience, and cooperation, aligning with the Prophet's ﷺ model of emotional attentiveness and gentleness in family interactions (Al-Nasaʾī, 1998). This dual function enables *tazkiyah* to serve as the central psychological engine through which marital transformation occurs.

Despite its richness, *tazkiyah* remains underdeveloped as a structured clinical model. Most Islamic counselling efforts incorporate elements of spirituality but lack an integrated sequence linking spiritual purification to relational behaviors. This gap necessitates a systematic virtue-based structure, which is addressed through the 8S model.

### *3.3 The 8S Tazkiyah-Based Marital Counselling Framework as the Applied Model*

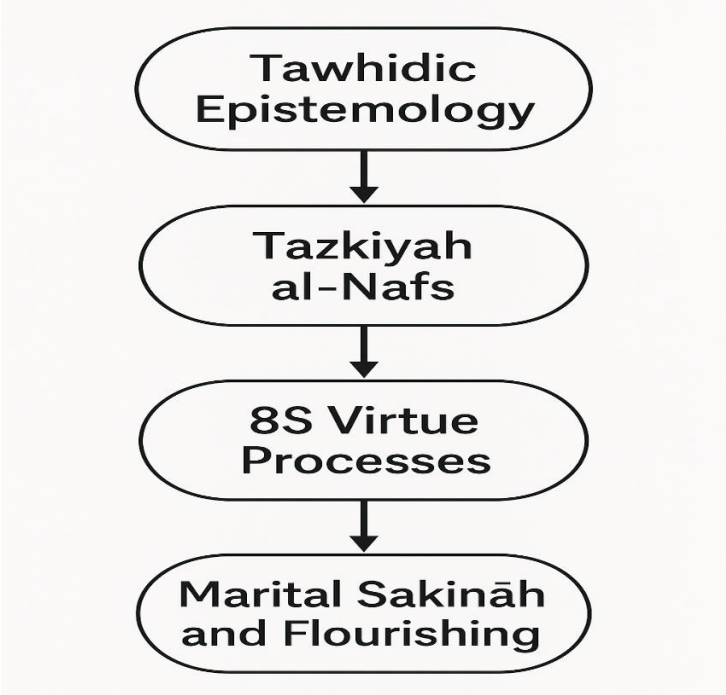
Section 2.4 highlights the absence of an integrated Islamic marital counselling model that systematically organizes Qur'anic virtues into a structured therapeutic sequence grounded in Islamic moral psychology. The 8S Tazkiyah-Based Marital Counselling Framework addresses this gap by operationalizing eight core Qur'anic virtues into a clear and progressive counselling model. Within this framework, tazkiyah al-nafs functions as the central psychospiritual mechanism underpinning the entire counselling process, rather than being one of the applied stages. Therefore, the applied dimensions of the model are articulated through eight virtue-based processes: *Ikhlāṣ, Ṣabr, Shukr, Shūrā, Sakīnah, Ṣidq, Khidmah, and Saʿādah.*

Ikhlāṣ (sincerity) establishes the motivational foundation of the counselling process by aligning marital intentions with the divine purpose rather than ego-driven expectations (Qurʾān 98:5). Ṣabr (patience) nurtures emotional regulation and psychological endurance, enabling spouses to manage conflict and adversity with restraint and perseverance, consistent with findings that spiritually grounded coping enhances relational resilience (Haque 2004). Shukr (gratitude) supports positive cognitive reframing by reinforcing appreciation and counteracting negativity bias in marital interactions (Ibn Kathīr, 1998). Shūrā (consultation) formalizes ethical communication through collaborative dialogue, shared decision-making, and mutual respect (Qurʾān 42:38). Sakīnah (tranquility) reflects emotional stability and spiritual reassurance within the marital relationship, representing a state of psychological safety and calm that emerges from the consistent practice of sincerity, patience, gratitude, and consultation (Quran 30:21).

Ṣidq (truthfulness) cultivates honesty, transparency, and moral integrity in speech, intention, and behavior, thereby strengthening trust and relational security (Qurʾān 9:119). Khidmah (service) externalizes inner moral refinement through compassionate action, mutual care, and shared responsibility, mirroring the conduct of the Prophetic household (al-Nasāʾī, 1998). Finally, Saʿādah (sustained relational flourishing) occupies a culminating position within the 8S framework. Unlike transient happiness, saʿādah denotes enduring well-being, grounded in

moral integrity, spiritual tranquility, and relational harmony. It represents a sustained state of marital flourishing that arises from the continuous embodiment of the preceding virtues over time.

Collectively, these eight virtues function as therapeutic processes that translate tazkiyah al-nafs into observable relational behaviors and ethical marital conduct. Conceptually, the model follows a vertical progression from intentional realignment through emotional regulation and communicative ethics toward relational stability and sustained flourishing, with tazkiyah operating transversally as the psychospiritual engine throughout the counselling process.




Source: Compiled by the Author

By integrating spiritual, ethical, and psychological dimensions, the 8S framework offers a culturally congruent, theoretically grounded, and practically applicable counselling framework that addresses the epistemological and methodological limitations identified in previous literature.

## 4.0 Methodology

This study adopts a qualitative, conceptual, and interpretivist research design to develop the 8S Tazkiyah-Based Marital Counselling Framework through a systematic analysis of Islamic textual sources and contemporary scholarly literature. A content analysis approach was employed to examine the Qurʾān, Prophetic traditions (ḥadīth), and classical Islamic works, particularly those of al-Ghazālī and Ibn Qayyim, alongside contemporary Islamic psychology literature and selected empirical studies on Muslim marital counselling. The analytical process was conducted in four interrelated stages. First, textual coding was performed to identify core virtue-related constructs emerging from Qurʾānic verses, Prophetic guidance, and classical writings. Second, these codes were subjected to thematic organization, allowing related concepts to be grouped into broader psychospiritual categories relevant to marital relationships. Third, the identified themes were synthesized into a coherent conceptual model, integrating

Tawḥīdic epistemology as the meta-theoretical foundation, tazkiyah al-nafs as the central psychospiritual mechanism, and the 8S virtue-based processes as the applied counselling sequence. Fourth, the emerging framework was validated through conceptual triangulation, drawing on classical exegesis, contemporary Islamic psychological theories, and empirical findings from Muslim-majority contexts, such as Indonesia and Malaysia.

Ethical and epistemic considerations guided the research process. These include maintaining epistemic humility, avoiding the over-secularization of Islamic concepts, and preserving fidelity to the Islamic scholarly tradition while critically and constructively engaging with modern therapeutic literature. This methodological approach ensures that the proposed framework is both textually grounded and methodologically rigorous, offering a robust conceptual contribution to the field of Islamic marital counselling and psychology.

## 5.0 Discussion

The development of the 8S Tazkiyah-Based Marital Counselling Framework advances a virtue-centered and spiritually grounded model that directly addresses the conceptual, theological, and methodological gaps identified in the literature review. This discussion interprets the model's components, explains the psychospiritual mechanisms underpinning its operation, situates its contributions within contemporary Islamic psychology, and highlights its implications for marital counselling practice. Collectively, these discussions clarify how the 8S structure translates the abstract principles of tazkiyah al-nafs and Qurʾānic virtue ethics into a coherent, structured, and actionable counselling methodology.

### *5.1 Interpretation of Model Components*

The 8S Framework synthesizes eight Qurʾānic virtues–*Ikhlāṣ, Ṣabr, Shukr, Shūrā, Sakīnah, Ṣidq, Khidmah, and Saʿādah*–into a dynamic psychospiritual  Within this model, *tazkiyah al-nafs* functions as the core psychospiritual mechanism that enables moral self-regulation, emotional refinement, and ethical transformation across all stages, rather than being one of the eight applied virtues. Each virtue represents a therapeutic construct rooted in revelation, reinforced by classical scholarship. Their sequencing reflects the developmental logic of Islamic tarbiyah, beginning with intentional inner reform and culminating in a sustained relational flourishing.

***Ikhlāṣ* (sincerity)** is a gateway virtue. Classical scholars emphasize that sincerity purifies intention from ego-driven motives (Al-Ghazālī, 2004). Within marital relationships, ikhlāṣ realigns goals with the divine purpose rather than personal gratification. This shift recalibrates emotional responses, reduces blame-oriented thinking, and enables spouses to approach conflicts with humility. In counselling contexts, beginning with *ikhlāṣ* allows therapists to facilitate cognitive and moral reframing rooted not merely in rational problem-solving but also in spiritual accountability.

**Ṣabr (patience)** is the stabilizing force in the model. Unlike passive endurance, ṣabr encompasses emotional regulation, cognitive flexibility and moral steadfastness. In marital counselling, ṣabr facilitates de-escalation, enabling spouses to navigate conflicts without spiraling into hostility. Classical Islamic psychology locates ṣabr in the disciplined

management of desire and anger, a view that resonates with contemporary therapeutic understandings of distress tolerance (Badri 2018).

**Shukr (gratitude)** introduces a positive psychological counterbalance to this relational strain. Islamic tradition regards gratitude as both a spiritual act and a cognitive orientation that shifts attention toward blessings and strengths. In marital settings, shukr facilitates positive reappraisal, increases emotional warmth, and disrupts the negativity bias. Empirical studies on Islamic premarital education report that gratitude-based practices enhance empathy and relationship satisfaction (Hamjah & Akhir, 2014).

**Shūrā (consultation)** marks the transition from intrapersonal to interpersonal processes in Islamic leadership. The Qurʾān highlights consultation as a hallmark of righteous relational conduct (Qurʾān 42:38), whereas classical fiqh identifies it as a relational duty. In therapeutic terms, shūrā formalizes communication skills such as active listening, turn-taking, negotiation, and shared decision-making. The 8S framework positions shūrā as effective precisely because it follows the emotional and moral preparation established by earlier virtues.

**Sakīnah (tranquility)** is both a virtue and a relational state. The Qurʾān describes sakīnah as a divine gift that instills emotional calm and spiritual reassurance (Qurʾān 30:21). Within the 8S sequence, sakīnah emerges when sincerity, patience, gratitude, and consultation are enacted consistently. Psychologically, it aligns with relational safety, affective regulation, and secure attachment, reflecting a stable and balanced marital environment.

**Ṣidq (truthfulness)** deepens relational integrity and trust. Classical ethics views ṣidq as honesty in intention, speech, and behavior. In marital counselling, it forms the foundation of trust and accountability, counteracting manipulation, avoidance, and emotional withdrawal patterns commonly associated with marital dissatisfaction.

**Khidmah (service)** externalizes inner moral refinement through compassionate action. The Prophet's ﷺ conduct within the household exemplifies service-oriented love and shared responsibility (Al-Nasāʾī, 1998). In therapeutic practice, khidmah manifests as care, cooperation, and emotional support, representing the behavioral embodiment of the virtues.
Finally, **Saʿādah (sustained relational flourishing)** occupies a culminating position within the 8S framework. In contrast to transient happiness, saʿādah denotes enduring well-being grounded in moral integrity, spiritual tranquility, and relational harmony. This reflects a stable state of marital flourishing arising from the sustained embodiment of sincerity, patience, gratitude, consultation, tranquility, truthfulness, and service over time.

Taken together, these virtues do not function as rigid steps but as interdependent and reinforcing processes within a coherent, psychospiritual system. This sequence mirrors the developmental progression found in classical tarbiyah: intentional alignment, emotional regulation, appreciative orientation, ethical communication, relational tranquility, moral integrity, compassionate action, and sustained flourishing.

### *5.2 Contributions to Islamic Psychology*

The 8S Framework contributes significantly to Islamic psychology by operationalising classical Islamic concepts into a structured therapeutic system. First, it responds to scholarly

calls for psychospiritual integrated frameworks rooted in Tawḥīdic epistemology rather than in Western-derived constructs (Badri, 2018; Rothman & Coyle, 2018). While the existing literature often discusses virtues such as ṣabr, shukr, and ikhlāṣ in isolation, the 8S framework situates them within a coherent relational sequence anchored in tazkiyah al-nafs.
Second, the Framework advances methodological development by offering a mid-range theoretical framework that connects theology with psychologically actionable constructs, including emotional regulation (ṣabr), cognitive reappraisal (shukr), ethical communication (shūrā), and prosocial behavior (khidmah).

Third, the framework integrates classical scholarship with contemporary empirical findings from Muslim contexts. Studies from Indonesia and Malaysia have demonstrated that spiritually anchored interventions improve marital outcomes (Hamjah & Akhir, 2014; Sari & Pramono, 2018). The 8S Framework provides a conceptual explanation for these outcomes, offering psychospiritual logic to guide future empirical research.
Finally, by positioning tazkiyah al-nafs as the core mechanism of transformation rather than a symbolic ideal, the model contributes to the indigenization of counselling theory within Muslim societies.

### *5.3 Contributions to Marital Counselling Practice*

The 8S framework offers practical value for marital counselling by providing therapists with a structured intervention model that integrates spiritual virtues into therapeutic practice. Existing programs, such as BP4 premarital counselling in Indonesia and state-mandated courses in Malaysia, are often educational rather than therapeutic. The 8S framework addresses this gap by sequencing virtues in accordance with therapeutic needs, enabling counsellors to diagnose relational difficulties and intervene with targeted, spiritually grounded strategies.
Moreover, the model provides a culturally congruent alternative to secular counselling approaches that may not resonate with Muslim clients. Rather than importing external theories, the 8S framework draws directly on Islamic moral psychology while remaining compatible with contemporary therapeutic practices.

### *5.4 Religious and Psychospiritual Implications*

The theological grounding of the 8S framework is central to its integrity. Rooted in a Tawḥīdic understanding of the human person, this model affirms that spiritual purification and relational conduct are inseparable. The virtues embedded within the framework reflect Qurʾānic moral psychology and prophetic exemplars, ensuring theological fidelity. By fostering sincerity, patience, gratitude, consultation, tranquility, truthfulness, service, and ultimately saʿādah, the framework aligns marital counselling practice with the Islamic vision of marriage as a source of sakīnah and sustained flourishing.

## 6. Conclusion

This study sought to address a longstanding gap in the Islamic marital counselling literature by developing a structured, virtue-based conceptual framework grounded in tazkiyah al-nafs and framed within a Tawḥīdic worldview. Although existing scholarship consistently affirms the centrality of Qurʾānic virtues such as *ikhlāṣ, ṣabr, shukr, shūrā, sakīnah, ṣidq, and khidmah* in sustaining marital harmony, these virtues have remained largely dispersed across ethical,

theological, and advisory discourses, with limited integration into a cohesive therapeutic model for marital therapy. Through a systematic content analysis of Qurʾānic verses, Prophetic traditions, classical writings by al-Ghazālī and Ibn Qayyim, and contemporary Islamic psychology literature, this study synthesized these insights into the 8S Tazkiyah-Based Marital Counselling Framework. The model articulates a clear psychospiritual structure linking Tawḥīdic epistemology, tazkiyah al-nafs as the core transformative mechanism, eight virtue-based counselling processes, and the attainment of marital sakīnah and sustained relational flourishing (saʿādah).

The findings of this conceptual study yield several important implications. First, the framework demonstrates that tazkiyah al-nafs is not merely an abstract spiritual ideal but a practical psychospiritual mechanism that regulates harmful impulses, nurtures ethical dispositions, and strengthens emotional and spiritual resilience in marital relationships. Second, the model offers a culturally congruent and theologically grounded alternative to value-neutral secular counselling approaches by rooting therapeutic work in spiritual intentionality, moral self-discipline, and prophetic relational compassion. Third, the 8S framework provides practitioners with a systematic and staged structure that moves beyond general moral exhortation toward clearly articulated virtue-based intervention processes supported by both textual foundations and psychological insights. In this respect, the framework represents a meaningful advancement in Islamic psychology and counselling by offering a theoretical foundation that can be translated into practical guidelines, assessment tools and therapeutic strategies.

Based on these contributions, several recommendations have emerged. Marital counsellors, educators, and religious practitioners are encouraged to integrate the 8S sequence into counselling modules, premarital programmes, and mediation settings, ensuring that interventions address both internal moral refinement (through sincerity, patience, and spiritual accountability) and relational conduct (through consultation, truthfulness, service, and cooperative engagement), ultimately orienting couples toward sustained flourishing. Training institutions may further adapt the framework into curricular materials to enhance practitioners' spiritual literacy and their capacity to facilitate virtue-based marital transformations. More broadly, the model invites practitioners to situate marital challenges within wider spiritual and moral contexts rather than reducing them to communication deficits or emotional incompatibility alone, thereby enabling more holistic and enduring forms of healing aligned with the Islamic vision of family life.

Finally, this conceptual study opens important avenues for future research. Empirical studies are required to operationalize and validate each virtue as an evaluable therapeutic construct. Qualitative research involving counsellors, couples, and religious practitioners may explore how the 8S processes manifest in real-world counselling contexts, while mixed-methods studies could examine the framework's impact on marital satisfaction, emotion regulation, and long-term relational stability. Comparative research may also investigate how the 8S model aligns with or diverges from existing Islamic counselling practices across different cultural settings, including BP4 programmes in Indonesia, Malaysian premarital modules, and mediation practices in Gulf contexts. Ultimately, by grounding marital counselling within a coherent, virtue-based Islamic psychological system, the 8S Tazkiyah-Based Framework offers a promising foundation for advancing both scholarly inquiry and professional practice in Muslim family well-being.

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# A NARRATIVE REVIEW OF GENERATIVE AI AND STUDENT COGNITIVE ENGAGEMENT

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***Abstract:*** *The integration of generative artificial intelligence (GenAI), particularly large language models such as ChatGPT, is reshaping educational practice and prompting renewed debate about its effects on students' cognitive engagement. While research on GenAI has expanded rapidly, existing studies remain fragmented across disciplines and often focus on adoption, perceptions, or technical capabilities rather than the cognitive processes involved. This narrative review synthesizes current literature published between 2022 and 2025 to examine these evolving cognitive implications. A search conducted in the Scopus database initially identified 1,550 records, from which 67 studies met the inclusion criteria following a structured screening process. The main aim is to examine how GenAI relates to critical thinking, metacognition, problem-solving, and deeper learning. Based on the diverse empirical and conceptual studies, the review identifies ongoing tensions in the field, including questions about whether GenAI supports or reduces cognitive effort, reshapes self-regulation, or alters learners' engagement with complex tasks. By mapping these emerging discussions, the review offers an integrated perspective on how generative AI is redefining cognitive engagement and highlights areas requiring further research and theoretical clarification.*

***Keywords:*** *Generative Artificial Intelligence, Cognitive Engagement, Critical Thinking.*

## Introduction

The rapid integration of generative artificial intelligence (GenAI) tools, especially large language models like ChatGPT, is transforming education at an unprecedented pace. This shift is widely recognized in recent literature, which documents exponential growth in GenAI research and highlights its disruptive impact on teaching, learning, and assessment practices across disciplines and educational levels (Bahroun et al., 2023). Unlike earlier educational technologies that focused on automating or delivering content, GenAI's ability to generate sophisticated, contextually relevant text, code, and multimedia enables it to act as both a conversational partner and a content co-creator, fundamentally altering the nature of human-AI interaction in learning environments (Yan et al., 2024).

This transformation has sparked significant scholarly and pedagogical debate, particularly around how GenAI reshapes the cognitive dimensions of student learning. Key questions remain unresolved, including the extent to which GenAI supports or reduces critical thinking, problem-solving, metacognition, and knowledge integration which are core components of cognitive engagement and deep learning (Yan et al., 2024). While some studies report that

GenAI can scaffold learning, foster creativity, and provide personalized feedback that enhances engagement and learning outcomes, others report about risks such as overreliance, diminished critical thinking, and threats to academic integrity (Yan et al., 2024).

Despite a growing body of research, most studies are discipline-specific, focus on attitudes or adoption, or evaluate AI systems in isolation, leaving a gap in comprehensive, cross-disciplinary syntheses that directly examine GenAI's influence on students' cognitive engagement (Bahroun et al., 2023). This gap limits the development of evidence-based principles for responsible and effective GenAI integration in education (Bahroun et al.,2023).

This article addresses this gap by presenting a systematic narrative review of the current literature to investigate the multifaceted relationship between generative AI tools and student cognitive engagement in educational contexts. The guiding research question is: How does the use of generative AI influence students' cognitive engagement in educational contexts? By synthesizing findings from different educational settings and research methodologies, this review aims to develop a nuanced perspective. Specifically, it seeks to map the evidence regarding how GenAI can potentially support or reduce cognitive processes such as critical analysis, metacognitive regulation, creative problem-solving, and conceptual understanding.

The review first details its methodology, then synthesizes the literature into key themes: the contested effects on critical thinking, GenAI's role in supporting self-regulated learning, implications for problem-solving and creativity, and the crucial importance of instructional frameworks. The study concludes by discussing implications for educators and researchers, proposing that the future of cognitive engagement in education depends not on resisting AI, but on redesigning learning experiences to leverage its capabilities in ways that augment human intellect.

## Background

The concept of cognitive engagement is central to understand deep and meaningful learning. Cognitive engagement is defined as the strategic and active mental effort learners utilize to process, monitor, and regulate their learning, often serving as the central mechanism for achieving higher-order academic goals (Sun et al., 2025). It is distinct from passive learning because it demands deliberate resource allocation and sophisticated strategy deployment (Kong et al., 2024; Sun et al., 2025). It is the psychological engine driving the acquisition of expertise. Grounded in constructivist and self-regulated learning (Essien et al., 2024; Kong et al., 2024; Lee et al, 2024) theories, it encompasses a suite of interrelated higher-order processes. Critical thinking which is the ability to analyze, evaluate, and synthesize information allows students to move past rote memorization (Drushlyak et al.,2025; Kong et al., 2024; Remerta Noni Naatonis et al., 2024). Metacognition is defined as the ability to think about one's own thinking (Mizumoto, 2023) which enables learners to plan, track progress, and adapt their approaches (Du et al., 2025; Klar, 2025; Sun et al., 2025); Wu & Thomas, 2025). Problem-solving and creative synthesis represent the application of knowledge and skills to new contexts. For decades, educational research has focused on designing environments either through collaborative learning (Al-Obaydi & Pikhart, 2025; Zhang & Wang, 2025), inquiry-based projects, and scaffolded instruction (Blanka Klimova & Paiva, 2024; Štuikys et al., 2025; Mutanga et al., 2025) that intentionally promote these cognitive activities which resulted in recognizing them as primary predictors of long-term retention, transfer, and academic success.

The integration of technology into education has a long history of aiming to expand these cognitive processes. From early computer-assisted instruction to intelligent tutoring systems (ITS) and adaptive learning platforms, the goal has often been to provide personalized pathways, immediate feedback, and access to information. However, the role of technology has largely been supportive or supplemental (Lee & Juuso Eronen, 2025; Li, 2023; Sánchez-Ruiz et al., 2023; Štuikys et al., 2025). Tools helped students practice, delivered content, or provided corrective feedback based on pre-defined rules and knowledge bases. The core actions of generating original arguments, formulating hypotheses, constructing explanations, and creating complex written work remained solely in the human domain. The cognitive burden of synthesis, creation, and critical evaluation was directly on the learner, with technology acting as a resource or a guide. This division of labor maintained a clear boundary where technology supported cognition but did not substitute its core generative and evaluative functions.

The inclusion of advanced generative artificial intelligence, particularly large language models (LLMs) like OpenAI's ChatGPT, represents a qualitative leap across the aforesaid boundary. Unlike previous technologies, GenAI is not a repository of information or a logic-based problem-solver. It is a generative and responsive model trained on massive quantities to predict and produce language that is coherent, contextually relevant, and stylistically sophisticated (Sánchez-Ruiz et al., 2023; Štuikys et al., 2025). This capability allows it to perform tasks such as drafting essays, explaining concepts, generating code, debating positions, and planning projects which were previously the exclusive territory of human cognition. It does not just support the learning process. In addition, it can also perform key intellectual outputs of that process. This fundamentally changes the traditional student-technology dynamic, positioning the AI not just as a tool, but as a simulated peer, tutor, or co-author. Therefore, this shift forces a re-examination of the nature of cognitive engagement. Now that a machine can generate a competent product, what cognitive work remains necessary for the learner, and how can the interaction be structured to ensure that the original work is not avoided by the learner but enhanced?

This disruptive potential has generated an increase of scholarly interest as shown in the initial search (refer Figure 1). Initial finding shows that literatures has clustered around several ideas: studies examining the technical capabilities of GenAI on academic tasks, surveys investigating student and educator perceptions of its utility and ethics; and philosophical and policy commentaries on academic integrity. While these are valuable, a focused synthesis of empirical and conceptual work that directly investigates the interaction effect of how working with this generative capability changes the internal cognitive and metacognitive processes of the learner is only now emerging. The pre-AI understanding of cognitive engagement provides the essential framework, and also the nature of how GenAI defines the new variable. This review positions itself at this critical intersection. It seeks to integrate different findings to address the core tension: is GenAI primarily a cognitive support that invites intellectual offloading, or can it be leveraged as a scaffold to provoke deeper thinking, reflection, and sophisticated problem-solving? Answering this requires moving beyond the tool's capabilities to analyze the evolving landscape of the engaged mind in the age of generative machines.

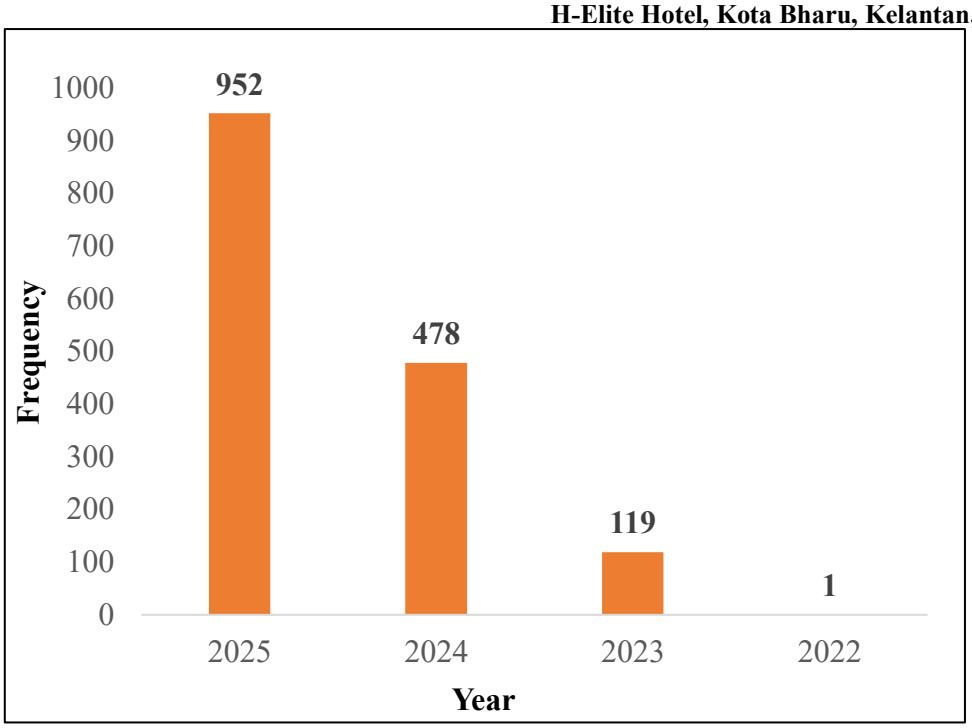



**Figure 1: Initial Search Result of 1550 Articles Based on Year**

## Methodology

This study employs a narrative review methodology. The approach is chosen to identify, select, and synthesize the increasing but fragmented literature on generative AI and cognitive engagement. The process was designed to be systematic and transparent, minimizing selection bias and ensuring a reproducible audit trail from the initial search to the final included studies. The literature search was conducted in Scopus, a multidisciplinary abstract and citation database known for its rigorous curation, to ensure the quality and relevance of identified sources. The search strategy was built around key conceptual clusters related to the research question:

Population/Context: ("student" OR "learner" OR "educat*" OR "classroom") AND
Intervention/Tool: ("generative AI" OR "large language model" OR "LLM" OR "ChatGPT" OR "GPT-") AND
Outcome: ("cognitive engagement" OR "critical think" OR "metacogniti" OR "self-regulated learning" OR "problem solv*" OR "deep learning" OR "higher order thinking").
The search was limited to free to download articles published in English and focused on the period from January 2022 to November 2025. This initial search yielded 1,550 records for screening.

A two-stage screening process was employed to refine the selection. The first stage involved a title and abstract screening against broad inclusion and exclusion criteria. Studies were included if they: (1) primarily focused on the use of a generative AI tool (such as ChatGPT) in a formal or informal educational context; (2) involved school, undergraduate, or postgraduate students as the primary subjects or focus; and (3) made any mention of cognitive, metacognitive, or learning processes. Studies were excluded if they: (1) focused solely on AI technical development, policy without pedagogical discussion, or study not done in educational

contexts; (2) were not peer-reviewed journal articles or conference proceedings (such as editorials without research, books); or (3) were duplicates. This first-stage screening reduced the selection to 473 potentially relevant papers.

The second stage involved a full-text screening for relevance and suitability based on a refined criterion directly linked to the research question. To be included in the final synthesis, a paper's abstract and also full text had to provide empirical findings, theoretical discussion, or a clear conceptual argument specifically about how the generative AI tool influenced, affected, or was theorized to relate to students' cognitive processes. Papers were excluded if their primary focus was on: (1) factors influencing adoption intention without measuring cognitive impact; (2) the AI tool's capabilities in isolation; (3) academic integrity or plagiarism detection without linking to cognitive outcomes; or (4) general attitudes/perceptions of students or teachers without evidence of cognitive influence. This second screening resulted in a final corpus of 67 papers directly relevant to answering the research question.

Key data were extracted into a structured framework for each of the 67 included papers before a thematic synthesis. Extracted information included: bibliographic details, educational context and level, research methodology, specific GenAI tool studied, key findings related to cognitive engagement, and the reported or implied pedagogical design. The synthesis was driven by an inductive-deductive approach. Initial themes were allowed to emerge from the data (inductive), while also being informed by established constructs from the literature on cognitive engagement and educational technology (deductive). The findings were analyzed for patterns and significant gaps that allows for the development of the narrative themes presented in the result sections of this study.

## Results & Discussion

The first part of the result provides an overview of all the papers involved. The next section addresses the complexities of GenAI integration by focusing on how the tool influences critical cognitive processes, self-regulation, efficiency, creativity, and the subsequent risks of reliance.

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# DEVELOPING THE FOUR ARABIC LANGUAGE SKILLS AND THEIR ROLE IN ENHANCING COMMUNICATIVE COMPETENCE AMONG NON-NATIVE LEARNERS

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***Abstract:*** *This study investigates methods for developing the four fundamental Arabic language skills - listening, speaking, reading, and writing - and their role in enhancing communicative competence among non-native Arabic learners. The purpose of this study is to identify effective teaching strategies that support the development of communicative ability in Arabic language learning. A descriptive qualitative approach was employed through a systematic literature review of academic journals, books, and previous research related to language education. The findings reveal that the integrated development of the four language skills significantly improves learners' fluency, confidence, and accuracy in communication. Listening and speaking activities were found to be particularly important in building real-time communicative ability, while reading and writing skills supported vocabulary expansion and structural accuracy. The study concludes that effective Arabic language instruction should adopt an integrated, communicative, and learner-centred approach, as this significantly enhances learners' ability to use Arabic effectively in real-life communication contexts.*

***Keywords:*** *Arabic Language Skills, Communicative Competence, Non-Native Learners, Teaching Strategies, Integrated Skills*

## Introduction

In Malaysia, the development of the Arabic language has evolved in parallel with the history of Islam in the country. Since the arrival of Islam through Arab traders and scholars during the seventh and eighth centuries, Arabic has become an important language within religious and educational contexts. Religious texts such as the Qur'an and Hadith require an understanding of Arabic, making it a central subject in Islamic educational institutions. For this reason, many religious schools teach Arabic to enable students to gain a deeper understanding of their faith (Mohd Sharifuddin, 2021).

The second shift of the Malaysian Education Blueprint (PPPM) 2013–2025 encourages every student to learn an additional language alongside Malay and English, enabling students to participate in the global community (Malaysia Education Blueprint, 2019). Consequently, Arabic is offered in Religious National Secondary Schools (SMKA), Government-Aided Religious Schools (SABK), Integrated Boarding Schools (SBPI), Federal Religious Secondary Schools (SMAP), National Primary Schools (SK) through the j-QAF programme, and National Secondary Schools (SMK) that implement Religious Stream Classes (KAA). The Arabic language is further strengthened through the Integrated Religious Curriculum (KBD) and the Integrated Tahfiz Curriculum (KBT), where Arabic serves as the main medium of instruction

and learning. Furthermore, the Ulul Albab Higher Certificate Curriculum (SUUA), which integrates memorisation, science, and heritage components, represents one of the Ministry of Education's efforts to enhance students' communicative and linguistic abilities, as well as their capacity to understand classical Arabic texts at the school level (Mohd Sharifuddin, 2021).

The learning of Arabic in Malaysia is not only intended for academic purposes but also as a means of communication. This objective is clearly stated in the Primary School Standard Curriculum (KSSR) and the Arabic Curriculum and Assessment Standard Document, which emphasize that the goal of Arabic education at the primary level is to produce students who master basic Arabic language skills and are able to communicate using simple sentences while practicing noble values (KSSR, 2015). Similarly, the Secondary School Standard Curriculum (KSSM) highlights the development of students' linguistic competencies to improve their social interaction skills and access to knowledge, in addition to applying correct linguistic structures in speaking, reading, and writing. One of the aims of the KSSM Arabic curriculum is to produce students capable of speaking fluently and correctly in various contexts (KSSM, 2018). This reflects the Malaysian Ministry of Education's aspiration to develop learners who possess strong communicative competence as a result of several years of Arabic language learning at the secondary level.

The Ministry's commitment to achieving this goal is evident in the standardized Arabic curriculum, which focuses on the four fundamental language skills: listening, speaking, reading, and writing. Mastery of these skills enhances students' readiness to interact and communicate freely in Arabic (KSSM, 2018). For knowledge or skills to be considered effectively acquired, they must be transferable and usable when needed. In the context of Arabic, these skills must be applicable in order to improve communicative competence, autonomous learning, and problem-solving.

Communicative competence involves the interaction between speaker and listener through the application of linguistic knowledge and skills to increase confidence in speaking a particular language. In addition to self-confidence, language proficiency itself is a crucial factor in improving communicative competence. This demonstrates that, beyond influencing confidence in interaction, the four Arabic language skills - listening, speaking, reading, and writing - contribute significantly to learners' confidence in communication (Maromar et al., 2018). Language is not only an essential tool for learning, teaching, and self-expression, but also a vital medium of communication with others, making its acquisition a fundamental human necessity (Muslih, 2016) .

This study explores various methods and strategies for acquiring Arabic language skills - listening, speaking, reading, and writing - among non-native Arabic learners. It focuses on how these methods contribute to the development of essential communicative competencies. Through an analysis of practical applications and outcomes, the study aims to identify the most effective practices that facilitate language acquisition and promote intercultural understanding. Furthermore, it highlights the broader role of Arabic language proficiency in bridging communicative gaps and fostering intercultural dialogue.

A descriptive approach is employed to provide a comprehensive overview of practices and challenges in teaching Arabic as a second language, offering valuable insights for educators, curriculum developers, and language policy makers. By emphasizing the relationship between

language acquisition methods and the development of communicative competence, this study seeks to contribute to more effective and engaging language learning experiences for non-native Arabic learners.

## Research Background

Language is the primary medium through which people communicate, exchange ideas, and build relationships. Arabic, as one of the most widely spoken languages in the world, occupies a significant position in global cultural, religious, and intellectual heritage. Since language represents one of humanity's greatest achievements and distinguishes human beings from other creatures, it reflects the highest form of human capability. Humans possess the ability to acquire linguistic sounds, articulate them, and use them to achieve communication with others. Language is not merely a tool for expressing thoughts; rather, it is the tongue of a nation deeply rooted in history (Boudouda, 2021). Therefore, mastering language - particularly Arabic for non-native speakers - is of great importance.

In addition to mastering the four fundamental language skills - listening, speaking, reading, and writing - learners must also be evaluated in terms of their ability to use the language in everyday communication. Accordingly, this study first presents essential conceptual definitions before engaging in further discussion.

### A. The Concept of "Skill"

From a linguistic perspective, a skill refers to proficiency in performing a task, and a skilled person is one who demonstrates mastery in a given activity. It is said: "He mastered this matter" meaning he became proficient in it. From a technical (terminological) perspective, many researchers have defined "skill" as the ability to perform and learn effectively whenever desired. Skill is considered a learned activity that develops through practice supported by feedback (Cottrell, 2013). Rihab (1996) defines skill as something that can be learned, acquired, or formed within the learner through imitation and training, and that what is learned varies according to the type, nature, characteristics, and objectives of the subject matter.

### B. Types of the Four Language Skills

The four language skills consist of listening, speaking, reading, and writing, along with their related sub-skills (Boudouda, 2021):

#### Listening skill

Listening is the medium through which human beings first connect with others in the early stages of life. Through listening, individuals acquire vocabulary, learn sentence patterns and structures, and receive ideas and concepts. It is also through listening that other language skills - speaking, reading, and writing - are developed (Taimah, 1987).

Listening ability can be observed in a learner through:

- Knowledge of Arabic, including its sounds, vocabulary, grammatical structures, and its use in various situations.
- Familiarity with the topic of the spoken discourse.
- Awareness of the cultural context that gives language its specific meanings, including the speaker's attitudes toward the topic and the shared experience between the speaker and listener.
- Interpretation of the surrounding circumstances of the speaking situation.
- The ability to understand paralinguistic cues such as the speaker's speed of speech, pauses, rising and falling intonation, stress patterns, facial expressions, hand movements, and voice quality, all of which provide meanings that go beyond the literal words.

**Speaking Skill**

Speaking skill is defined as spontaneous and free discussion that takes place naturally between two individuals about a specific topic (Taimah, 1987). Speaking is considered essential in facilitating mutual understanding among individuals, as it contributes to the clear transmission of ideas and emotions, thereby enhancing the effectiveness of communication and reducing misunderstanding.

**Reading Skill**

Reading is a cognitive activity that consists of four main processes: recognition, comprehension, evaluation, and interaction (Taimah, 1987).

- **Recognition** refers to the ability to decode written symbols, relate the sound of a word to its form, and distinguish it from other words.
- **Comprehension** involves understanding the relationships between word meanings and sentence structures and grasping both direct and indirect meanings expressed in the text.
- **Evaluation** is the ability to judge what one reads, express opinions about it, accept what is reasonable, reject what is illogical, and compare the ideas in the text with one's prior knowledge.
- **Interaction** refers to the integrated intellectual activity performed by the reader when engaging with printed material, which begins with sensing a problem, searching for solutions through the text, responding emotionally and cognitively, and ultimately making decisions.

**Writing Skill**

Writing skill is regarded as learners' ability to write correctly in terms of spelling and handwriting (Taimah, 1987). Writing skill includes:

- The ability to express ideas clearly and accurately.
- Writing words according to the conventions agreed upon by native language communities.
- Selecting words and arranging them within an appropriate structural system.

## C. The Concept of Communication Skills and the Difference Between Communication and Contact

Communication skills are defined as the abilities used in delivering or receiving various types of information. The process of communication varies depending on the medium used, such as face-to-face communication, telephone communication, or electronic communication, each of which requires specific skills to achieve effective interaction. In its simplest form, "contact" or "transmission" refers to the process of transferring ideas, information, and meanings (messages) from a sender to a receiver through a particular channel of communication that varies according to context. Messages are transmitted through shared and understood symbols between the sender and the receiver, or symbols that are commonly recognised within a society or civilisation ("Communication Skills that Make You a Successful Office Manager", n.d.).

From these definitions, it can be observed that the difference between communication and transmission lies in the element of participation. Transmission focuses on the existence of one active party, such as a person watching television, where the receiver remains passive. In contrast, communication refers to a shared, interactive process that involves two-way exchange. An example is the interaction between a teacher and students in a classroom, where ideas, opinions, and information are exchanged dynamically.

## D. The relationship of the four skills with communication skills

The fundamental forms of effective communication skills include the ability to speak and listen effectively, time management and organisation, critical thinking and problem-solving, the clear and accurate delivery of ideas, the use of body language and facial expressions, as well as the ability to interact and engage with others in a positive and effective manner. All of these skills are highly important in communication, as they enable individuals to attract the audience's attention and convey messages accurately and effectively (Effective Communication Skills: The Secret to Success in Personal and Professional Life, 2024). However, the development of these skills cannot be achieved by students without mastery of the four fundamental language skills, whose methods of acquisition will be discussed later.

## Problem Statement

Since language functions as a tool for communication, there is an inherent practical relationship between linguistic skills and communicative competence. Based on this conceptual link, the title of the current study was formulated. The need now is to clarify how these relationships operate within the field of teaching Arabic to non-native speakers. According to the Malaysian Ministry of Education (KPM), the Arabic curriculum aims to develop students' oral communication abilities by ensuring mastery of the four language skills - listening, speaking, reading, and writing - with a particular emphasis on communicative competence.

However, in practice, Malaysian students studying Arabic continue to face difficulties in all four skills, particularly in communicative performance. Research indicates that students in religious secondary schools exhibit significant weaknesses in Arabic communication despite daily exposure to the language in the classroom, and many demonstrate fear or reluctance to speak Arabic (Maromar et al., 2018). Similar challenges persist at the tertiary level, where students struggle to master speaking skills despite years of prior exposure.

Several studies report that communicative weaknesses stem from instructional practices that prioritize grammar exercises and rote vocabulary memorization over conversational activities, guided listening, or reenactment tasks that foster real communication. Such approaches limit students' opportunities for meaningful interaction in Arabic during lessons (Ali et al., 2017). As Maromar et al. (2018) reaffirm, these challenges affect both secondary and university students.

Further findings show that tertiary students, especially those specializing in Islamic studies, still lack adequate speaking proficiency. Factors such as shyness, low confidence, fear of making mistakes, and anxiety about peer judgment contribute to their reluctance to speak Arabic (Jamali et al., 2018).

It is widely accepted that the aim of foreign language learning is to achieve communicative competence, defined as the ability to express and receive ideas effectively (Shutuh, 2021). The literature further emphasizes that integrating the four language skills is essential for achieving this competence, as learners must use Arabic meaningfully in real-life situations. Communicative performance, therefore, varies depending on learners' environments, daily experiences, personal traits, language proficiency levels, and the contexts in which communication occurs (Janadbah & Sharef, 2024).

While some perspectives argue that an excessive focus on communicative skills may marginalise other aspects of language learning, this study asserts that integrated instruction in the four language skills is vital. It is this integration that ultimately supports the successful development of communicative competence in Arabic among non-native learners.

## Literature Review

A number of previous studies addressing the development of the four language skills were reviewed, particularly those that demonstrated the impact of training and practice on enhancing communicative competence

### *Development of The Four Core Language Skills*

Studies such as Boudouda (2021) emphasized that mastery of listening, speaking, reading, and writing is essential for linguistic creativity and for strengthening learners' awareness of the Arabic language. Similarly, Muslih (2016) highlighted the importance of addressing common linguistic weaknesses through integrated skill-based instruction, demonstrating how coordinated teaching of the four skills contributes fundamentally to communicative proficiency.

### *Interactive, Innovative, And Communicative Approaches in Language Instruction*

Research by Jamali et al. (2018) showed that the use of interactive classroom activities and innovative teaching strategies produced substantial improvements in learners' linguistic performance. Che Haron et al. (2012) further expanded this perspective by focusing on speaking skills, recommending strategies such as repetition, imitation, and media-supported vocabulary practice through songs and films, all of which strengthen oral competence. Reinforcing this communicative orientation, Mat Daud et al. (2021) stressed the importance of

integrating the four skills within communicative language teaching (CLT), illustrating how meaningful tasks and classroom interaction contribute to authentic language use.

### *Challenges, Learner Strategies, And Emerging Pedagogical Directions in Teaching Arabic To Non-Native Speakers*

Mukhlisin (2017) discussed the difficulties faced by educators, noting the need for varied and learner-centred methods that consider students' cognitive styles and individual differences. Meanwhile, Fauzi et al. (2024) examined learners' use of indirect and cognitive strategies - such as planning and self-monitoring - and found similar patterns across genders, indicating consistent learning behaviours among non-native learners. Extending these discussions, Ma et al. (2025) provided a forward-looking perspective through a systematic review of Arabic language teaching within STEM contexts, highlighting the importance of integrating sociocultural and linguistic dimensions, strengthening teacher professional development, and adopting tools such as concept maps to enhance interactive learning.
Previous studies show a diversity of methods and strategies aimed at developing the four language skills, especially in the context of teaching Arabic to non-native speakers. These skills have been shown to be an essential pillar in achieving learner communication proficiency, whether through interactive methods or field applications. However, there is still a need to unify efforts and develop effective teaching practices that take into account the cultural and linguistic context of non-Arabic speaking learners.

## Methodology

This article uses a literature study approach by analyzing scholarly sources related to strategies for enhancing basic language skills (listening, reading, writing, and speaking) and their role in developing communication skills. Data were collected from academic journals, reference books, and research reports that addressed theories and approaches in language education.

## Discussion and Recommendations

The synthesis of the literature points to several significant observations concerning the acquisition of Arabic language skills and their role in communication.

### *Arabic Language Development Strategies*

**Listening Skill:** (Taima, 1987)
Several strategies can be employed to develop learners' listening skills in classroom instruction. These strategies may be effectively implemented by teachers during teaching and learning activities.

**a) Diversification of educational materials.**

Teachers should employ a variety of audio resources, such as recordings and audio clips, to expose learners to different accents, speech patterns, and styles. This exposure enhances learners' listening comprehension and auditory discrimination. Listening activities may also include tasks in which students summarize the content they have heard or transcribe phrases

and sentences as part of dictation exercises. Furthermore, instructional materials should be carefully aligned with specific learning objectives and adapted to learners' proficiency levels to ensure their appropriateness and effectiveness.

**b) Apply interactive strategies.**

Teachers are encouraged to promote post-listening discussions that facilitate deeper comprehension and enable learners to exchange interpretations collaboratively. Practice with teachers or peers provides learners with authentic listening experiences and immediate feedback on pronunciation and comprehension. Additionally, note-taking during listening activities helps learners identify key ideas and vocabulary, thereby improving information processing. Such activities may be conducted through guided discussions of audio texts or by asking targeted questions related to the intended learning outcomes.

In support of this approach, Che Ali and Mohammad Al-Ramadeen (2023) highlighted questioning strategies as a core component of active and cooperative learning. These strategies aim to empower learners by transforming them from passive recipients into active participants in the learning process through the development of autonomy, knowledge acquisition, skill enhancement, and value formation.

**c) Assessing comprehension in innovative ways**

Teachers may employ assessment techniques such as content summarization and interactive questioning to evaluate learners' understanding and promote critical thinking. To increase engagement and reduce cognitive load, listening activities can be designed around specific themes, enabling learners to build contextual vocabulary that supports comprehension during communicative interactions.

Overall, the integration of these strategies contributes to the creation of a supportive learning environment that enhances learners' Arabic listening skills, ultimately leading to greater fluency and confidence in language use.

**Speaking Skill:**

Developing speaking skills is essential for enabling learners to communicate effectively and use language meaningfully. A range of instructional strategies may be employed to enhance speaking proficiency, with emphasis on active participation, structured practice, and the use of varied learning resources. These strategies can be summarized as follows:

a) **Interactive dialogue-based activities.**

This kind of activities encourage the exchange of ideas through group discussions, thereby enhancing learners' ability to express opinions and increasing their confidence in language use (Che Ali & Mohammad Al-Ramadeen, 2023). Face-to-face interaction allows teachers to model correct speech while engaging learners in guided dialogue, promoting immediate practice and feedback - both of which are crucial for language acquisition. Regular question-and-answer sessions further stimulate learner participation and help them articulate ideas in Arabic more fluently. Taima (1983) noted that short dialogues related to everyday situations - such as

greetings, inquiries, and responses concerning the learner and their environment - are easier to memorize. Therefore, teachers should clearly define the topic and context of the dialogue to maximize learning effectiveness.

b) **The use of role-play and dramatic activities.**

Acting-based activities enhance oral expression and make the learning process more engaging and enjoyable. By simulating real-life situations, learners are encouraged to use Arabic in meaningful contexts, thereby strengthening their speaking skills through experiential practice. Abu Umairah (2024) highlighted that integrating play-based elements into instructional materials effectively increases learner motivation and learning efficiency, fosters creativity, and facilitates deeper content comprehension. Similarly, Al-Sini et al. (1990) emphasized that dramatizing dialogues helps internalize language structures, reinforces memory, and brings classroom lessons to life.

c) **Story telling as a pedagogical tool.**

This process enhances linguistic comprehension and promotes meaningful oral expression. To maximize the effectiveness of storytelling activities, teachers should provide constructive feedback on learners' spoken performance, either through informal observation during classroom interaction or through structured assessment following presentations. According to Taima (1983), storytelling not only serves as an enjoyable learning activity but also contributes to vocabulary development by exposing learners to new lexical items and enabling them to understand words across diverse contexts and situations.

Incorporating these strategies into Arabic language instruction enhances learners' speaking proficiency while simultaneously fostering confidence, motivation, and active engagement in the learning process.

**Reading Skill:** (Al-Basis, 2011)

Developing Arabic reading skills in the classroom requires a systematic and well-structured instructional approach that accounts for the distinctive characteristics of the Arabic language. Several effective strategies have been identified in the literature to support learners in developing reading proficiency:

**a) Direct Guidance.**

Through guided reading, teachers can closely observe learners' ability to decode written symbols, associate written forms with their corresponding sounds, and distinguish words accurately within a text. These foundational skills are essential for reading development and are particularly important in Arabic due to its orthographic and phonological features (Taima, 1983). During guided reading activities, teachers may also encourage learners to read with specific objectives, such as identifying grammatical structures or extracting key vocabulary. This focused reading approach, as emphasized by Al-Basis (2011), helps sustain learner engagement and enhances overall comprehension.

**b) Collaborative learning strategies.**

Teachers can provide a variety of reading materials - including narratives, essays, and academic texts - to accommodate different interests and proficiency levels. Exposure to diverse text types enables learners to become familiar with different writing styles and communicative contexts in Arabic. At the same time, collaborative reading activities foster positive reading attitudes and promote deeper engagement with texts.

**c) Reading aloud.**

Reading aloud activities support active learner participation and contribute to improved pronunciation, intonation, and fluency. Encouraging learners to read aloud allows them to practice accurate articulation while receiving immediate feedback from the teacher or peers. In addition, activities such as oral summarization of texts promote interaction and enhance comprehension, making reading a more dynamic process than silent reading alone.

Overall, teaching reading skills plays a vital role in Arabic language learning, as it supports vocabulary acquisition, grammatical development, and the growth of critical thinking skills. A comprehensive reading instruction framework may include pre-reading activities to activate background knowledge, vocabulary-building exercises to expand learners' lexical repertoire, and post-reading discussions to reinforce comprehension and encourage meaningful engagement with texts.

**Writing Skill:**

Developing learners' writing skills requires the implementation of instructional strategies that support idea generation, linguistic accuracy, and meaningful expression. Several approaches have been identified as effective in enhancing Arabic writing proficiency:

**a) Collaborative writing activities.**

Encouraging students to work in groups to produce shared texts promotes collaboration and communication while enabling learners to exchange ideas and provide constructive peer feedback. Such interaction contributes to the collective development of writing skills and helps learners refine their vocabulary use and sentence structure (Al-Basis, 2011). To maximize effectiveness, collaborative writing should be implemented regularly, as consistent practice supports vocabulary retention and syntactic development. In addition, teacher feedback remains essential in helping learners identify their strengths and areas for improvement, thereby fostering a growth-oriented attitude toward writing (Taima, 1983).

**b) Integration of technology in writing instruction.**

The use of word-processing software, language-learning applications, and interactive digital tools can make writing activities more motivating and accessible. These technologies help address common challenges in Arabic writing, such as limited vocabulary and grammatical inaccuracies, by providing features such as spell-checking, auto-correction, and formatting support. As noted by Al-Jadani (2024), the effective use of technology facilitates interactive learning and assists learners in developing writing skills in a more engaging and learner-friendly manner.

Incorporating these strategies into classroom instruction contributes to the development of Arabic writing proficiency by providing learners with structured support, meaningful practice, and constructive feedback. Together, these approaches form a comprehensive framework for nurturing confident and competent writers of Arabic.

***The Role of Language Skills in Achieving Communication Skills***

Language skills - listening, speaking, reading, and writing - are fundamental to effective communication. Mastery of these skills not only enables personal expression but also facilitates professional interaction and intercultural communication (Mat Daud et al., 2021). Communication constitutes the primary function and ultimate goal of language use; therefore, communicative competence in Arabic is essential for non-native speakers to interact effectively in real-world contexts. Such competence bridges the gap between linguistic knowledge and actual language use, thereby enhancing learners' ability to communicate in Arabic in ways comparable to native speakers (Janadbah & Sharef, 2024).

Although all four language skills are essential in learning Arabic, a fundamental question arises: which of these skills should come first in the learning process to achieve communicative proficiency?

Mohd Nor et al. (2021) argue that speaking should be prioritized, as it is the most frequently used skill in everyday communication and the most challenging to acquire. They further suggest that speaking serves as an immediate means of linguistic interaction, rendering it more critical than reading and writing. In contrast, the present study adopts the view that listening should precede the other skills. This position is consistent with Mohd Din and Mohammad Seman (2019), who maintain that Arabic instruction should begin with intensive listening activities to enable learners to acquire accurate pronunciation and develop the ability to distinguish Arabic sounds and intonation patterns precisely. Achieving this outcome requires teachers to provide accurate phonological models for learners to imitate, as the ability to reproduce sound patterns forms a fundamental basis for daily communication. Jamali et al. (2018) similarly emphasized the primacy of listening, asserting that learners cannot produce accurate speech unless they first develop strong listening skills, which serve as the foundation for all other language abilities. Nevertheless, an intermediate perspective proposes that listening and speaking may be integrated within a single instructional phase, allowing learners to be exposed to correct pronunciation through repeated listening while simultaneously engaging in guided pronunciation practice (Mohd et al., 2025).

It is important to note that achieving communicative goals does not depend on mastery of a single skill; rather, it requires the integrated development of all four language skills. Learners must first develop listening comprehension, which can be enhanced through exposure to diverse audio materials, systematic vocabulary recording, and comprehension assessment through question-and-answer activities. Speaking skills are then developed to enable learners to express ideas through meaningful conversational tasks, such as discussions of everyday topics and role-play activities that reinforce accurate intonation and contextual usage. Reading plays a crucial role in knowledge acquisition and may be strengthened through direct teacher guidance to maintain focus, as well as through collaborative reading activities that increase engagement. Writing, in turn, allows learners to apply and articulate their knowledge and can be fostered through peer-

based writing tasks that encourage idea exchange, alongside the use of technology to facilitate the learning of complex expressions.

In sum, the regular and systematic practice of listening, speaking, reading, and writing through effective instructional approaches represents the most appropriate pathway to achieving communicative competence. Recent educational studies confirm that integrating the four language skills within an active learning environment leads to comprehensive improvements in learners' overall linguistic performance (Mat Daud et al., 2021).

**Recommendations**

Based on the findings of this study on the development of communicative competence, the following recommendations are proposed:

a) The sequencing of language skills in instructional textbooks should be aligned with the specific objectives of the programme and the needs of learners, rather than being determined by rigid traditional conventions. While some textbooks may begin with listening and others with speaking, within a communicative approach, listening should be regarded as the foundational skill for the development of communicative competence.
b) Teachers should emphasize the integration of language skills as they naturally occur in real-life communication. For example, learners practise listening through interaction and dialogue, develop reading skills through writing-related tasks, and apply multiple skills simultaneously in authentic communicative contexts.
c) In communicative language training, teachers should carefully select vocabulary that is closely related to the communicative situations being addressed. This enables learners to perform the required language functions effectively within specific contexts..
d) Learners should be provided with ample opportunities to move, interact, and participate in communicative activities that simulate real-life situations, thereby bringing authentic language use into the classroom as much as possible..

**Communicative situations that may be incorporated into classroom include:**

1. Daily interaction among students
2. Giving instructions, directions, and guidance
3. Simulations and language discussions
4. Compliments, speeches, dialogues, and seminars
5. Organizing activities and events that require speaking in Arabic
6. Extensive reading of magazines, newspapers, and books
7. Listening to audio materials such as radio programmes, news bulletins, seminars, and interviews

**Conclusion**

In today's globalized world, language proficiency has become increasingly important for academic achievement as well as for the professional success of language learners who intend to work in their fields of study. Professionals are required to navigate diverse linguistic and cultural environments, making effective cross-cultural communication a critical necessity. Strong language skills contribute to building professional networks, enhancing negotiation processes,

and facilitating collaboration with colleagues from different backgrounds, thereby strengthening professional relationships and career opportunities. Based on the preceding discussion, it can be concluded that achieving communicative competence requires balanced development of listening, speaking, reading, and writing skills. Each skill plays a distinct role in promoting effective communication at both personal and professional levels. As individuals strive to improve these competencies, they enhance their ability to interact with others and manage the complexities of communication challenges in the modern era.

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# ISLAMIC LEADERSHIP MODELS: A COMPARATIVE STUDY

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***Abstract*** *: This study presents a systematic comparative analysis of Islamic leadership models in educational settings, examining how contemporary frameworks integrate core Islamic principles with modern leadership theory and institutional needs. Drawing on 40 peer-reviewed articles published between 1990 and 2024, this study employs a Comparative Literature Review (CLR) supported by qualitative content analysis to evaluate the epistemological foundations, conceptual structures, and operational dimensions of selected models. Through the construction of a comparative matrix and the use of visual analytical tools such as radar charts, this study identifies common thematic components including spirituality, ethical character, shura-based decision-making, community engagement, and prophetic role modelling while also highlighting notable differences in contextual adaptability, methodological depth, gender inclusivity, and practical clarity. The findings indicate that although many models contribute meaningfully to Islamic educational leadership discourse, the Al-Hidabi Leadership Model demonstrates the highest level of conceptual coherence, spiritual grounding, and operational applicability. Distinguished by its revelation-guided epistemology and integration of spiritual, ethical, emotional, cognitive, and strategic dimensions, the model offers a balanced framework capable of addressing contemporary educational challenges while remaining anchored in Islamic values. By synthesizing dispersed theoretical perspectives and offering a structured, evidence-based comparison, this study contributes to the advancement of Islamic leadership scholarship and provides practical insights for policymakers, school leaders, and educators seeking faith-aligned and culturally authentic leadership approaches. This analysis underscores the need for future empirical studies to operationalize and validate these models in diverse educational environments.*

***Keywords:*** *Islamic leadership, comparative analysis, educational leadership, spirituality, Al-Hidabi Model.*

**Leadership**: Leadership is the ethical and strategic influence exercised by individuals to guide others toward shared educational goals, grounded in Islamic values like *shura*, *Amanah*, and *Qudwa*.

**Model**: A model is a structured framework that defines key components and processes of leadership, serving as a guide for theory and practice within Islamic educational contexts.

**Comparative Study:** An analytical approach was used in this research to examine multiple Islamic leadership models by identifying their similarities and differences based on defined criteria such as theoretical frameworks, key components, leadership styles, and the extent of Islamic integration.

**Introduction**:

In the evolving landscape of educational leadership, there is an increasing need to explore models that resonate with cultural, spiritual, and ethical dimensions, particularly in Muslim societies. The growing body of literature on Islamic-based educational leadership reflects a concerted effort to redefine the theoretical and practical boundaries of leadership through the lens of Islamic epistemology. As global educational systems face moral dilemmas, socio-political challenges, and demands for inclusive governance, Islamic leadership frameworks offer a unique paradigm rooted in Qur'anic principles, Prophetic traditions, and values of justice, consultation, and trustworthiness.

The surge in interest has led to the development of numerous models, each attempting to balance classical Islamic teachings with contemporary organizational demands. These include comprehensive frameworks such as Al-Hidabi's revelation-guided leadership model, the Balanced Leadership from an Islamic Perspective (BLIP), and context-specific approaches like Padela's framework for Muslim female leaders. Alongside these conceptualizations, there is an emerging recognition of the need for empirical rigor and operational clarity to assess the effectiveness of Islamic leadership in practical educational settings.

Despite the richness of these models, there exists a gap in comparative analysis that critically examines their philosophical foundations, structural components, and applicability. This study addresses this gap by comparatively reviewing forty academic contributions to Islamic educational leadership. It aims to answer three key questions: (1) What are the published Islamic leadership models? (2) What are the similarities and differences among these models? and (3) Which model emerges as the most effective based on a structured comparison of their theoretical coherence and practical adaptability?

Through an academically rigorous and thematically organized synthesis, this paper seeks to contribute to the scholarship on educational leadership by offering a nuanced understanding of how Islamic principles are being translated into actionable leadership frameworks. The findings are particularly relevant for educators, policymakers, and scholars interested in faith-integrated models of leadership that prioritize ethical governance, community well-being, and spiritual accountability.

**Methodology:**

This study employed a comparative literature review (CLR) approach to identify, evaluate, and synthesize Islamic leadership models in the context of educational leadership. Following a comparative study, 40 peer-reviewed articles were selected and analysed.
Data Sources, Selection Criteria, and Analysis

The articles reviewed in this study were sourced from a range of academic databases and peer-reviewed journals specializing in educational leadership, Islamic studies, and organizational behaviour. To ensure relevance and rigor, the selection criteria included articles published between 1990 and 2024 that focused explicitly on Islamic educational leadership. Eligible studies also needed to present either a conceptual framework, a defined leadership model, or an empirical analysis of leadership within Muslim contexts. Articles were excluded if they

concentrated solely on secular leadership theories, lacked a clear framework or model, or were not written in English.

Following selection, the articles were analysed using qualitative content analysis. Each leadership model was examined for its theoretical or philosophical framework, its key components such as values, traits, and functions, and the type of leadership style it embodied (e.g., transformational, participative). In addition, the degree of Islamic integration was assessed, particularly the extent to which the models were anchored in Qur'anic principles or Prophetic traditions.

To compare models, a comparative matrix was constructed, followed by a radar chart visualization to examine dimensional emphasis across leadership traits. Operational scoring was applied to assess emphasis on six core leadership dimensions: spirituality, ethics, strategic thinking, empowerment, consultation, and role modelling.

This mixed-method comparative approach allowed both qualitative richness and visual synthesis, leading to a robust evaluation of the most comprehensive Islamic leadership model.

**Research questions:**

1. What are the published Islamic leadership models?
2. What are the similarities and differences between these leadership models?
3. What is the most effective model of leadership based on the comparison?

Comparative Analysis of Islamic Leadership Models: A Comparative Review Research Question 1: What are the published Islamic leadership models?

The comparative review of 40 academic articles reveals a diverse set of leadership models derived from both classical Islamic sources and contemporary educational leadership theories. The most notable models identified include:

1. Al-Hidabi Leadership Model – A revelation-guided holistic model integrating heart, mind, akhlaq, competence, and spiritual accountability (Al-Hidabi, 2023).
2. Balanced Leadership from an Islamic Perspective (BLIP) – Integrates spiritual consciousness with ethical, relational, and instructional practices (Elkaleh, 2023).
3. Islamic Balanced Leadership Model (Wasatiyyah) – Founded on moderation between material and spiritual dimensions, balancing rights and responsibilities (Farrag & Sobh, 2023).
4. Islamic Educational Leadership Framework – Rooted in Qur'anic values such as amanah, shura, tafakkur, and justice (Na'imah & Muhibbin, 2022).
5. Padela's Theocentric Leadership Framework – Emphasizes modeling prophetic behavior and fostering a God-centered worldview (Amatullah, 2024).
6. Shalah al-Jama'ah Model – A ritual-based leadership structure inspired by congregational prayer and linked to organizational order and unity (Tontowi et al., 2020).
7. Spiritual-Motherhood Model – Frames leadership through nurturing, care, and spiritual commitment among Muslim women leaders (Lahmar, 2024).

8. Jubran's Role-Style Model – Combines five educational roles and four leadership styles anchored in prophetic ethics (Jubran, 2015).
9. Ethical Participative Leadership – Connects participative decision-making and ethical attitudes to performance outcomes (Torlak et al., 2021).
10. Spiritual Leadership (Fry's Model in Islamic Contexts) – Based on vision, hope/faith, altruistic love, and inner life adapted into Islamic schools (Subhaktiyasa et al., 2023).

Research Question 2: What are the similarities and differences between these leadership models?

Despite their diverse origins, Islamic leadership models reviewed share several foundational similarities:

- Spiritual Foundation: Most models emphasize taqwa (God-consciousness), ethical integrity, and accountability to Allah (Elkaleh, 2023; Na'imah & Muhibbin, 2022).
- Ethical Orientation: Justice, honesty, amanah, and humility appear as universal values across all models (Torlak et al., 2021; Lahmar, 2024).
- Consultative Decision-Making: Shura is a recurring principle, promoting inclusivity and collective reasoning (Amatullah, 2024; Jubran, 2015).
- Role Modeling: Leading by example, inspired by prophetic practices (qudwah), is a critical element (Farrag & Sobh, 2023; Tontowi et al., 2020).

However, notable differences emerge in:

- Framework Scope: While models like Al-Hidabi and BLIP are holistic, others are focused, such as the Shalah al-Jama'ah model, which emphasizes ritual structuring.
- Gendered Dimensions: Models such as Padela's and Lahmar's provide a unique epistemological lens centred on female Muslim leadership.
- Contemporary Integration: Some frameworks (e.g., Innovation & Instructional Leadership, Hojeij, 2024) incorporate modern leadership styles and technology-driven strategies, while others remain classical.
- Operationalization: Quantitatively validated models like the Ethical Participative Leadership (Torlak et al., 2021) offer empirical links to performance, unlike more qualitative conceptual frameworks.
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Research Question 3: What is the most effective model of leadership based on the comparison? The comparative synthesis suggests that the Al-Hidabi Leadership Model stands out as the most comprehensive and effective due to its:

- Balance Across Domains: It integrates spirituality, ethics, cognitive and emotional competence, role modelling, and impact orientation.
- Revelation-Based Epistemology: Rooted directly in Islamic ontology and divine accountability, aligning with both traditional and modern expectations of leadership.
- Applicability: Suitable for educational and community-based institutions due to its clear principles and structured components.

Compared to other models, Al-Hidabi scores consistently across key leadership dimensions such as consultation, role modeling, empowerment, and strategic thinking. Its ability to

synthesize Qur'anic values with measurable impact mechanisms enhances both its practical relevance and ideological robustness (Al-Hidabi, 2023).

**The comparative matrix of the Al-Hidabi Leadership Model alongside forty other Islamic leadership models.**

This table helps you compare:

- Model type
- Key dimensions
- Core characteristics
- Leadership style
- Level of Islamic integration

| Model | Framework | Key Components | Style | Core Characteristics | Islamic Integration |
|---|---|---|---|---|---|
| Al-Hidabi Leadership Model | Revelation-Guided Holistic Leadership | Heart, Mind, Akhlaq, Traits, Competence, Impact | Iman-Centered / Integrated | Spiritual, Ethical, Strategic, Transformational | Very High |
| BLIP (Balanced Leadership Islamic Perspective) | Balanced Ethical Leadership | Spiritual Core, Shura, Role Modeling, Empowerment | Participative / Ethical | Just, Empathetic, Visionary, Sincere | High |
| Managerial Leadership in Education | Managerial + Leadership Functions | Planning, Organizing, Ethical Behavior, Influence | Strategic / Operational | Disciplined, Accountable, Task-Oriented | Moderate |
| Islamic Balanced Leadership (Farrag & Sobh) | Wasatiyyah (Moderation) Model | Mind, Heart, Rights, Responsibilities, Spirituality | Moderation-Based / Ethical | Balanced, Emotionally Intelligent, Reflective | High |
| Islamic Educational | Qurâanic Value-Based Leadership | Amanah, Taqwa, Shura, Tafakkur, Justice | Spiritual / Ethical | Responsible, Just, Humble | Very High |

| | | | | | |
|---|---|---|---|---|---|
| Leadership (Na'imah) | | | | | |
| Ethical Participative Leadership (Torlak et al.) | Decision-Making â†' Ethics â†' Performance | PDM, Moral Traits, Attitude, Knowledge | Participative / Ethical | Supportive, Just, Transparent | Moderate |
| Jubran's Role-Style Model | Five Roles + Four Styles | Visionary, Servant, Guide, Collaborative, Shuratic | Integrated Role-Based | Caring, Strategic, Educative | High |
| Innovation & Instructional Leadership (Hojeij) | Transformational + Instructional | Collaboration, Vision, Risk-Taking, Empowerment | Innovative / Hybrid | Empowering, Adaptive, Strategic | Moderate |
| Padelaâ€™s Female Muslim Leadership Framework | Theocentric Leadership | Modeling, Theocentric Worldview, Consultation | Spiritual / Participative | Devoted, Humble, Inclusive | Very High |
| Interdisciplinary Leadership Model | Identity Practice Outcomes | Critical Thinking, Systems Thinking, Reflection | Collaborative / Adaptive | Reflective, Humble, Learner-Centered | Low |
| Learner-Centered Global Leadership | Experiential Global Competency | CQ, Reflection, Problem-Solving, Global Awareness | Learner-Centered / Global | Adaptable, Ethical, Inclusive | Low |
| Spiritual-Digital Islamic Leadership | Spiritual + Tech-Based Curriculum | Visionary, Shura, Empowerment, ICT Integration | Visionary / Contextual | Balanced, Ethical, Innovative | High |
| Shalah al-Jamaâ€™ah | Prayer-Inspired Supply Chain Leadership | Imam Model, Unity, Purity, Corrective Process | Spiritual / Structured | Disciplined, Ethical, Accountable | Very High |

| | | | | | |
|---|---|---|---|---|---|
| Framework (Tontowi) | | | | | |
| Kouzes & Posner (Jordanian Context) | Five Practices Model (LPI) | Challenge, Vision, Model, Enable, Encourage | Transformational / Participative | Inspirational, Reflective, Empowering | Moderate |
| Spiritual-Motherhood Leadership | Islamic Ontological Feminist | Spirituality, Care, Reconciliation, Tawhid | Nurturing / Ethical | Compassionate, Responsible, Worship-Oriented | Very High |
| Responsible Leadership (Cavagnaro) | Identity, Behavior, Responsiveness | Self-Transcendence, Triple Bottom Line | Ethical / Systemic | Reflective, Sustainable, Value-Driven | Low Moderate |
| Fryâ€™s Spiritual Leadership (SLR) | Vision Faith Altruism â†' Wellbeing â†' Performance | Hope, Calling, Membership, Inner Life | Spiritual / Transformational | Caring, Purposeful, Ethically Grounded | Moderate High (when Islamized) |
| Systematic Review on Muslim Societies (Ahmed) | Hallinger's ABCD: Antecedent Behavior Context Outcome | Shura, Taqwa, Role Modeling, Contextual Fit | Mixed / Value-Centric | Culturally Sensitive, Trust-Based | High |
| Islamic-Based Leadership Meta-Review (Arar et al.) | Faith-Based + Community-Responsive | Charisma, Shura, Stewardship, Ethics | Spiritual / Responsive | Contextual, Ethical, Inclusive | High |
| Strategic Role of Muslim | Competency + Character-Based | Responsibility, Justice, Decisiveness, Qudwah | Situational / Feminine-Islamic | Capable, Accountable, Ethical | High |

| | | | | | |
|---|---|---|---|---|---|
| Women in Education | | | | | |
| Transformational Leadership in Pesantren | Transformational Leadership | Charisma, Inspiration, Stimulation, Consideration | Visionary, Inspiring, Ethical, Individual-focused | Transformational | Moderate (moral alignment) |
| Prophetic Values in Islamic Ed. | Prophetic Leadership | Humanization, Liberation, Transcendence | Sidq, Amanah, Tabligh, Fathonah | Prophetic, Transformational | High (Quran-based) |
| SBM Leadership Framework | Enculturation Leadership | Planning, Mentoring, Evaluation | Participatory, Collaborative, Evaluative | Contextual/Collaborative | Moderate (ethics + practice) |
| PR and Leadership in Schools | PR-based Leadership | Human relations, Persuasion, Participation | Trust-builder, Communicative, Ethical | Democratic/Strategic | Moderate |
| Surah Yusuf-based Leadership | Prophetic/Character Leadership | Spiritual, Social, Managerial | Honesty, Patience, Justice, Wisdom | Prophetic/Strategic | High (Quran-based) |
| Situational Leadership in Ed. | Situational Leadership | Discipline, Spirit, Skill | Adaptive, Reflective, Collaborative | Situational/Contextual | Moderate |
| Revised Transformative Leadership | Transformational + Islamic | Bassâ€™s 4I + Islamic traits | Visionary, Courageous, Wise | Transformative-Spiritual | High |
| Balun Tolerance Model | Transformational-Internal-Collective | Trust, Art, Tradition, Dialogue | Collaborative, Ethical, Mediator | Democratic/Interfaith | High (community-cantered |

| | | | | | |
|---|---|---|---|---|---|
| SBM Follow-up Leadership | Enculturation (SBM) | Plan, Implement, Evaluate | Visionary, Collaborative, Reflective | Mentoring/Participative | Moderate |
| Pattani Conflict Leadership | Contextual/Transformational | Adaptation, Inclusion, Harmony | Resilient, Diplomatic, Visionary | Strategic/Inclusive | High (conflict-informed) |
| Leadership in Learning (Bass + Islamic) | Learning Leadership | Culture, Ethics, PD, Assessment | Empowering, Visionary, Moral | Instructional/Transformational | Moderate |
| Urgency of Leadership | Mixed (Situational + Transformational) | Trust, Delegation, Conflict Mgmt | Just, Consultative, Resilient | Flexible/Value-based | High |
| Leadership in Islamic Ed. | Situational + Prophetic | Sidq, Amanah, Shura, Fathonah | Honest, Visionary, Democratic | Prophetic/Adaptive | High |
| Afifah (Conf. Version) | Spiritual + Situational | Sidq, Amanah, Adl, Shura | Moral, Inclusive, Consultative | Contextual/Spiritual | High |
| Muslim Women s Leadership | Values-Based + Historical | Trust, Justice, Inclusion | Initiative, Fair, Honest, Strategic | Participative/Democratic | High (gender-conscious) |
| Leadership in Conflict (Azizah) | Conflict-Responsive Leadership | Curriculum, Stakeholder Engagement, Cohesion | Inclusive, Visionary, Peace-driven | Strategic/Adaptive | High (conflict-informed) |
| Leadership in Learning (Sarwan) | Instructional + Transformational | Learning Culture, PD, Ethics, Assessment | Collaborative, Empowering, Reflective | Instructional/Spiritual | Moderate |

| | | | | | |
|---|---|---|---|---|---|
| Women s Strategic Leadership | Spiritual + Participative | Trust, Justice, Empowerment | Honest, Responsible, Inclusive | Participative/Democratic | High (female-centric) |
| Philosophy of Qur'anic Leadership | Qurâ€™anic Ontological-Epistemic | Tawhid, Adl, Shura, Amanah | Truthful, Consultative, Just | Philosophical/Prophetic | Very High |

A full synthesis summary across all 41 Islamic leadership models, including the Al-Hidabi model and 40 peer-reviewed article frameworks:

1. Leadership Models: Typologies and Philosophies

| Model Category | Represented By |
|---|---|
| Transformational Models | Pesantren, Revised Transformative, Balun Model, SBM Frameworks |
| Prophetic/Character-Based | Surah Yusuf, Prophetic Values, Qur'anic Frameworks |
| Situational/Contextual Models | Pattani Conflict, Situational Leadership in Ed., PR-based Leadership |
| Spiritual/Iman-Centred | Al-Hidabi, Afifah's Model, Islamic Ed. Leadership (Qur'an & Hadith-based) |
| Integrated/Hybrid Models | SBM Follow-Up, Women's Strategic Leadership, Conflict-Responsive Leadership |

➡️ The Al-Hidabi model is the most integrative, combining spiritual, moral, strategic, and professional leadership.

2. Core Dimensions Across Models

| Dimension Theme | Common Forms Across Models |
|---|---|
| Spiritual Foundation | Tawhid, Iman, Akhlaq, Prophetic Traits (Sidq, Amanah, Fathonah, etc.) |
| Strategic Thinking | Vision, planning, implementation, evaluation |
| Character Formation | Honesty, humility, justice, wisdom |
| Collaboration & Consultation | Shura, community engagement, participatory leadership |
| Professional Competency | Instructional skills, communication, conflict resolution, administrative management |
| Impact Orientation | Seen clearly in Al-Hidabi, Balun, and SBM models (community change, ethical legacy, outcomes) |

➡️ The Al-Hidabi model uniquely formalizes these into six structured domains (Heart, Mind, Akhlaq, Traits, Competencies, Impact).

3. Shared Leadership Characteristics

| Recurring Characteristics | Models Emphasizing This |
|---|---|
| Visionary and Ethical | Transformational, Surah Yusuf, Al-Hidabi |
| Just and Accountable | Prophetic Values, Qur'anic Philosophy, Leadership in Conflict |
| Adaptive and Context-Aware | Situational Leadership, Pattani Model, Women's Strategic Leadership |

| Recurring Characteristics | Models Emphasizing This |
|---|---|
| Collaborative and Empowering | SBM, PR-based Leadership, Al-Hidabi |
| Mentor and Role Model (Uswah) | Prophetic models, Surah Yusuf, Al-Hidabi |

4. Islamic Integration: Depth & Breadth

| Level of Islamic Integration | Examples |
|---|---|
| Very High (Textual + Spiritual + Practical) | Al-Hidabi, Qur'an & Hadith Philosophy, Prophetic Values Models |
| High (Qur'anic Traits + Institutional Application) | Surah Yusuf, Balun Model, Revised Transformative Leadership |
| Moderate (Ethical alignment + partial integration) | SBM Frameworks, PR-based Leadership, Learning Leadership (Bass+Islam) |

➡️ The Al-Hidabi model is the only one that explicitly operationalizes revelation (wahy) into competencies and action.

5. Distinctive Contributions of the Al-Hidabi Model

| Unique Feature | Explanation |
|---|---|
| Tazkiyah + Leadership | Purification of self is the leadership entry point |
| Heart & Mind as separate but integrated | Balances emotional/spiritual and intellectual development |
| Impact as a leadership dimension | Measurable transformation for dunya and akhirah |
| Piesta Values & Experiential Tools | Connects theory with active workshops, mentoring, and reflection |

Synthesis:

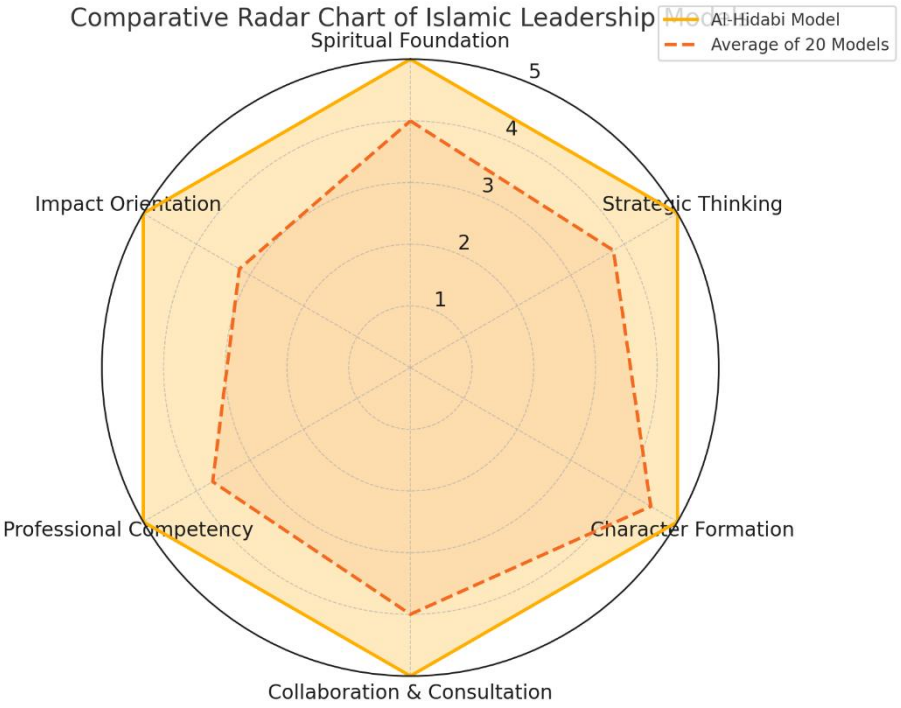
The Al-Hidabi Leadership Model Advances Islamic leadership theory by:

- Providing a revelation-rooted, holistic framework that combines spiritual, cognitive, moral, and professional growth.
- Comparatively addressing impact and transformation beyond institutional goals, towards societal service and divine accountability.
- Standing out among the 40 other models for its balance of classical Islamic principles with contemporary leadership science.
-

The radar chart visually compares the Al-Hidabi Leadership Model to the average profile of 40 Islamic leadership models across six key dimensions:

- Spiritual Foundation
- Strategic Thinking
- Character Formation
- Collaboration & Consultation
- Professional Competency

- Impact Orientation




The Al-Hidabi model demonstrates balanced and consistently high scores, especially in spiritual depth and holistic impact, which often appear less emphasized or scattered in other models

The radar chart visualizes leadership models with "Very High Islamic Integration", comparing their emphasis on six key dimensions:

- Spirituality
- Ethics
- Strategic Thinking
- Empowerment
- Consultation (Shura)
- Role Modeling

We can see how models like Al-Hidabi, Padela's Female Muslim Leadership, and the Spiritual-Motherhood framework score highly across nearly all axes.

What the Radar Chart Shows

This radar chart compares Islamic leadership models that scored "Very High" in Islamic integration across six leadership dimensions commonly emphasized in Islamic educational leadership.

Each axis represents one dimension. Each line or "web" is a model, showing how much that model emphasizes each dimension.

The six Dimensions Used in the Radar

| Dimension | Meaning in Islamic Leadership Context | How It Was Measured (Proxy) |
|---|---|---|
| Spirituality | Focus on inner faith, God-consciousness (taqwa), and worshipful intent | Terms like "spiritual", "faith", "taqwa" in model description |
| Ethics | Justice, honesty, amanah (trust), fairness, and moral integrity | Mentions of justice, honesty, or ethical traits |
| Strategic Thinking | Long-term vision, purpose-driven decision-making | Vision, planning, and future-orientation references |
| Empowerment | Enabling others, mentoring, delegating responsibility | "Empowerment", "transformation", or support terms |
| Consultation | Shura (consultative leadership), inclusivity, shared decision-making | "Shura", "participative", or "collaborative" styles |
| Role Modelling | Leading by example (qudwah), inspirational behaviour, and personal accountability | Explicit reference to role modelling or a Prophetic example |

How to Read It

- The further a model reaches out on a spoke (axis), the stronger it emphasizes that dimension.
- A balanced hexagon indicates the model is holistically developed (like Al-Hidabi).
- An uneven shape (e.g., strong in spirituality but weaker in consultation) reveals a more focused or niche model.

We Observe:

| Model | Strengths Highlighted on the Radar |
|---|---|
| Al-Hidabi | Balanced across all six dimensions—complete, integrated framework |
| Padela's Female Leadership | High in spirituality, role modeling, consultation—relational and ethical focus |
| Spiritual-Motherhood Model | Excels in spirituality, ethics, role modeling—nurturing and ontological |
| Islamic Educational Leadership (Na'imah) | Strong in ethics and consultation—principled and inclusive |
| Shalah al-Jama'ah Framework | Strong in structure, ethics, role modeling—ritually inspired discipline |

The dimension score table for leadership models with "Very High" Islamic integration. It shows whether each model emphasizes the following six dimensions (1 = emphasized, 0 = not emphasized):

| Model | Spirituality | Ethics | Strategic Thinking | Empowerment | Consultation | Role Modeling |
|---|---|---|---|---|---|---|
| Al-Hidabi Leadership Model | 1 | 1 | 1 | 1 | 0 | 0 |
| Islamic Educational Leadership (Na'imah) | 0 | 1 | 0 | 0 | 1 | 0 |
| Padela's Female Muslim Leadership | 0 | 0 | 0 | 0 | 1 | 0 |
| Shalah al-Jama'ah Framework | 0 | 1 | 0 | 0 | 0 | 0 |
| Spiritual-Motherhood Leadership | 0 | 0 | 0 | 0 | 0 | 0 |

Observations:

- Al-Hidabi is the only model that scores across four dimensions, showcasing its broad integration.
- Most other models focus narrowly on one or two key principles (e.g., ethics or consultation).
- Surprisingly, some models titled "spiritual" did not explicitly mention "spirituality" in the scoring keywords, which may suggest a need for deeper content analysis.

**Conclusion**

This comparative study critically examined forty Islamic leadership models within educational contexts, analyzing their theoretical foundations, structural components, leadership styles, and levels of Islamic integration. Despite the diversity of frameworks, certain core pillars—such as **spiritual consciousness (taqwa)**, **ethical conduct (amanah, adl)**, **consultative governance (shura)**, and **prophetic role modeling (qudwah)**—consistently emerged as the foundational elements across most models.

However, significant variations were observed regarding scope, gender perspectives, contemporary applicability, and empirical validation. Some models emphasized traditional ethical leadership, while others integrated modern strategic and instructional elements.

Among all models analyzed, the **Al-Hidabi Leadership Model** distinguished itself as the most comprehensive, holistic, and operationally effective framework. Its structured integration of spirituality, ethical character, cognitive development, leadership traits, professional competencies, and societal impact—rooted directly in Qur'anic revelation and Prophetic tradition—positions it as a benchmark for Islamic educational leadership in contemporary settings.

**Key Findings**

- Islamic leadership models universally emphasize spiritual and ethical principles but vary in operational scope and practical emphasis.
- A holistic leadership model must balance spirituality, ethics, strategic vision, empowerment, consultation, and role modeling to achieve true educational and societal transformation.
- The Al-Hidabi model successfully operationalizes these dimensions into a cohesive, actionable framework, offering both theoretical rigor and practical adaptability.

By the end, this study significantly contributes to the growing field of Islamic educational leadership by:

- **Filling a critical gap** through a structured, systematic comparative analysis of forty Islamic leadership models.
- **Providing visual tools and matrices** that synthesize complex theoretical landscapes into accessible comparative frameworks.
- **Highlighting a paradigm shift** toward revelation-guided, spiritually grounded leadership that addresses both institutional effectiveness and societal well-being.

By advancing a comprehensive, faith-integrated model of leadership, this research reinforces the need for culturally authentic, ethically robust, and strategically effective paradigms to guide educational leadership within Muslim societies. Future research should continue to build on these findings, exploring the practical implementation of holistic Islamic leadership frameworks in diverse educational and organizational contexts.

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# THE RESEARCH ON THE PATH OF PROMOTING INDUSTRIAL INTEGRATION THROUGH E-COMMERCE DEVELOPMENT IN HANGZHOU UNDER THE CONTEXT OF THE DIGITAL ECONOMY

**Gao Xueyan**
**Alfred Chee Ah Chit**

***Abstract:*** *The ongoing technological revolution has significantly transformed consumer behaviors, while the rapid development of the digital economy has propelled the digitalization and clustering of industries into an inevitable trajectory. As China's e-commerce hub, Hangzhou is positioned to leverage its advantages in digital economy and new e-commerce development to spearhead the integration of the digital and real economies. Confronted with challenges such as the spatial limitations of industrial integration, bottlenecks in the smooth flow of key elements, and barriers to cross-regional collaboration, this study draws upon advanced cases such as the Guangzhou-Foshan metropolitan integration, the Tianlifang·Linping Future Farm, and the development of New York's Silicon Alley. The paper advocates for the strategic use of e-commerce to drive transformative changes, emphasizing the allocation of significant roles for e-commerce participants in optimizing customer demand, resource allocation, and governance mechanisms. It highlights the importance of upgrading the industrial chain, value chain, and benefit chain to create a robust industrial ecosystem. Furthermore, the paper suggests promoting urban-rural integration by using core industries to lead the development of distinctive industries, facilitating resource integration, and encouraging cross-regional collaborations to foster synergies between domestic and foreign trade. It also emphasizes the synchronization of living and production while guiding project planning and talent mobility as a means to promote balanced economic growth and sustainable development.*

***Keywords****: Digital Economy, New E-commerce, Industrial Integration*

## 1 Introduction

The technological revolution and industrial transformation have driven the global economic restructuring. New industries and models have brought about the development demand for deep industrial integration. The traditional development model which is centered around a single industry, is transitioning towards a development model of multi-industry integration. This has become a new trend and driving force for the high-quality and new-normal development of China's economy.

A new round of information technology revolution has given rise to new business models, while the transformation of consumer habits has led to the rapid rise of emerging e-commerce formats. This has injected new vitality into the digital transformation of industries and provided opportunities for leapfrog development in less developed regions. E-commerce, with its high penetration, has gradually changed traditional modes of production, circulation, distribution, and consumption. From this perspective, e-commerce naturally aligns with the formation of China's new "dual circulation" development pattern.

As the "E-commerce Capital", Hangzhou has seen a continuous increase in its online retail volume. In 2024, the total retail sales of goods achieved through public networks by above-

designated-size retail units reached 245.7 billion yuan, an increase of 10.5% compared to the previous year. This accounted for 49.8% of total retail sales, an increase of 4.3 percentage points from the previous year(Hangzhou Municipal Bureau of, 2025). In foreign trade, in 2024, Hangzhou exported 58.0 billion yuan through the customs cross-border e-commerce platform, an increase of 5.8%. This accounted for 27.1% of the province's cross-border e-commerce exports(Hangzhou Municipal Bureau of Commerce, 2025), maintaining the largest scale in the province. At the same time, a series of issues such as monopoly, financial risks, and data security, as well as governance challenges, continue to intensify. Additionally, the development of the industry economy led by e-commerce highlights a structural imbalance between the growth of "soft" services in consumer life and the limited development of "hard" manufacturing in physical production. The contradiction between the strong growth of leading enterprises based on scale expansion and the weakness of small and medium-sized enterprises, as well as the imbalance in urban-rural and regional development, is also prominent. Specifically, the service sector accounts for as much as 70%, while the digitalization rate of the manufacturing industry is only 35%. Furthermore, the income gap between urban and rural areas has reached 1.64 times(Du & Guan, 2021; Xu, 2025).

Therefore, this study focuses on Hangzhou's "1248" Digital Economy Plan(Digital Economy Division, 2022), aiming to build a domestic and international "dual circulation" hub city. With the "Industrial Brain + Future Factory" as the foundation and city space as the scale, the study explores how to precisely promote e-commerce development, facilitate the balance between "soft" and "hard" industries, accelerate the "e-commerce going abroad" strategy, empower the integration of the primary, secondary, and tertiary industries, broaden the channels for shared prosperity, and establish a mechanism and path for constructing a modern industrial system. Additionally, it lays the foundation for coordinated cross-regional standardized governance within the Yangtze River Delta and the Hangzhou Metropolitan Area.

## 2 Current Situation

### *2.1 Spatial constraints on urban expansion*

Hangzhou is located in the central area of the Yangtze River Delta Economic Zone, with a solid foundation for regional collaborative development, as well as rich natural resources and a favorable cultural environment. However, with the dual pressures of population growth and economic transformation, the demand for urban expansion is increasing. Land resources have become a key constraint on Hangzhou's further development. Even with the "industrial vertical expansion" model, which seeks to address this through vertical spatial expansion, limitations remain due to the need to preserve cultural landmarks and meet future development requirements. Height restrictions for indoor buildings and the overall insufficiency of land resources pose challenges(Yan, 2023). At the same time, Hangzhou faces a conflict between industrial manufacturing and the carrying capacity of its ecological environment. Currently, the reduction of green spaces and urban construction in the central areas have led to changes in air quality, which has drawn significant social attention.

In addition, Hangzhou faces the common traffic pressure issues of large cities, and its "Three Mountains and Two Lakes" natural landscape presents inherent challenges in terms of transportation and maintenance. The city's regional mainline and convergence planning is complex, with operational contradictions such as congestion in the middle of transportation routes and underutilization at both ends. Therefore, in road traffic planning, it is essential to

further synchronize considerations of industrial resources, talent demands, and traffic flow directions, as well as explore the possibility of coordination between these factors and the transportation system.

### *2.2 The dilemma of smooth flow of urban and rural elements*

Hangzhou faces a coordination dilemma in ensuring the smooth flow of urban and rural elements for integrated development. The urbanization rate of Hangzhou is 84.2%, with districts such as Shangcheng, Gongshu, and Binjiang reaching 100%. However, the degree of urban-rural integration in Hangzhou remains low. In 2024, the per capita disposable income of all residents in Hangzhou was 76,777 yuan, ranking first in the province, but its growth rate ranked last in the province. The per capita disposable income of rural residents was 50,805 yuan, resulting in an income disparity of 1.64 times(Hangzhou Municipal Bureau of Commerce, 2025). The characteristics of the urban-rural dual structure remain prominent, reflecting a “strong city, weak countryside” pattern. The core reason for this issue lies in the insufficient flow of resource elements, including “people”, “land”, “industry”, and “capital”. Under the backdrop of rapid urbanization, industrial reform, and consumption upgrading, the core of the city’s tertiary industry has squeezed manufacturing to surrounding areas, expanding spatially into rural regions. The urban fringe areas are fragmented and inefficient in land use(Wu, 2021). On one hand, there is a spatial contradiction between land demand and rural homestead and idle farmhouse resources, with land demand and supply unable to align(Li, 2018). On the other hand, the migration of rural populations to urban areas has resulted in an aging population in rural regions and a lack of talent under expansion opportunities. Moreover, the spatial layout of rural areas in Hangzhou is dispersed, and the radiating and driving capacity of towns and cities is relatively weak. People, goods, and information interact intensely in the interspersed zones between “towns” and “rural areas”(Ren & Huang, 2020; Shi & Fan, 2024). There is a lack of supporting infrastructure for regulation and the transmission of resource elements, making it difficult to achieve the effective “piecemeal development” of urban-rural integration.

### *2.3 Cross-regional restrictions on industrial chain integration*

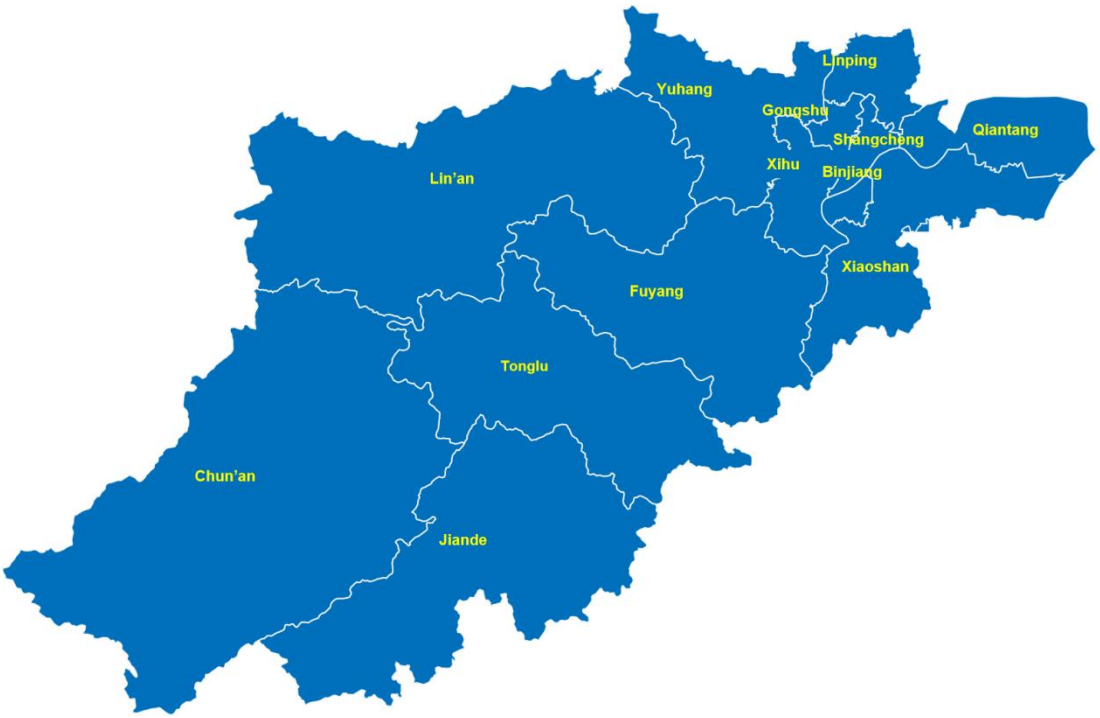



**Figure 1 Zhejiang Province Map (http://ghzy.hangzhou.gov.cn/)**

**Table1. Hangzhou Industry Spectrum**

| No. | District | Industries |
|---|---|---|
| 1 | Chun'an | **Emerging industries:** Big data and big finance, life sciences and healthcare, and the digital economy<br>**Strength industries:** Large-scale tourism, large-scale healthcare, large-scale industry, and eco-friendly specialty agriculture |
| 2 | Jiande | **Emerging industries:** Big data and big finance, life sciences and healthcare, and the digital economy<br>**Strength industries:** Large-scale tourism, large-scale healthcare, large-scale industry, and eco-friendly specialty agriculture |
| 3 | Lin'an | **Emerging industries:** high-end equipment, life sciences, integrated circuits, new energy, new materials<br>**Strength industries:** wires and cables, composite decorative materials, optoelectronics |
| 4 | Tonglu | **Main industries:** Express delivery and logistics, visual intelligence, magnetic materials, new energy, life and health, fashion industry<br>**Future industries:** Artificial intelligence and integrated circuits<br>**Specialty industries:** Large-scale tourism |
| 5 | Fuyang | **Key industries:** Digital economy<br>**Signature industries:** Optoelectronic communications, intelligent equipment, biomedicine, digital security, integrated circuits<br>**Future industries:** Blockchain, quantum information, virtual reality |

| | | |
|---|---|---|
| **6** | **Yuhang** | **Digital Economy:** Next-generation artificial intelligence, integrated circuits, next-generation communication technologies and smart terminals, critical foundational software, cybersecurity<br>**Future Industries:** Blockchain, AI+life sciences and quantum information, future networks, brain-inspired computing initiatives, green and low-carbon technologies<br>**Others:** Biotechnology and pharmaceuticals, intelligent manufacturing equipment |
| **7** | **Xiaoshan** | **Leading industries:** smart cars, new materials<br>**Emerging industries:** life sciences, integrated circuits, smart equipment<br>**Future industries:** blockchain, quantum information, next-generation mobile communications, additive manufacturing, new energy |
| **8** | **Xihu** | **Digital Economy and Innovation:** FinTech, Life Sciences, Aerospace Information, Intelligent Manufacturing<br>**Emerging Industries:** 5G Industry, Quantum Information, Brain-Inspired Chips, Next-Generation Artificial Intelligence, and Other Cutting-Edge Industries<br>**Cultural and Creative Industries:** Cultural Industry, Cultural Tourism IntegrationGongshu<br>**New industries:** commerce and finance, digital economy, life sciences and health, cultural creativity<br>Future industries: new energy, integrated circuit design, aerospace |
| **9** | **Gongshu** | **Emerging industries:** digital commerce and finance, life sciences and healthcare, cultural creativity<br>**Future industries:** new energy, integrated circuit design, aerospace |
| **10** | **Binjiang** | **Basic industries:** intelligent computing, integrated circuits<br>**Advantageous industries:** intelligent Internet of Things, digital communications, digital health, digital cultural and creative industries, digital finance, digital e-commerce, intelligent manufacturing<br>**Future industries:** quantum information, next-generation communications technology, next-generation artificial intelligence, third-generation semiconductors, flexible electronics, cell science |
| **11** | **Linping** | **Industrial clusters:** high-end equipment manufacturing, life sciences and healthcare, fashion industry<br>Specialty industries: industrial internet<br>**Future industries:** 5G ecosystem, third-generation semiconductors, next-generation artificial intelligence |
| **12** | **Shangcheng** | **Pillar industries:** financial services, consumer services, intelligent manufacturing<br>**Specialty industries:** professional services, healthcare |

| | | |
|---|---|---|
| **13** | **Qiantang** | **Advanced manufacturing:** semiconductors, life sciences, smart cars and smart equipment, aerospace, new materials<br>**Future industries:** artificial intelligence, virtual reality, additive manufacturing, quantum information<br>**Modern service industries:** R&D testing, e-commerce, tech finance, software and information, cultural tourism |

In 2024, Hangzhou's GDP reached 2.19 trillion yuan. From an industrial perspective, the service sector remains the dominant force, accounting for over 70% of GDP. The added value of the digital economy reached 630.7 billion yuan, and the industrial added value of large-scale enterprises was 440.9 billion yuan (Hangzhou Municipal Bureau of Statistics, 2025). However, the development of the manufacturing sector has been less than satisfactory. When seeking industrial chain, cluster, and circle development, there are three main issues.

1.Strong Homogeneity in Industrial Cluster Planning

Industrial homogeneity refers to similar industrial structures. This homogeneity may generate cluster effects within regional industries, but some scholars argue that homogeneous competition can lead to administrative intervention under government-enterprise economic alliances, which may hinder the free flow of production factors and result in market fragmentation(Xia & Tian, 2024; Zhu et al., 2024). Within Zhejiang Province, many similar industries exist, including light industry manufacturing, textiles and apparel, and household appliances. While promoting the "same line, same quality, same standards" initiative for domestic and foreign trade products, one approach is to meet domestic and foreign demand by improving quality, enhancing markets, and expanding the variety of products. However, an unreasonably constructed system and a lack of product diversity may also lead to disorderly competition(Gu, 2024). In development planning, Hangzhou's nine industrial chains overlap entirely with Zhejiang Province's ten industrial chains, indicating that local characteristics remain to be explored.

2. Low Vertical Integration of Industries

Currently, in Hangzhou's key industries, such as electrical machinery and equipment manufacturing, and automobile manufacturing, new momentum is highlighted with a significant rise in the production of new products like industrial robots, lithium-ion batteries, and solar cells. However, the three key drivers of Hangzhou's export growth—electric passenger vehicles, lithium-ion batteries, and solar cells—are part of many similar industries with rich product diversity. Still, cross-regional upstream and downstream coordination within the industrial chain lacks depth, leading to small industrial scales, insufficient prominence of leading enterprises, and a lack of "chain leaders." Consequently, integration is inadequate, preventing the realization of scale effects and technological spillovers. Moreover, there is high external dependence on raw material supply, such as the lithium battery sector's reliance on upstream lithium ore, and the hydrogen energy field's dependence on hydrogen resources. Hangzhou faces shortages of key raw materials in developing integrated circuits and new energy vehicles.

3. Low Horizontal Cross-Regional Coordination of Industries

Currently, Hangzhou relies on Yunqi Town and collaborates with Shanghai and Jiangsu to establish Haina Town and Xuelang Town, jointly developing the industrial hub of the Yangtze River Delta's urban brain. They are promoting projects such as the Haining-Yuhang Cooperation Development Zone, the Jianggan-Anji Industrial Park, and the Binjiang "Zhuji Island". However, the industrial development directions within different districts of Hangzhou vary. For instance, Shangcheng District focuses on financial services and consumer services, Yuhang District specializes in artificial intelligence, integrated circuits, and key basic software, and Jiande City is focused on the general aviation industry, life and health, tourism, and water industries. There are relatively few cross-regional collaborative projects based on core and advantageous industries, and specialized cooperation has not yet formed. Furthermore, Hangzhou's local automobile brand, Geely, has a local supply rate of only 50%, which is lower than Guangzhou's 80% and far below the 70% international average. There is also a lack of policy-driven supply chain horizontal coordination with local automobile parts enterprises, such as those in Taizhou.

## 3 Innovative Practices

### *3.1 Regional Collaboration and Co-construction of Urban and Rural Areas*

The economic development of the Bay Area, represented by the San Francisco (Silicon Valley-San Francisco-Oakland) region, offers significant insights for Hangzhou's development. The San Francisco Bay Area currently consists of four major economic sectors: technological innovation (Silicon Valley in the South Bay), headquarters services (San Francisco), port trade (Oakland in the East Bay), and tourism consumption (the North Bay's farmland area, Golden Gate Bridge in San Francisco, and Silicon Valley). In 2024, the "Bay Area Planning 2050+" initiative was proposed, focusing on four key areas: economy, environment, housing, and transportation. Economically, the plan explores universal basic income to address economic inequality; environmentally, it aims to transform existing buildings into green and energy-efficient ones and protect and improve land, air, and water resources in Bay Area communities; in housing, it focuses on affordable rental housing and converting old shopping centers and office parks to meet housing needs for families with varying income levels; and in transportation, strategies include highway congestion pricing, parking fees, traffic system transformation, and optimization of transportation networks to alleviate traffic pressure.

In addition, in China, the integration of cities such as Guangzhou-Foshan and Xi'an-Xianyang provides valuable insights for collaborative cross-regional construction, serving as national examples of full-region urban integration. The Guangzhou-Foshan integration is based on cultural similarities, economic development needs, and the development strategy of the Guangdong-Hong Kong-Macau Greater Bay Area. Foshan, guided by a market and private sector-oriented economy, drives the development of its districts, with the secondary industry accounting for over 60% of GDP. In contrast, Guangzhou's economy is government-led, driven by large state-owned enterprises, with foreign investment driving progress. The tertiary industry contributes over 60% of its GDP.

The Guangzhou-Foshan integration has gone through three stages: infrastructure interconnection, bidirectional smooth flow of production factors, and co-city living. The policy guidance spans three phases: before 2008, the concept of Guangzhou-Foshan integration was

driven by market forces and entered the government's decision-making scope; by the end of 2008, the "Pearl River Delta Reform and Development Planning Outline" elevated the integration of Guangzhou and Foshan to a strategic level. This was followed by infrastructure construction, the improvement of institutional mechanisms, the development of an industrial coordination system, environmental protection policies, and the establishment of a "1+4" high-quality development integration pilot zone. By the end of 2021, the "Guangzhou-Foshan Full-Region Integration 14th Five-Year Development Plan" further advanced the integration. As a result, Guangzhou and Foshan have become a well-structured "core-edge" urban spatial form, with technological and industrial transfer from Guangzhou to Foshan, and complementary industry chain layouts such as the automobile industry in Guangzhou and auto parts in Foshan. Overall, the realization of Guangzhou-Foshan integration is attributed to the close geographical proximity, economic links, and government planning. Key factors include: smooth transportation, with the Guangzhou-Foshan subway meeting the close interconnection of daily life and work; economic integration, with the complementarity between Foshan's manufacturing and high-tech industries and Guangzhou's economic development promoting resource optimization and efficient utilization; and strategic alignment, with the integration occurring under major strategies like the Belt and Road Initiative and the Guangdong-Hong Kong-Macau Greater Bay Area, continuously optimizing regional economic layouts and driving high-quality development.

Considering the geographic distance in the context of Hangzhou's metropolitan area development, Hangzhou's city center is 130 kilometers from Shaoxing's city center, with stylistic differences; it is 80 kilometers from Jiaxing's city center (with Jiaxing being 98.31 kilometers from Shanghai's city center); and over 80 kilometers from Huzhou's city center, all of which significantly exceed the 20 km and 25 km distances between Guangzhou and Foshan. This creates a cross-regional barrier in terms of geography. At the same time, there is potential for complementary industrial collaboration between the regions. Economically, cross-regional co-construction can alleviate Hangzhou's high-end manufacturing "all tower with a thin base" issue and generate benefits from scale development. Overall, based on Hangzhou's development characteristics and goals, the focus should be on innovation and transformation, utilizing the e-commerce sector's leadership role to reduce geographical barriers, and under the umbrella of regional collaboration in the Yangtze River Delta, creating a metropolitan area with Hangzhou's unique features.

### *3.2Integration and Isomorphism of Digital and Real Industries*

The Tianlifang·Linping Future Farm is located at the intersection of the main urban area of Hangzhou's eastern region. In 2021, Linping District focused on the fragmentation of farmland and the potential of hollow villages. The district implemented a unified relocation plan for villages such as Gejiache Village, Fangqiao Village, Chaoyang Village, Yonghe Village, and Yongxi Village in the Qiaosi Subdistrict. The area underwent comprehensive land management, including the revitalization of farmland, restoration of 440 acres of arable land, reclamation of 835 acres of construction land, and the expansion of 2,300 acres of industrial space. This ultimately resulted in nearly 5,000 acres of Future Farm. The development project emphasizes the integration of permanent basic farmland, high-standard farmland, and grain functional areas, creating continuous land by linking roads, waterways, and fields. The project also includes the construction of scenic corridors, rural visitor lounges, and walking greenways. This initiative consolidates the red line for food security, forms a tourist experience ecosystem

with fields of canola flowers and lush tea gardens, and introduces supplementary educational research bases, cultural tourism product design, and live streaming. This not only revitalizes land resources but also provides opportunities for reform iteration. Additionally, Linping District has become a hub for the fashion and digital industries, with the construction of the Yishang Town, which in 2023 hosted over 2,700 companies and 1,400 businesses in the Computing Power Town, achieving annual revenues of 32.99 billion yuan and 3.87 billion yuan, respectively.

### *3.3 Science and Technology Innovation Cluster with Silicon Alley Renewal*

The concept of Silicon Alley originated in New York as an embedded old-city renewal model. Initially centered around the Iron Building at the intersection of Fifth Avenue and Broadway in Manhattan's downtown, the model later expanded to the DUMBO area in Brooklyn, and extended into Manhattan's middle and lower parts. Silicon Alley has grown into a region without clear boundaries, aggregating a large number of new media, network technology, and fintech companies, and has become a hub for emerging trends and applications. It represents a common model for utilizing existing space in urban centers to develop tech enterprises.

The development approach of Silicon Alley focuses on several key aspects. First, it prioritizes human-centered development, shifting the logic from "industry-people-city" to "city-people-industry." It aims to optimize the living and working experiences of intellectuals, addressing both basic survival needs such as affordable housing and subsidies and the more nuanced "city preference" of talent, such as cool tech experiences in new retail and high-end medical services malls, similar to Amazon Go in Seattle or the SuXing Living Store in Chengdu. Additionally, the model takes into account the long-term developmental needs of talent and cities, creating pathways that attract talent and integrate city resources into a tech ecosystem. It also provides a variety of scenario combinations and densities that support the nurturing of new technologies and industries, leading to the creation of new applications and products.

Silicon Alley has successfully utilized existing infrastructure to create four distinct types of spaces: tech research and development spaces primarily for educational and R&D institutions; manufacturing test spaces focusing on the revival of the manufacturing sector; community micro-manufacturing spaces empowered by technology; and residential spaces focused on providing comfortable and livable service environments. Silicon Alley's success stems from three factors: first, mature internet technologies that offer solutions promoting business, fashion, and public service development; second, the transformation of old office buildings and factories to release space; and third, leveraging the cultural charm of old cities to offer diverse services and create high-quality urban communities.

For Hangzhou, the Silicon Alley model offers valuable insights. Like New York, Hangzhou has a high living index and an advanced information index, renowned for its public welfare culture, media, entertainment, leisure, and fashion, with a rich cultural foundation. However, Hangzhou also faces similar challenges: the contradiction between expanding urban industries and limited space, the integration of new technologies with old infrastructure, and balancing high-speed quality improvement with economic slowdown. The Silicon Alley model provides a new reference for revitalizing urban vitality, offering a pathway to harmonize these challenges and foster innovation in Hangzhou's future urban development.

## 4 Pathways for E-commerce Integration and Participation

New technologies, new models, and new business formats empower industrial upgrades. Hangzhou has a solid foundation for industrial upgrading, urban-rural integration, and collaborative industrial cluster development. Under the development goals of becoming a "New E-commerce Capital", Hangzhou has introduced the "Several Opinions on Promoting High-Quality Development of New E-commerce in Hangzhou". As of 2023, Hangzhou hosted 128 e-commerce platforms and more than 12.5 million platform outlets, fostering 39 "unicorn" companies and 317 "potential unicorn" companies. Additionally, the number of cross-border sellers reached 63,463, forming 16 cross-border e-commerce industrial belts, laying a solid foundation for integrating new e-commerce with the real economy, promoting the flow of market elements, and stimulating consumer vitality.

### *4.1 Transform technological paradigms and extend industrial chains*

E-commerce breaks the boundaries of time and space, connecting high-quality products, leading enterprises, and consumer market demands within the city, driving synchronous growth across the industrial chain and horizontal business expansion. Firstly, e-commerce expands upstream into production and manufacturing, where market demand is fed back to guide product development, manufacturing, storage, and sales, promoting the development of proprietary brands and products, and enhancing supply chain integration. Secondly, it extends downstream by improving logistics and after-sales services, strengthening the formation of self-built logistics networks, such as installation and maintenance services. Additionally, e-commerce encourages the expansion of horizontal business areas, integrating industries across sectors and channels, such as financial services, digital content, and cloud computing. This leads to the interaction of online and offline resources, achieving bi-directional empowerment of "platform + industry" and connecting urban-rural consumption logistics. It leverages the advantages of physical economies in product channels, logistics distribution, business management, and brand building to form a "convenience store + express delivery + supply chain + community services" model, promoting the free flow of elements and deepening market penetration. Lastly, China's cross-border e-commerce has entered a new stage of deepening long-term development, with e-commerce empowering small and medium-sized enterprises, as well as marginalized communities, in both local and global market participation.

### *4.2 Building symbiotic networks and enhancing value chains*

The process of enhancing the value chain involves optimizing each step from product procurement to customer after-sales services, aiming to increase efficiency, reduce costs, and improve the customer experience. Overall, e-commerce optimizes supply chain management by dynamically managing inventory, pricing, and supply times, connecting supply and demand networks. It also improves customer experience by enhancing personalized recommendations and rapid search, introducing 24/7 customer service and intelligent robots to improve pre-sale and after-sale service quality. Moreover, data-driven marketing and sales are promoted to achieve precise marketing and dynamic pricing, increasing conversion rates and customer retention, thus maximizing profits. E-commerce businesses also activate data innovation, integrating full-cycle automation technologies to improve operational efficiency and using blockchain technology to enhance supply chain transparency and traceability, thus increasing customer trust. In summary, e-commerce enterprises can enhance efficiency at each stage of

their value chain, create more customer value, and gain a competitive advantage in the fierce market competition.

### *4.3 Evolve organizational dynamics and improve benefit chains*

The operation of e-commerce businesses enhances the reasonable distribution and optimization of various stakeholders' interests. New e-commerce optimizes supplier relationships, establishes fair pricing mechanisms, and ensures long-term cooperation and win-win outcomes. It strengthens consumer rights by ensuring returns and after-sales services, expanding the supply of personalized services and experiences. It also fosters cooperation between platforms and merchants, promoting shared benefits and incentivizing product supply, which is beneficial for supporting and training small and medium-sized merchants. Furthermore, new e-commerce platforms improve transparency and refine platform rules, ensuring policy optimization and strengthening the supervision of unfair competition within the platform. Overall, e-commerce enterprises can better coordinate the interests of all parties, creating a stable and efficient benefit chain system that ensures long-term competitive advantage in the market.

### *4.4 Create multi-cross collaborative chains and build industrial ecosystems*

Focusing on the cultivation of advanced manufacturing clusters in Hangzhou, the city develops its industrial layout according to five key urban pillar industries: culture, tourism and leisure, financial services, life and health, and high-end equipment manufacturing. Additionally, three leading industries—artificial intelligence, cloud computing and big data, and information software—are strategically fostered, alongside the development of "nine iconic industrial chains" in visual intelligence (digital security), biomedicine and health, smart computing, integrated circuits, network communication, energy-saving and new energy vehicles, smart homes, smart equipment, and modern textiles and fashion. By implementing the "one file, one policy" and "one industry, one policy" approach, Hangzhou enhances the overall industrial level and establishes the "Zhejiang Manufacturing" and "Hangzhou Manufacturing" brands. New e-commerce, through platform technology development and data-driven ecosystems, provides integrated solutions that connect third-party merchants, suppliers, logistics service providers, and payment platforms. This facilitates industrial chain integration, value addition, and clustering, offering API interfaces and developer toolkits to enrich platform functions and drive the construction of an industrial ecosystem.

## 5. Policy Recommendations

### *5.1 Core Industries Driving Distinctive Industries, Urban Radiation to Rural Areas*

Strengthen the integration of e-commerce with manufacturing and consider urban-rural collaboration alongside industrial cluster planning. Continue promoting the "attract large and strengthen" initiative by guiding advantageous enterprises to participate in provincial layouts. In the process of industrial advancement, identify points of disconnection, weaknesses, and low-value-added sectors, and increase the attraction of key projects.

Firstly, clarify the geographical location, natural resources, dominant industries, supporting infrastructure, and development obstacles within Hangzhou's sectors, ensuring the implementation of development roles and mentorship.

Secondly, leverage the advantages of e-commerce to effectively allocate resources, linking urban and rural resources, especially by awakening the "sleeping assets" in rural areas and promoting the circulation of idle elements into the city. Urban industrial development will lead to entrepreneurial and employment opportunities in rural areas, blurring the urban-rural boundary, reducing external transaction costs, and improving the efficiency of spatial operations.

Thirdly, for industrial clusters, focus on the restructuring and stratification of homogeneous industries, further enhancing market segmentation and avoiding harmful competition.

### *5.2 Coordinate urban resources and link domestic trade with foreign trade*

With the aim of enhancing Hangzhou's competitiveness, becoming a domestic and international "dual circulation" hub city, and developing as a regional center city, strengthen the guidance of new e-commerce data and integrate the upstream and downstream industries, resources, and flows of production and circulation, coordinating with surrounding cities for joint development.

Within the province, strengthen integration with Hangzhou's planning by utilizing the internet, integrated circuits, and petrochemical manufacturing industries to create a strong core for urban cluster development. Expand the Hangzhou-Shaoxing integrated urban area to demonstrate the model effect and deepen the construction of the Hangzhou-Jiaxing-Huzhou-Shaoxing metropolitan area. Simultaneously link Ningbo, facilitating the "Hangzhou-Ningbo" dual-city development and advancing "Hangzhou-Shaoxing-Ningbo Integration".

Utilize the advantages of cross-border e-commerce and strengthen connections with Western and Southern China regions, inviting service providers to join cross-border e-commerce networks. Plan and layout industrial cooperation and resource exchanges.

Improve the circulation system within the port area by constructing an intelligent, collaborative digital platform, promoting the development of cross-border cloud negotiations, digital exhibitions, and other high-benefit, sustainable new business models in international trade. Actively promote the coordination of domestic and foreign trade.

### *5.3 Project Planning and Talent Flow, Synchronizing Life and Production*

Talent is an indispensable guarantee for development. In a major development environment, rural populations consist mainly of two categories: those migrating to cities and those returning to rural areas. On one hand, efforts should be made to settle the urban immigrants, freeing up space for large-scale agricultural operations, and communicating the need for industrial cluster construction. Expanding the scope of industrial resource allocation will ensure the optimal use of land. On the other hand, coordinate rural assets based on suitability, utilizing surplus facilities in rural areas to calculate service radii, and convert them into multifunctional spaces for cultural, medical, and elderly care services. Establish targeted production, living, and cultural tourism industries and supply chains, encouraging "new farmers" to bring projects, plans, and innovations. This will follow the "project + location + talent" model to form an integrated development and supporting construction, promoting leisure agriculture, rural guesthouses, agricultural product processing, and rural e-commerce. This will enhance the return flow of urban technology, elements, and resources, invigorating rural areas.

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# LECTURERS TEACHING STYLES AND STUDENTS' ACADEMIC ENGAGEMENT AMONG UNIVERSITY STUDENTS: A FACTOR ANALYSIS APPROACH

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***Abstract:*** *This study aims to investigate the teaching styles of lecturers and students' academic engagement at Universiti Malaysia Sabah (UMS). The objective of this study is to identify the factors between lecturers' teaching styles and students' academic engagement. A questionnaire used for this study, and the respondents are Universiti Malaysia Sabah undergraduate students. The methodology of this study is factor analysis. The study results indicate four factors produced, namely lecturer teaching method, commitment to assignments, active student involvement and*

*student motivation. In conclusion, the study results provide insights into the factors influencing academic performance and the learning experiences of the respondents.*

***Keywords:*** *Lecturers Teaching Styles, Students' Academic Engagement, Factor Analysis*

## Introduction

Zhang (2020) states that a lecturer's teaching style refers to the way lecturers organize and handle interactions between themselves and students in the learning process. Recent studies highlight the issue that the higher education system in Pakistan lacks student involvement in an important part. Most lecturers give lectures on a one-way basis, following the characteristics of the traditional annual system in the semester system (Mahmood, 2021). This is considered a major obstacle to achieve a quality, creative, and proactive classroom environment. Therefore, in this study, there is a need to examine the factors that influence high student academic engagement in relation to their academic success, while the lecturer's teaching style can also influence student motivation and behaviour in teaching and learning. The objective of this study is to identify factors that influence lecturers' teaching styles and students' academic engagement among Universiti Malaysia Sabah students.

## Literature Review

In a study conducted in Taiwan, Tang *et al.* (2022) found that the expert and delegator model teaching styles could significantly predict student learning engagement. Student engagement in academics is determined by teaching techniques and the quality of lecturers. In addition, Dr. Ronald F. Ferguson from Harvard University developed the Tripod research platform in 2001. Tripod offers a framework designed to study teaching techniques and how they impact student success (Phillips *et al.*, 2021).

Lecturers portrayed themselves as committed practitioners with a clear sense of responsibility and ownership, by positioning students as emerging social scientists and delivering messages that nurture their autonomous motivation (Montenegro, 2022).

## Methodology

The study used questionnaires to collect data from participants. The questionnaire contains two parts. The first section collects demographic data. The second section contains question items related to the lecturer's teaching style and the student's academic engagement. This questionnaire was given to Universiti Malaysia Sabah students. Students are asked to provide their assessment based on a Likert scale or use multiple-choice items. The rating scale used ranges from 1 to 5, where 1 represents strongly disagree and 5 represents strongly agree. Bujang *et al.* (2024) recommend a minimum sample size of 30 for reliability testing of questionnaires.

As noted by Schrepp (2020), Cronbach's alpha is commonly employed to evaluate the internal consistency and overall reliability of multi-item scale. A Cronbach's alpha higher than 0.7 is commonly viewed as ideal for evaluating an instrument (Izah *et al.*, 2024). Amirrudin *et al.* (2021) stated if the Cronbach's alpha value is more than 0.9, the reliability level is at the excellent level. Kaliyadan and Kulkarni (2019) explain that descriptive statistics summarize the characteristics of a sample without drawing inferences grounded in probability theory.

Computer technology has enabled the use of factor analysis in fields such as social sciences, medicine, economics, and geography (Yong & Pearce, 2013). According to Sürücü *et al.* (2022), exploratory factor analysis is designed to simplify data by revealing interpretable patterns and relationships among observed variables in a measurement tool. This study used exploratory factor analysis to research the dataset by identifying the intricate relationships between items and grouping items that are part of integrated concepts (Shrestha, 2021). Factor analysis is considered unsuitable for data interpretation when the Kaiser-Meyer-Olkin (KMO) value is below 0.5 (Tabachnick & Fidell, 2019).

**Table 1 Kaiser-Meyer-Olken Value Interpretation Criteria**

| KMO value | Adequacy of the correlations |
|---|---|
| 0.9 to 1 | Very Good |
| 0.8 to < 0.9 | Good |
| 0.7 to < 0.8 | Medium |
| 0.6 to < 0.7 | Reasonable |
| 0.5 to < 0.6 | Acceptable |
| < 0.5 | Unacceptable |

(Reddy & Kulshrestha, 2019)

A factor was retained for inclusion if it demonstrated a loading of 0.4 or higher, consistent with the guidelines proposed by Yin & Shen (2024). In the total variance explained table, components with eigenvalues exceeding one are considered factors (Maskey *et al*., 2018).

## Results and Discussion

### *Pilot Study*

Pilot study was conducted by distributing questionnaires to students to find out the stability of the reliability test value obtained to determine whether the items used were at a good level or not. The reliability test in this study used 43 Likert scale items that were answered by 31 Universiti Malaysia Sabah students. The number of respondents for this study is 31, which complies with Bujang *et al.* (2024), who recommend a minimum sample size of 30 for reliability testing of questionnaires. The results of the pilot study are shown in Table 2, where the overall value of Cronbach's alpha higher than 0.6 indicates the high internal consistency in the questionnaire's set of data. Based on Amirrudin *et al.* (2021), if the Cronbach's alpha value is more than 0.9, the reliability level is at the excellent level. The Cronbach alpha value of 0.944 in this study indicates that the items used in the questionnaire are at an excellent level. Therefore, data gained from the pilot study indicates that it is reliable to be tested and the set question is to be retained in continuing this study.

**Table 2: Reliability Test**

| Number of items | Number of respondents | Cronbach's alpha |
|---|---|---|
| 43 | 31 | 0.944 |

### *Descriptive Statistics*

A total of 388 respondents involved in this study, 321 women and 67 men respectively. Therefore, 82.7% of respondents came from female students while 17.3% came from male students. Figure 1 shows the pie chart consists of the frequencies and percentages of gender.

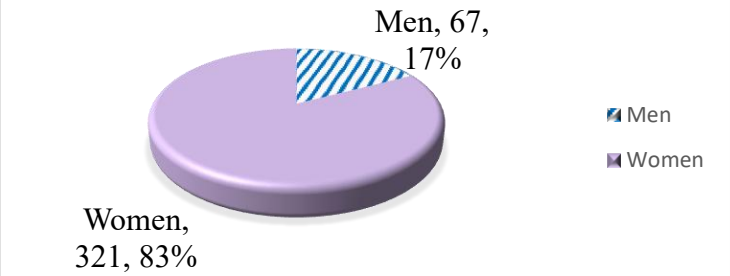



**Figure 1: Pie Chart: Gender**

Figure 2 shows the bar chart consists of the frequencies of study type. There were 105 students preferred study in group while 283 students preferred study alone.

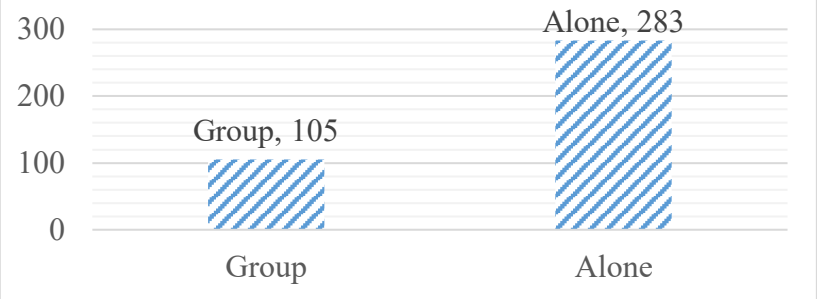



**Figure 2: Bar Chart: Study Type**

### *Explanatory Factor Analysis*

Table 3 shows the results of the Kaiser-Meyer-Olkin (KMO) and the Bartlett's Test of Sphericity. The Kaiser-Meyer-Olkin test yields a value of 0.937. Reddy & Kulshrestha (2019) suggested the result is very good. Tabachnick & Fidell (2019) considered factor analysis is suitable for data interpretation when the Kaiser-Meyer-Olkin value is more than 0.5. The Bartlett Spericity Test, with (sig.) of less than 0.001 where the value is less than the alpha value of 0.05, gives a strong indication that the correlation matrix in the data is not an identity matrix. These results confirming that factor analysis is a suitable technique for analyzing the collected data. In conclusion, this data is suitable for factor analysis.

**Table 3: Kaiser-Meyer-Olkin and the Bartlett's Tests**

| Test | Value |
|---|---|
| Kaiser-Meyer-Olkin | 0.937 |
| Bartlett's Test of Sphericity | <0.001 |

Based on Table 4, there are four factors extracted, which are labeled as factors 1, 2, 3 and 4. Four factors are extracted meaning that they have an eigenvalue greater than 1.0 (Maskey *et al.,* 2018). The eigenvalue of the first factor is 17.159 and explains the 39.904% variance in the original data. The eigen value for the second factor is 3.028 and explains the 7.042% variance in the original data. The third factor, with an eigenvalue of 1,797, explains the 4,180% variance in the original data. The eigenvalue of the fourth factor is 1.173 and explains the 2.727% variance in the original data. Based on the cumulative percentage value, these four factors explain 53.853% of the lecturer's teaching style and students' academic engagement, while 46.147% is explained by the other factors.

**Table 4: Total Variance Explained**

| | Extraction Sum of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| Component | Total | Percentage of Variance | Cumulative Percentage | Total | Percentage of Variance | Cumulative Percentage |
| 1 | 17.159 | 39.904 | 39.904 | 12.935 | 30.081 | 30.081 |
| 2 | 3.028 | 7.042 | 46.946 | 4.875 | 11.336 | 41.418 |
| 3 | 1.797 | 4.180 | 51.126 | 3.719 | 8.648 | 50.066 |
| 4 | 1.173 | 2.727 | 53.853 | 1.532 | 3.562 | 53.629 |

Table 5 shows the rotating component matrix results. A factor with at least a value of 0.4 is selected to be included in a factor as suggested by Yin & Shen (2024). A total of four factors were calculated namely Factor 1, Factor 2, Factor 3 and Factor 4. Factor 1 consists of 25 items namely items B21, B11, B5, B13, B10, B18, B1, B22, B6, B23, B20, B19, B24, B2, B12, B8, B25, B3, B7, B4, B14, B15, B9, B17 and B16. Factor 2 consists of B35, B31, B30, B37, B36, B27, B43 and B39 which are eight items. Factor 3 consists of seven items, namely B33, B34, B38, B28, B29, B26 and B42, while Factor 4 consists of B32, B41 and B40.

**Table 5: Rotating Component Matrix**

| | Factor | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| B21 | **.786** | | | |
| B11 | **.767** | | | |
| B5 | **.744** | | | |
| B13 | **.739** | | | |
| B10 | **.733** | | | |
| B18 | **.728** | | | |
| B1 | **.725** | | | |
| B22 | **.722** | | | |
| B6 | **.722** | | | |
| B23 | **.713** | | | |
| B20 | **.709** | | | |
| B19 | **.704** | .435 | | |
| B24 | **.697** | | | |

| | | | | |
|---|---|---|---|---|
| B2 | **.691** | | | |
| B12 | **.690** | | | |
| B8 | **.686** | | | |
| B25 | **.683** | | | |
| B3 | **.680** | | | |
| B7 | **.672** | | | |
| B4 | **.660** | | | |
| B14 | **.649** | | | |
| B15 | **.595** | | | |
| B9 | **.591** | | | |
| B17 | **.575** | | | |
| B16 | **.531** | | | |
| B35 | | **.714** | | |
| B31 | | **.699** | | |
| B30 | | **.679** | | |
| B37 | | **.623** | | |
| B36 | | **.577** | .435 | |
| B27 | .424 | **.547** | | |
| B43 | | **.521** | | |
| B39 | | **.457** | | |
| B33 | | | **.728** | |
| B34 | | .429 | **.635** | |
| B38 | | | **.592** | |
| B28 | | | **.581** | |
| B29 | | | **.519** | |
| B26 | | | **.494** | |
| B42 | | | **.470** | |
| B32 | | | | **.685** |
| B41 | | | | **.645** |
| B40 | | | | **.445** |

Table 6 shows the percentage variances and name of the factors. Lecturer's teaching method is the name of Factor 1. Students' commitment to assignments is Factor 2. Students' active involvement is Factor 3 and Student motivation is Factor 4. The percentage variances for the Factor 1, Factor 2, Factor 3 and Factor 4 are 39.904%, 7.042%, 4.18% and 2.727% respectively.

**Table 6: Percentage Variances and Name of the Factors**

| Factor | Percentage Variance | Name |
|---|---|---|
| 1 | 39.904 | Lecturer's teaching method |
| 2 | 7.042 | Students' commitment to assignments |
| 3 | 4.180 | Students' active involvement |
| 4 | 2.727 | Student motivation |

## Conclusion

The objective of this study was to examine the factors influencing the teaching style of lecturers and the academic involvement of students at Universiti Malaysia Sabah (UMS). The objective of this study had been achieved by the use of factor analysis. The results of Kaiser-Meyer-Olkin (KMO) measurements for sample adequacy and Bartlet's Sphericity test showed the data were suitable for factor analysis. The resulting four factors are extracted, in which the components in the described overall variance table that have an eigenvalue greater than one are considered as factors. The name of four factors produced as Factor 1, Lecturer Teaching Methods, Factor 2, Students' commitment to assignments, Factor 3, Students' Active Involvement and Factor 4, Student Motivation were found to influence the lecturer's teaching style and the active involvement of students in Universiti Malaysia Sabah.

## Future Research

In depth study the positive and negative effects of the factors that influence the lecturers' teaching style with the academic engagement of students. Alternative methods may also be considered such as interviews and observations. Interviews allow researchers to gain more in-depth information through direct interaction with respondents, while observation allows researchers to observe behaviors or situations without relying entirely on written responses.

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# MANAGEMENT-ENACTED SAFETY CULTURE IN A PLANTATION: A QUALITATIVE PILOT STUDY

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***Abstract:*** *Safety culture is widely recognised as a critical determinant of occupational safety performance, particularly in high-risk agricultural settings such as oil palm plantations. This paper reports findings from an exploratory pilot study that examines how plantation management in Malaysia enacts safety through leadership behaviour, OSH management systems, routine communication practices, and responses to operational constraints. Guided by Cooper's tripartite model, Hudson's safety culture maturity ladder, Reason's Swiss Cheese Model, and Zohar's safety climate theory, the study adopts a qualitative case study approach. Semi-structured interviews were conducted with three key personnel, the Plantation Manager, OSH Manager, and Assistant OSH Manager, at an award-winning plantation in Sabah, supported by field observations of daily morning roll calls. Data were analysed using reflexive thematic analysis. Four interrelated themes were identified: (1) visible leadership commitment to safety, (2) structured OSH management systems and layered defences, (3) routine safety communication with limited worker voice, and (4) operational constraints that create latent conditions. The findings describe a management-enacted safety approach characterised by strong safety signalling and systematic controls, alongside vulnerabilities related to OSH staffing capacity, administrative workload, and constrained training resources. The study provides practical insights for strengthening safety governance in plantation contexts and informs the design of a larger multi-site investigation that will incorporate worker perspectives and objective safety indicators.*

***Keywords****: Safety culture; Management; Occupational safety and health; Oil palm plantations; Malaysia*

## Introduction

Safety culture is widely acknowledged as fundamental to occupational safety performance, particularly in industries characterised by persistent physical and environmental hazards (Bisbey et al. 2021). Oil palm plantations represent such high-risk settings, where workers perform demanding manual tasks, handle agrochemicals, and operate machinery across uneven terrain and variable weather conditions. These conditions heighten exposure to injury and illness and place considerable importance on how management shapes safe working environments.

Although safety culture has been extensively examined in sectors such as construction, mining, and oil and gas, empirical studies in plantation contexts remain limited, especially in Malaysia

(Rahim, H. et. al, 2023). Plantation operations present distinctive challenges: geographically dispersed worksites, labour-intensive processes, and a workforce comprising both local and migrant workers. These features complicate the implementation and sustainability of conventional OSH controls, yet remain under-examined in safety culture scholarship. Existing research often focuses on compliance outcomes or worker behaviour, providing limited insight into how safety culture is enacted by plantation management in daily practice.

To address this gap, the present pilot study examines how plantation management conceptualises, prioritises, and enacts safety practices in an award-winning oil palm plantation in Sabah. The study focuses specifically on management enactment, leadership behaviour, organisational systems, and routine communication, rather than attempting to measure workforce-wide safety perceptions. This approach enables closer examination of how safety priorities are signalled and operationalised under real-world constraints.

Guldenmund (2000) highlights ongoing conceptual ambiguity in safety culture research, reinforcing the need for context-specific interpretations. The study is guided by four complementary theoretical frameworks. Cooper's tripartite model conceptualises safety culture as the interaction of psychological, behavioural, and situational elements. Hudson's safety culture maturity ladder provides a developmental lens, distinguishing reactive, calculative, and proactive approaches to safety management. Reason's Swiss Cheese Model explains how latent organisational weaknesses may align with active failures to produce accidents, while Zohar's safety climate theory emphasises the role of managerial behaviour and communication in shaping perceptions of safety priority. Together, these frameworks provide a robust lens for examining safety culture as an enacted and dynamic organisational process.

Recent empirical literature underscores the significance of leadership, systems, and communication in shaping safety outcomes across high-risk industries. Studies consistently show that engaged leadership and consistent safety messaging strengthen safety climate, while constraints such as inadequate training and understaffing continue to create vulnerabilities, even in certified operations. However, little is known about how plantation management navigates these realities in practice. This study addresses that gap through an in-depth qualitative examination of management-enacted safety culture in a plantation context.

This study contributes to safety culture research in three ways. First, it conceptualises safety culture as a management-enacted practice rather than only a measurable outcome. Second, it extends established safety culture frameworks into an under-researched agricultural setting, namely oil palm plantations. Third, as a qualitative pilot study conducted in an award-winning plantation, it provides practical insights and informs the design of a larger multi-site study that will incorporate worker perspectives and objective safety indicators.

## Literature Review

### *Safety Culture Frameworks*

Safety culture has been conceptualised through multiple complementary models. Cooper's (2000) tripartite framework defines safety culture as the interaction between psychological factors (attitudes and perceptions), behavioural factors (observable safety practices), and situational factors (policies, systems, and organisational context). This framework highlights

the need to examine not only formal safety systems but also how safety is enacted through daily managerial and worker behaviour.

Hudson's (2007) safety culture maturity model provides a developmental perspective, distinguishing between pathological, reactive, calculative, proactive, and generative cultures. Organisations operating at calculative or proactive stages typically rely on formal systems, audits, and performance indicators, while more mature cultures emphasise learning, anticipation, and shared ownership of safety. Reason's (1997) Swiss Cheese Model complements this view by illustrating how accidents emerge from the alignment of latent organisational weaknesses across multiple defence layers, rather than from isolated individual errors.

Zohar's (1980) safety climate theory focuses on workers shared perceptions of safety priority, shaped primarily by supervisors' daily actions and communications. Empirical research consistently demonstrates that safety climate mediates the relationship between leadership behaviour and safety outcomes, making managerial enactment a critical mechanism in high-risk settings.

***Management Enactment and the Development of Safety Culture***

The literature consistently emphasises that management enactment, reflected through leadership style, commitment to safety, communication practices, resource allocation, and the governance of safety processes, plays a decisive role in shaping organisational safety culture. Rather than existing as a fixed attribute, safety culture emerges from how managers translate safety policies into everyday practices and expectations.

A growing body of research highlights the behavioural influence of leadership styles on safety outcomes. Transformational leadership is frequently identified as the most influential in cultivating strong safety cultures. Leaders who demonstrate idealised influence and inspirational motivation foster positive safety climates and increase employee engagement in safety initiatives (Ta et al., 2022). Evidence from the manufacturing sector shows that transformational safety leadership enhances safety climate, which subsequently mediates employee participation in safe work behaviours (Drăghici et al., 2022). Similar patterns are observed in the education sector, where leaders who articulate a clear safety vision, promote capacity development, and lead with safety-oriented values strengthen institutional safety practices (Mat Lazim et al., 2022).

In contrast, transactional leadership tends to emphasise monitoring and enforcement. Management-by-exception active (MBEA), whereby leaders closely monitor deviations and intervene when errors occur, can be effective in high-risk environments such as offshore oil and gas operations, particularly where accident risk is perceived to be high (Ta et al., 2022). However, passive or laissez-faire leadership, characterised by inaction and weak oversight, is repeatedly associated with poor safety climates and adverse safety outcomes (Ta et al., 2022). These findings collectively demonstrate that leadership style is a central mechanism through which management shapes employee perceptions and behaviours relating to safety.

Beyond leadership style, management commitment is repeatedly identified as a fundamental driver of safety culture. In the palm oil milling industry, recurrent incidents have been linked to the "3C Principle": Condition, Competency, and Commitment, where weak leadership

commitment acts as a primary barrier to sustainable safety improvement (Hong, 2022). The author further proposes a four-level safety culture progression model: Right, Relationships, Replication, and Respect, illustrating how organisations evolve from authority-driven compliance toward cultures where process safety becomes embedded and reflexive. Complementary evidence shows that management's visible commitment influences safety compliance and participation; when commitment is lacking, workers may rationally prioritise production pressures over safe performance (Zara et al., 2023). These insights reinforce the notion that management commitment operates as both a symbolic and practical signal of organisational priorities.

A further dimension of enactment relates to communication and control of information. Supportive communication climates, characterised by openness, feedback, and dialogue, are associated with stronger worker commitment to safety (Zara et al., 2023). Oil palm plantations represent high-risk environments with elevated exposure to heat, chemicals, and manual handling hazards, as documented in systematic reviews of occupational health and safety (OHS) conditions in the palm oil industry (Myzabella et al., 2019). In small and medium-sized enterprises (SMEs), open communication practices and conflict-resolution mechanisms have been shown to sustain both productivity and safety (Anggak et al., 2025). However, the literature also reveals contrasting practices in which management restricts access to hazard information. Studies of palm oil plantations report instances where workers are not informed about the toxic chemicals they handle, limiting their ability to assess risks (Rajamanickam & Kinasih, 2024). Moreover, safety audits may be strategically manipulated; organisations may rehearse audit scenarios, selectively present interviewees, and temporarily enforce PPE usage to portray compliance, thereby masking everyday unsafe realities (Rajamanickam & Kinasih, 2024). These practices illustrate how management can shape safety culture not only through support and transparency, but also through mechanisms of control and concealment.

Management enactment is also evident in human resource practices and resource distribution, which operationalise safety priorities. Training is widely recognised as one of the strongest predictors of positive safety culture across industrial sectors (Rahim et al., 2023). Effective safety leadership in educational institutions includes ensuring systematic transfer of safety knowledge to both staff and students (Mat Lazim et al., 2022). In SMEs, continued technical and safety training has been linked to improved worker confidence and reductions in workplace accidents (Anggak et al., 2025). Resource provision forms a parallel strand of enactment; access to appropriate tools, infrastructure, and protective equipment enables safe practices and

enhances worker efficacy. Nevertheless, research reveals cases where management fails to provide adequate protective equipment, such as appropriate respirators, forcing workers to rely on uncomfortable or ineffective alternatives that may endanger health and contribute to fatigue (Rajamanickam & Kinasih, 2024). These findings highlight the material dimension of safety culture, where managerial decisions about investment and provisioning directly shape risk exposure.

Finally, the literature positions safety culture within a broader financial and strategic context. Although some organisations perceive safety as a financial burden, longitudinal evidence demonstrates that sustained investment in safety policies, training, and safety teams improves safety performance and organisational financial outcomes, including earnings before interest, tax, depreciation and amortisation (EBITDA) (Bautista-Bernal et al., 2024). From a resource-based view (RBV) perspective, internal capabilities such as skilled leadership, competent

workers, and well-designed work environments, constitute strategic resources that can generate competitive advantage and long-term sustainability (Anggak et al., 2025). Thus, management enactment of safety culture extends beyond compliance or risk avoidance, becoming a strategic organisational function with implications for productivity, legitimacy, and sustainability.

## Methodology

This study employed a qualitative exploratory case study design to examine safety practices and management-enacted safety culture within a certified, award-winning oil palm plantation in Sabah, Malaysia. The site was purposively selected due to its exemplary safety record, having twice received a national Occupational Safety and Health (OSH) Plantation Award, and its relevance as a model plantation for examining established safety practices. A single-case design was appropriate as it allowed in-depth exploration of processes and meanings surrounding safety culture within a real-world organisational context.

Semi-structured interviews were conducted with three key informants who held primary responsibility for safety governance and operational oversight: the Plantation Manager, the Occupational Safety and Health (OSH) Manager, and the Assistant OSH Manager. All informants had substantial experience in plantation operations and OSH management (approximately 6–20 years). Interviews explored leadership roles and safety priorities, implementation of OSH management systems, safety communication routines, worker engagement mechanisms, and operational constraints influencing day-to-day safety practices. Each interview lasted between 60 and 90 minutes.

To complement interview accounts and strengthen contextual understanding, non-participant field observations were undertaken during daily morning “roll call” meetings, and site visits were conducted at the chemical storage and mixing areas, as well as at the workshop where vehicles and tractors are serviced. Observations focused on the content and delivery of safety briefings, personal protective equipment (PPE) checks, safety signage, and general workplace conditions, without evaluating individual worker performance. Observational notes provided opportunities to compare reported practices with their enactment in routine operations.

Interview transcripts and observational field notes were analysed using reflexive thematic analysis. The analytic process involved iterative familiarisation with the data, generation of initial codes, and progressive development and refinement of themes through constant comparison across data sources. Although primarily inductive, analysis was informed by sensitising concepts drawn from established safety culture frameworks, which aided interpretation without constraining the emergence of themes. Consistent with a reflexive qualitative stance, the researchers considered how their professional backgrounds in occupational safety, industrial relations, and organisational research might shape interpretation. Regular analytical discussions were held to challenge assumptions, interrogate emerging explanations, and ensure that findings remained grounded in participants’ accounts rather than normative expectations of “good” safety practice.

As a pilot study, the design also enabled assessment of the richness of qualitative data, adequacy of the interview protocol, and feasibility of conducting a larger multi-site investigation. Ethical approval was obtained prior to data collection, informed consent was secured from all participants, and pseudonyms were used to protect confidentiality. This study sought to understand how safety is enacted and governed at leadership level; therefore, data

collection focused intentionally on management personnel. Worker perspectives will be incorporated in subsequent phases.

## Findings

Analysis of interview transcripts and observational field notes generated four interrelated themes describing how safety is enacted, communicated, and constrained within the studied plantation. Together, these themes illustrate a management-driven approach to safety characterised by visible leadership commitment, structured OSH systems, routine communication, and ongoing operational challenges that create latent vulnerabilities.

### *Theme 1: Visible Leadership Commitment to Safety*

Across all interviews, managers described safety as a core organisational value and personal responsibility rather than merely a regulatory obligation. The OSH Manager characterised his role as highly approachable and relational:

"Workers call me not only for OSH matters, but also for other welfare issues. They know they can come to me." (OSH Manager)

Leadership commitment also extended to initiatives beyond statutory requirements. Drawing on his medical background, the OSH Manager introduced twice-monthly visits by a visiting medical officer:

"Before this it was once a month, but I felt it was not enough. So now the doctor comes twice a month." (OSH Manager)

The Plantation Manager emphasised safety as non-negotiable and closely linked the plantation's recognition to sustained commitment:

"We cannot compromise safety. That is why we received the OSH award." (Plantation Manager)

However, leaders also acknowledged pressures associated with safety governance:

"Honestly, a lot of reports have to be prepared. It is very demanding." (Plantation Manager)

Despite these demands, managers remained visibly involved, frequently leading morning briefings. Overall, leadership actions and narratives indicated strong safety signalling while revealing the personal effort required to maintain it.

### *Theme 2: Structured OSH Management Systems and Layered Defences*

The plantation operated with a comprehensive OSH structure encompassing documented hazard identification, risk assessment and risk control (HIRARC) procedures, an emergency response plan, and a quarterly safety and health committee. Managers described these systems as integrated into routine practice:

"Whatever work is planned, HIRARC must be done first. It is not just on paper." (Assistant OSH Manager)

Although the plantation was not ISO 45001 certified, managers reported voluntary alignment with its clauses alongside MSPO and RSPO standards:

"We follow ISO practices even though certification is not yet obtained." (OSH Manager)

Digital tools further supported system monitoring, including a mobile audit application for recording hazards and corrective actions. Fourteen trained OSH coordinators supported implementation across units:

"They are our eyes in the field. If anything is unsafe, they inform us immediately." (Assistant OSH Manager)

Budget records indicated strong emphasis on hazard control, with approximately 60% of the RM61,000 OSH budget allocated to PPE. However, only RM1,500 was allocated to training, suggesting limited formal capacity-building.

Together, these arrangements formed layered defensive mechanisms aimed at preventing incidents and maintaining compliance.

***Theme 3: Safety Communication and Routine Climate Signalling***

Daily morning "roll call" assemblies functioned as the central platform for reinforcing expectations. Managers regularly addressed observed behaviours:

"Before this we saw someone sitting on the tractor. I reminded them again – this is not allowed." (Assistant OSH Manager)

Observations confirmed that roll calls operated simultaneously as compliance checks. Attendance and PPE inspections occurred before work began, and workers were asked to correct deficiencies:

"If they don't wear the PPE, we stop them first. Only after they wear properly, they can go." (OSH Manager)

Communication was not entirely top-down. A workers' committee provided a structured means of raising issues, and managers described maintaining openness:

"If they have problems—safety or personal—they can come straight to me." (Plantation Manager)

Storytelling was frequently used to highlight risk:

"Sometimes I share real accident stories so they understand why rules are there." (OSH Manager)

These everyday practices contributed to continuous signalling that safety remained a core organisational expectation.

***Theme 4: Operational Challenges and Latent Conditions***

Despite visible commitment and system structure, managers described persistent constraints affecting implementation. Limited staffing, particularly of certified safety and health officers (SHOs), resulted in dual role demands:

"We cover many estates, so sometimes we cannot be everywhere." (OSH Manager)

Administrative workload was also emphasised:

"The paperwork for audits is heavy. It takes time away from the field." (Plantation Manager)

Training budgets were modest, leading to reliance on informal, on-the-job learning:

"We do briefings and toolbox talks, but specialised training is difficult because of cost." (Assistant OSH Manager)

Field observations further highlighted contextual challenges, including heat stress and difficult terrain. PPE was occasionally removed during hot conditions, and deviations from procedures occurred when oversight was reduced:

"Sometimes they say it's too hot with the mask, so they take it off." (OSH Manager)

These conditions did not immediately result in incidents, but they constituted underlying vulnerabilities that could weaken defences when combined with production pressures.

**Summary of Findings**

The findings portray a plantation with strong formal commitment to safety, visible leadership engagement, and structured OSH systems. Safety communication is frequent and embedded in daily routines. However, staffing limitations, administrative pressures, budget constraints for training, and environmental challenges introduce latent risks that complicate sustained implementation.

The interpretation of these findings in relation to safety culture frameworks is developed in the discussion section.

**Discussion**

***Linking Findings Back to Safety Culture Theory***

Interpreted through the theoretical frameworks outlined earlier, the findings demonstrate differentiated contributions across core dimensions of safety culture. Leadership visibility, routine communication, and PPE enforcement reflect the behavioural and situational elements of Cooper's model, while the plantation's formal OSH architecture aligns closely with Hudson's calculative stage, with emerging features suggestive of proactive practice. Persistent staffing, workload, and training constraints correspond to Reason's latent conditions that may

erode safety defences over time. Daily safety briefings and supervisory presence functioned as salient safety climate signals, consistent with Zohar's premise that workers infer managerial priorities through routine interaction.

This pilot study therefore reveals a management-enacted safety approach characterised by strong safety signalling, structured organisational controls, and routine communication, accompanied by resource constraints that challenge sustainability (Cooper, 2000; Hudson, 2007; Reason, 1997; Zohar, 1980).

***Interpreting Management Enactment of Safety Culture***

The study explored how safety is enacted, communicated, and constrained within a plantation environment, based on interviews and observational data. Crucially, the findings reflect the perspectives of managers responsible for OSH oversight. They therefore illuminate how safety culture is explained, justified, and enacted from a leadership standpoint rather than describing workers' lived realities. This distinction is important, as previous research shows that management narratives may emphasise order and commitment, whereas frontline perspectives can expose gaps between policy and practice (Zohar, 1980; Rajamanickam & Kinasih, 2024).

Within this managerial lens, safety culture appears strongly management-driven: leaders articulate safety as a core value, formal systems are actively maintained, and communication routines signal expectations on a daily basis. When viewed alongside the literature, these practices illustrate how safety culture is actively constructed through management enactment, reflecting Cooper's conception of safety culture as the interaction of psychological, behavioural, and situational elements.

*a. Leadership Commitment and Safety Culture Development*

Leadership emerged as the principal mechanism shaping safety expectations. Managers framed safety as both moral obligation and organisational value, and their presence at briefings and welfare initiatives served as visible symbols of priority. These findings reinforce evidence that transformational and supportive leadership strengthen safety climate and participation (Ta et al., 2022; Drăghici et al., 2022; Mat Lazim et al., 2022), and they substantiate Zohar's argument that employees interpret organisational values through daily supervisory behaviour.

At the same time, leadership commitment carried costs. Administrative burdens and operational pressures stretched managerial capacity, echoing research showing that sustained safety leadership requires ongoing emotional, administrative, and temporal investment (Hong, 2022; Zara et al., 2023). In maturity terms, this positions the plantation at the boundary between calculative and proactive culture: safety is clearly prioritised, but still reliant on oversight, reporting, and procedural control rather than fully embedded shared responsibility.

*b. Structured Systems and the Logic of Layered Defences*

Formal OSH systems, certification alignment, and documented procedures provided a coherent framework of layered defences. These reflect the calculative logic described in Hudson's model and align with research associating OSH management systems with improved risk governance (Bautista-Bernal et al., 2024). Coordinators and digital audits reinforced Reason's concept of multiple barriers preventing accidents.

However, the emphasis on PPE expenditure relative to training suggests a preference for tangible controls over capability development. Similar patterns reported elsewhere indicate that organisations may equate safety maturity with system documentation rather than learning capacity (Rahim et al., 2023). Thus, while systems increased control, they did not automatically deepen cultural ownership, reinforcing the argument that maturity advances when structure is complemented by reflection and competence development.

*c. Communication Practices as Climate Signalling*

Daily roll calls and risk stories served as repeated cues about acceptable behaviour, illustrating Zohar's claim that safety climate is continually produced through social interaction. Mechanisms for upward voice, such as the workers' committee, further suggested movement toward participatory communication often associated with more mature cultures (Anggak et al., 2025). Yet communication remained largely management-directed and situated within formal routines. Unlike studies reporting deliberate withholding of hazard information in some plantations (Rajamanickam & Kinasih, 2024), managers in this case presented an image of transparency, though this conclusion is based on managerial narration and requires corroboration from workers.

*d. Latent Conditions and Structural Constraints*

Despite strong commitment and systemisation, structural limitations created latent vulnerabilities. Understaffing, documentation demands, environmental heat, and modest

training budgets constrained proactive supervision and consistent behavioural reinforcement. These conditions exemplify Reason's insight that accidents develop when background weaknesses align with active failures under pressure. Such tensions highlight that safety maturity is shaped as much by resources and organisational design as by leadership intention. Within Hudson's continuum, the plantation appears beyond the reactive stage but remains dependent on centralised oversight rather than distributed generative practice.

**Integrating the Findings**

Taken together, the findings indicate that safety culture in this plantation is best understood as the product of managerial enactment. Leadership behaviour, resource allocation, formal systems, and communication practices combine to produce a structured and intentional safety environment, yet one constrained by workload pressures and uneven capability development.

From a theoretical standpoint, the study demonstrates that:

i. Cooper's psychological, behavioural, and situational domains intersect in everyday management practice;
ii. Hudson's maturity ladder is useful not as a static label, but as a developmental trajectory;
iii. Zohar's climate theory explains how supervisory interaction mediates meaning; and
iv. Reason's model reveals vulnerabilities that persist despite formal system strength.

At the same time, the management-centred dataset highlights how leaders construct and narrate safety more than how workers experience it. Future research incorporating multiple workforce

perspectives will be essential for examining whether managerial intentions translate consistently into everyday practice.

## Limitations and Future Research

Several limitations should be acknowledged. The study draws primarily on the views of managers and supervisors, resulting in a leadership-centred perspective on safety culture. While appropriate for understanding policy implementation and decision-making, it does not fully capture workers' everyday experiences. Future research should incorporate frontline, contract, and migrant worker voices to provide a more comprehensive picture.

Second, the research was conducted in a single plantation belonging to one organisational group, which limits wider generalisability. Comparative studies across multiple estates and companies would enable broader examination of how organisational context influences safety culture development.

Third, reliance on interview narratives supplemented by observation may be affected by impression management, particularly in certification-driven environments. Future work would benefit from additional data sources such as safety records, audit findings, and anonymous worker surveys.

Fourth, the cross-sectional design captured safety culture at one point in time. Longitudinal research could provide insight into how cultures evolve, especially in response to incidents, leadership transitions, or regulatory change.

Finally, further studies could extend the theoretical scope by examining how safety culture frameworks intersect with labour relations, worker precarity, and ethical governance in plantation contexts.

Despite these constraints, the study offers an important contribution by illustrating how safety culture is narrated and enacted from a managerial perspective in a high-risk agricultural environment. Continued research integrating multiple perspectives and organisational settings will deepen understanding of how safety cultures develop, strengthen, and occasionally fracture.

## Conclusion

This pilot study explored how plantation management enacts safety within a high-risk agricultural context, drawing on interviews with key OSH leaders and supporting field observations. The findings depict a safety environment characterised by visible leadership commitment, structured management systems, and consistent communication practices, co-existing with resource and workload constraints that create latent vulnerabilities.

Viewed through established safety culture frameworks, the plantation appears positioned between calculative and proactive maturity: safety is prioritised and systematised, yet still reliant on managerial oversight and constrained by structural pressures. The study underscores that safety culture is not merely influenced by management; it is actively constructed through leadership actions, resource decisions, and communication routines.

Because the data reflect only management perspectives, the findings should be interpreted as insight into how leaders conceptualise and narrate safety rather than as a full representation of workforce experience. Nevertheless, they offer valuable direction for strengthening leadership development, training investment, worker participation, and workload design in plantation safety governance.

This study also demonstrates the feasibility and value of qualitative inquiry in agricultural OSH research and lays the groundwork for a larger, multi-site investigation incorporating worker perspectives and objective safety indicators.

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# TESTAMENTARY CAPACITY IN MALAYSIAN: A LEGAL ANALYSIS

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***Abstract:*** *The concept of testamentary capacity lies at the heart of succession law, serving as a fundamental prerequisite for the validity of a will. Malaysian courts have consistently emphasized that a testator must possess a 'sound disposing mind' at the time of executing the will, a standard that has evolved through judicial interpretation and common law principles, notably influenced by the English case of Banks v Goodfellow (1870). This paper examines the concept of testamentary capacity within the Malaysian legal framework, focusing on statutory provisions, judicial interpretations, and practical challenges. For this purpose, this article employs the doctrinal content analysis technique by reviewing the relevant primary and secondary data sources including statutory legal provisions, case law, and other legal and non-legal literature that are relevant to testamentary capacity. It explores the requirements under the Wills Act 1959, analyses key case law, and identifies gaps in current practice. This paper concludes that there are some limitations of the traditional criteria established in the case Bank v Goodfellows (1870). Thus, there is a need to revisit the law and consider the current challenges impose by the complex family dynamics and cognitive impairments issues that are relevant to the testamentary capacity of testators.*

***Keywords:*** *Testamentary, Capacity. Will, Testate, Banks v Goodfellows*

## Introduction

The concept of testamentary capacity lies at the heart of succession law, serving as a fundamental prerequisite for the validity of a will. Basically, testamentary capacity refers to the legal and mental ability of an individual to make a will that reflects their true intentions regarding the distribution of their estate upon death. In *Chin Jhin Thien & Anor v Chin Huat Yean @ Chin Chun Yean & Anor* [2020] 4 MLJ 581, the court held that testamentary capacity denotes the ability of a person to make a valid will and generally referred to as the 'sound disposing mind' of the testator. Every individual may freely make his will, how old so ever he may be, for it is not the integrity of the body but of the mind that is requisite in preparing a will.

The determination of testamentary capacity however is not without challenges. Issues often arise in cases involving elderly testators, individuals with cognitive impairments, or those under suspicious circumstances. Malaysian courts have consistently emphasized that a testator must possess a 'sound disposing mind' at the time of executing the will, a standard that has evolved through judicial interpretation and common law principles, notably influenced by the English case of Banks v Goodfellow (1870). In Malaysia, this principle is primarily governed by the Wills Act 1959, which applies exclusively to non-Muslims, while Muslims are subject to Islamic inheritance principles under Syariah law. The requirement of capacity ensures that a will is not only legally enforceable but also ethically sound, safeguarding the autonomy of the testator while protecting beneficiaries from undue influence or fraud.

This paper seeks to examine the Malaysian legal perspective on testamentary capacity by analysing the relevant statutory provisions, judicial decisions, and some practical challenges. By doing so, the study aims to contribute to the discourse on balancing individual autonomy with the need for safeguards against exploitation in the making of wills.

## Methodology

This article adopts a qualitative doctrinal research approach, focusing on the analysis of statutory provisions, judicial decisions, and scholarly commentary related to testamentary capacity in Malaysia. The research is primarily library-based, relying on legal texts, case law, and academic literature to examine the Malaysian legal framework governing testamentary capacity. Primary sources include statutes such as the Wills Act 1959, Age of Majority Act 1971, and landmark Malaysian cases whilst secondary sources comprise scholarly articles. The analysis is guided by objectives to identify statutory requirements, examine judicial interpretation, and explore challenges in proving testamentary capacity in will execution.

## Literature Review

The concept of testamentary capacity has been extensively studied, with a focus on the legal and cognitive abilities required to make a valid will. Its significance is underscored by the role it plays in safeguarding the autonomy of individuals particularly the elderly and those with cognitive impairments, while ensuring the integrity of testamentary documents against undue influence and invalidation. The Banks v Goodfellow (1870) case remains a cornerstone in this field, establishing the fundamental criteria for assessing testamentary capacity (Ryan-Morgan & Troup, 2019).

Despite the established legal criteria, assessing testamentary capacity can be challenging, particularly in individuals with mental disorders or cognitive impairments. Conditions such as dementia, schizophrenia, and mood disorders can significantly impact an individual's cognitive abilities, making it difficult to determine their capacity to make a will (Pang et al., 2009). The increasing prevalence of these conditions, especially among the elderly, has led to a rise in cases where testamentary capacity is contested, highlighting the need for reliable and standardized assessment methods (Shulman et al., 2005). A review of the literature reveals several key concepts and themes that inform contemporary understanding of testamentary capacity. Legal definitions remain anchored in the Banks v Goodfellow criteria, but clinical and neuropsychological perspectives have expanded the scope of assessment to include memory, executive function, decision-making, and theory of mind (Economou & Kontos, 2023).

## The Legal Principle

The concept of testamentary capacity has evolved over time, with significant legal precedents shaping its current understanding. One of the most influential cases is Banks v. Goodfellow (1870), which established the criteria for determining testamentary capacity. According to this case, a person must understand the nature of the act of making a will, the extent of their property, the claims of potential beneficiaries, and must not be affected by any delusions that influence their decisions (Pang et al., 2009) . This legal framework has been widely adopted and remains a cornerstone in the assessment of testamentary capacity.

The meaning of testamentary capacity was explained by Cockburn CJ in Banks v Goodfellow (1870) LR 5 QB 549, in the following words:

"It is essential to the exercise of such a power that a testator shall understand the nature of the act and its effects; shall understand the extent of the property of which he is disposing; shall be able to comprehend and appreciate the claims to which he ought to give effect; and, with a view to the latter object, that no disorder of the mind shall poison his affections, pervert his sense of right, or prevent the exercise of his natural faculties, that no insane delusion shall influence his will in disposing of his property and bring about a disposal of it which, if the mind had been sound, would not have been made."

The testator in Banks v Goodfellow (1870) was John Banks who was a wealthy man and owned considerable number of estates. He had a history of mental illness, including delusions and epilepsy. In December 1863, he made a new will that left his entire estate to his niece, Margaret Goodfellow. Banks died two years later, and Ms Goodfellow died shortly after that. His heir-at-law, William Banks, challenged the validity of the will on the basis that Banks was not of sound mind when he made it. The court found that Banks did have a sound disposing mind when he made the will. They held that he was aware of the nature of the act of making a will and its effects and that he understood the extent of his property and what he was giving away. They also found that he was aware of the people who would normally inherit and that could comprehend and appreciate the possibility that they may claim. Therefore, the will was held to be valid.

**Legal Framework in Malaysia**

For a will to be valid, the testator ought to be of sound mind. It is important that the testator must have testamentary capacity to make a will, failing which shall render the will invalid. A testator is said to have testamentary capacity when he is fully conscious, has a sound mind, understands and approves the contents of the will. The legal regulation of testamentary capacity in Malaysia is primarily anchored in the Wills Act 1959 (Act 346), supplemented by the Age of Majority Act 1971 and related statutes governing succession and probate. These provisions collectively establish the requirements for a valid will and the mental competence of the testator.

For Muslims, testamentary dispositions are subject to Syariah law, which limits bequests to one-third of the estate and requires compliance with faraid principles. All states are governed by their own enactments relating to personal law and from 14 states in Malaysia only seven states introduced specific legislation relating to Muslim will namely Selangor, Melaka, Negeri Sembilan, Pahang, Kelantan, Sabah, and Perak, whereas another two states had introduced bills namely Terengganu and Federal Territories.

Nevertheless, this article focuses exclusively on non-Muslim wills governed by the Wills Act 1959. Hence, Muslim testamentary dispositions under Syariah law are excluded. The Wills Act 1959 applies exclusively to non-Muslims in Peninsular Malaysia, as Muslims are governed by Syariah inheritance principles. Section 3 Wills Act 1959 states that as regard to property disposable by will, every person of sound mind may devise, bequeath, or dispose of property by will, executed in manner hereinafter required, all property which he owns or to which he is entitled either at law or in equity at the time of his death notwithstanding that he may have

become entitled to the same subsequently to the execution of the will. Section 4 Wills Act 1959 prohibits wills made by persons under the age of majority, which is defined as 18 years under the Age of Majority Act 1971. According to Section 5 Wills Act 1959, a Will is held valid if the testator has the mental capacity in understanding the nature and the effect of the terms and conditions of the Will and consented to the terms and conditions of the Will

All these requirements, if fulfilled, should constitute a valid will in Malaysia. It is important to note that although the Wills Act 1959 uses the term 'sound mind,' it does not provide a statutory definition, leaving interpretation to judicial precedent where the courts decided to rely on common law principles, particularly the test established in Banks v Goodfellow (1870).

**Judicial Interpretation**

Judicial interpretation plays a pivotal role in defining testamentary capacity in Malaysia, as the Wills Act 1959 does not provide a detailed statutory definition of 'sound mind.' Courts have consistently relied on the common law test established in Banks v Goodfellow (1870). Malaysian courts have adopted this interpretation and have consistently applied this standard in cases such as *Udham Singh v Indar Kaur* and *Gan Yook Chin & Anor v Lee Ing Chin & Ors*, where the judiciary examined whether the testator comprehended the implications of their will despite age-related cognitive decline. In *Udham Singh v Indar Kaur* [1971] 2 MLJ 263, the court emphasized that capacity must exist at the time of executing the will and that old age or physical weakness does not negate capacity unless it impairs comprehension. The former Federal Court in this case had followed the decision in *Banks v Goodfellow* (1870) case where the court reiterated the principle as follows: -

"A person has testamentary capacity when he understands the nature of his act and its effect; the extent of the property of which he is disposing; the claims to which he ought to give effect; and, with a view to the latter object, no disorder of the mind must poison his affections, pervert his sense of right, or prevent the exercise of his natural faculties, and no insane delusion must influence his will in disposing of his property, and bring about a disposal of it which, if the mind had been sound, would not have been made."

The case of *Tho Yow Pew v Chua Kooi Hean* [2002] 4 MLJ 97 illustrates that minimal capacity suffices if the testator understands the nature and effect of the will. In *Lee Ing Chin @ Lee Teck Seng & Ors. v. Gan Yook Chin & Anor.* [2003] 2 MLJ 97, the court expressly stated that a mere bodily ill-health or imperfect memory is insufficient. There must be some vitiating factors to discharge the testamentary capacity of deceased such as mental disorder or insane delusion. Whereas *Sethambal Doraiappah v Krishnavani Muniandy* [2004] 1 CLJ 869 addressed undue influence issue and ruled that the propounder must dispel suspicion surrounding execution. In *Wasunan Tonrab & Anor v Lee Ah Sin @ Lee Sin Kee* [2025] MLJU 2766, the defendant who challenged the validity of the will was unable to show that the deceased lack testamentary even though he claimed that the deceased was 71 years old at that time, under the care of the defendant, and was undergoing hospital treatment and needed continuous medications.
Scholarly commentary emphasizes that testamentary capacity is not synonymous with general mental health; rather, it refers to a 'sound disposing mind' capable of making rational decisions about property distribution. The court in *Manogaran a/l Singraveloo & Ors v Amanah Raya Bhd & Anor* [2024] MLJU 896 held that a testator is said to have testamentary capacity when the testator is fully conscious, has a sound mind, understands and approves the contents of the will. The criterion of sound disposing mind has been discussed in the case of *Lee Wee Chian v*

*Lee Huat Hun* [2013] MLJU 117 and *Tho Yow Pew and Anor v Chua Kooi Hean* [2002] 3 AMR 3703. The court held that sound testamentary capacity means that three things must at one and the same time. Firstly, the testator must understand that he is giving his property to one or more objects of his regard. Secondly, he must understand and recollect the extent of his property. Thirdly, he must also understand the nature and extent of the claims upon him both of those whom he is including in his will and those whom he is excluding from his will. In these circumstances, the testator must realise that he is signing will and his mind and will must accompany the physical act of execution.

In *Kong Kin Lay & Ors v Kong Kin Siong & Ors* [2025] 5 MLJ 891, the court held that a testamentary capacity is different from a person's 'soundness of mind' to enter into a contract under section 11 and 12 of the Contracts Act 1950. Thus, it may be seen that testamentary capacity is not to be equated with contractual capacity as a person may lack the mental capacity to enter a contract and yet may have sufficient testamentary capacity as been held in the case of *Lee Ing Chin @ Lee Teck Seng & Ors v Gan Yook Chin & Anor* [2003] 2 MLJ 97.

**The Challenges**

The Banks v. Goodfellow (1870) criteria, while foundational, may not fully encompass the nuances of modern testamentary decisions, especially in cases involving neurodegenerative diseases, psychiatric disorders, and undue influence (Ryan-Morgan & Troup, 2019). Retrospective assessments, often required when the testator is deceased, add another layer of complexity, as they rely heavily on historical medical records and witness testimonies (Zago & Bolognini, 2020).

The problem with the traditional testamentary capacity test lies in its potential inadequacy to address contemporary challenges. Challenges to wills based on testamentary capacity are expected to rise due to demographic shifts and the growing incidence of cognitive disorders among the elderly (Shulman et al., 2005). For instance, the presence of cognitive impairments such as dementia schizophrenia, and mood disorders on testamentary capacity can significantly impact a testator's ability to meet the legal requirements, yet the criteria do not provide detailed guidance on evaluating such conditions (Purser & Lonie, 2019). Recent literature also highlights practical challenges in assessing capacity, particularly among elderly individuals or those with neurodegenerative conditions.

A systematic review of global practices notes significant variability in legal and medical approaches, with some jurisdictions recognizing the concept of 'lucid intervals' for dementia patients (Shulman et al., 2005). This underscores the need for medical evidence in contentious cases that is a point echoed in Malaysian practice where solicitors often seek medical certification to mitigate future disputes. Hence, there is a need to have statutory clarification of 'sound mind' in the Wills Act 1959. Furthermore, there must be a requirement of mandatory medical certification in high-risk cases (e.g., elderly or cognitively impaired testators), to ensure the validity of their will shall not be contested after they died.

Moreover, the retrospective nature of many capacity assessments complicates the process, as the primary source of evidence that is the testator is no longer available (Ryan-Morgan & Troup, 2019). The court in *Soo Kian Huat v Soo Bee Choo* [2016] MLJU 926 referred to *R*am Gopal v Aipna Kunwar AIR 1922 PC 366 where it was stated that a will is one of the most solemn documents known to the law. By it a dead man entrusts to the living the carrying out

of his wishes and as it is impossible that he can be called either to deny his signature or to explain the circumstances in which it was executed it is essential that trustworthy and effective evidence should be given to establish compliance with the necessary forms of the law.

## Conclusion

Testamentary capacity remains a cornerstone of succession law, ensuring that wills reflect genuine intentions while safeguarding against undue influence. The Malaysian framework, anchored in the Wills Act 1959 and judicial interpretation, adopts common law principles but lacks statutory clarity. Case law demonstrates reliance on legal criteria over medical diagnoses, creating practical challenges. The legal standards for assessing testamentary capacity have their roots in the 19th-century case of Banks v. Goodfellow (1870), which set enduring criteria. Over time, the integration of medical and psychological assessments has become essential, reflecting the complexities of modern life and the need for nuanced evaluations. Despite these advancements, the core principles established in historical case law continue to guide contemporary practice. This paper recommends statutory reform and professional guidelines to balance autonomy with protection. These measures aim to enhance certainty, fairness, and trust in the administration of wills in Malaysia.

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# INHERITABILITY OF DIGITAL ASSETS OF DECEASED PERSON IN MALAYSIA

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***Abstract:*** *Death is an unchallengeable reality that cannot be disputed. Everyone will die one day, leaving behind a bulk of properties to be enjoyed by the legal heirs. The law is clear in terms of transmission of tangible assets. Nonetheless, the issue is different in the case of the inheritability of digital assets. In today's digital age, the process of transmitting the digital albums or digital music that previously kept as physical picture albums and music album collections to the legal heirs is growing more complicated. This paper aims to examine the current legal position of inheritability of digital assets and challenges in Malaysia. For this purpose, this article employs the doctrinal content analysis technique by reviewing the relevant primary and secondary data sources including statutory legal provisions, case law, and other legal and non-legal literature that are relevant to inheritability of digital assets. This paper concludes that the law is silent as regard to the inheritability of digital assets in Malaysia. As a result of the rapid advancement of information technology and the advent of the fourth industrial revolution, the moment has come for the legislature to devote the appropriate amount of attention to the establishment of a legal framework for digital inheritance. Hence, incorporating digital inheritance within the present law in Malaysia necessitates changes to the legislation. by taking into account the challenges that are currently being faced interested parties.*

***Keywords:*** *digital, inheritance, deceased estates, personal representatives, administration, Malaysia.*

## Introduction

Death is an unchallengeable reality that cannot be disputed. Everyone will die one day, leaving behind a bulk of properties a bulk of properties to be enjoyed by the legal heirs. It puts an end to the marriage, some contractual responsibilities, certain personal rights, and it initiates the process of transferring property upon death. Additionally, it indicates the end of a legal personality (Kharitonova, 2021). The deceased will typically leave behind items that might be extremely important on an emotional, economic, or scientific level after they pass away. Therefore, legislators across jurisdictions have developed laws to regulate the fate of the deceased's assets in the post-mortem. These above-mentioned assets seem to raise no legal issue since the ownership is clear, registered and cannot be challenged in most cases.

On the other hand, when it comes to digital assets, it seems that the reality is rather different. The administration of digital assets, also known as digital inheritance, is one of the areas of law that is now undergoing rapid transformation, particularly considering the rise of the fourth industrial revolution and the advent of the digital era. Digital inheritance refers to the process of conveying or transferring digital assets or digital content to the beneficiaries of the deceased. The procedure involves comprehending what digital assets and rights are available as well as

dealing with them after a person has died away. In these circumstances, the economic role of an inheritance right might be subscribed to. It covers things that are often commercial or proprietary in nature and may be ascribed a monetary value depending on their price. In this sense, proprietary rights can be transmitted to other people either during the lifetime of the person who has passed away, or at the absolute least, after the person has passed away (Grochowski, 2019). There is a big difference between what the law recognises as a tangible asset now and what a digital asset is. As it stands now, the law on the administration of estates doesn't seem to do enough to protect the rights of heirs and in providing a helpful hand to the personal representatives when it comes to digital assets. As no one can avoid the rapid expansion and growing popularity of the digital world, it is essential to investigate the legal status of digital assets or digital inheritance of a deceased person. Accordingly, this paper aim to examine the current legal position of inheritability of digital assets and challenges in the context of administration of deceased's estates.

## Research Methodology

Aiming to examine the current legal position of inheritability of digital assets of deceased's estates, this article employed qualitative doctrinal legal research as the article intends to discuss in-depth and detailed on the matters. By using qualitative methods many new aspects of problem can be identified and thus once they are identified, suggestion would follows resulting in the research result and findings being more beneficial and practical (Abdullah, 2018; Yaqin, 2008). For this purpose, this article employs the doctrinal content analysis techniques by reviewing the relevant primary and secondary data sources gathered from multiple sources including statutory legal provisions, case law, and other legal and non-legal literature that are pertinent to inheritability of digital assets in the context of administration of estates law. Analysis of the statutes and article journals are made to evaluate the loopholes in the Malaysian law and suggest necessary improvement to the existing law.

## Current Legal Framework in Malaysia

Prior to the advent of digitisation, the administration of deceased's estates was restricted to the physical asset which were governed by several legislations. The act of collecting and gathering in the estate of the deceased in order to facilitate the operation of transmitting and transferring to the rightful owner items left behind by the deceased is referred to as the administration of estates (Noor & Aziz, 2019). In Malaysian law, the Probate and Administration Act 1959, the Small Estates (Distribution) Act 1955, the Distribution Act 1955, the Rules of Court 2012, and many other statutes provide the foundational framework for deceased estates and inheritance law. Other statutes, such as the Distribution Act 1955, also contribute to this framework.

The law of inheritance is often governed by one of two regimes: testate succession or intestate succession. Execution of testamentary documents such as a will, codicil, and trust documents by a testator to designate a personal representative with instructions on how to handle the estate after his death constitutes testate succession (Halim et al., 2018). When a person dies without a will in Malaysia, his estate is distributed to his heirs in a predetermined order according to the operation of the law, which is accomplished by applying the rule of intestacy in accordance with the Distribution Act 1958 for non-Muslims and the rules of *faraid* for Muslims. This occurs in the context of an intestate succession. It takes place when a person passes away without leaving a will behind (Halim & Noor, 2014).

Moreover, it is essential to emphasise the fact that the personal representative is one of the primary stakeholders in the administration of the estate. He plays an important part in ensuring that the estate of the dead person is adequately managed and handled in a timely and effective manner. It is entwined with the law that governs the administration of estates in Malaysia, which is known as the Probate and Administration Act 1959. This act mandated the appointment of a person to the office of executorship or administratorship known as personal representative before the deceased person's estate could be legally dealt with. Their continued existence is a reflection of a deceased person's estates as well as the manner in which their estate will be administered after their death. (Halim & Noor, 2014).

However, with the advent of the digitalization era, the traditional role of personal representatives, which entails locating the assets of the deceased, paying off the deceased's debt, and distributing the assets of the deceased in accordance with the last will and testament, has been completely reformed. The typical method of putting the final touches on the deceased estates involves doing a search through the dead person's documents, which may include accounts and invoices. These records can be recognised by referring to the saved records or the mail that was received during the deceased lifetimes. The advent of the digital world, on the other hand, has led to a reduction in the amount of paper trail left behind (Cahn, 2014) and caused difficulties to the personal representative in identifying the deceased estates.

**Inheritability of Digital Assets**

There is a significant gap between the present tangible asset recognised by the law and digital assets. The administration of estates legislation in Malaysia as it stands now appears to fall short of appropriately the issue on inheritability of digital assets (Noor & Aziz, 2022). There are no provisions in the administration of estates statutes and legislation that relate to the inheritability of digital assets or digital inheritance, and this shows that they are insufficient to control the legal challenges that are currently being faced (Zulhuda, 2017).

In the past few years, more people on social media and in blockchain ecosystems have talked about digital inheritance. As a result, digital assets like social media content, digital currency like cryptocurrencies, and non-fungible tokens have become more valuable and common. This means that there needs to be a clear and safe legal mechanism to transfer these assets when the owner dies (Goldston et al., 2023). Over the course of the past few years, the digital assets have essentially supplanted the physical assets. Digital assets are intangible media information recorded in computers and other computer-related technology. To access this information, a person can use a computer, a storage drive, a smart phone, the internet, or a server hosted by a third party, such as an Internet Service Provider. The list is projected to extend in the near future to include e-mail accounts, blogs, social networking sites, personal webpages, documents, movies, and picture storage services (Agarwal & Nath, 2021). Wyczik (2025) argued that digital assets are more akin to intellectual property than to tangible assets by drawing on a spectrum of case law recognising digital assets as objects of property rights. As a consequence of this, in today's digital age, the process of transmitting the picture albums and music collections to the legal heirs is growing more complicated.

As no one can escape the digital world's rapid evolution and increasing popularity, Fuchs (2021) is of the opinion that discussions on both national and international inheritance law are shifting their attention to the digital estate as a key topic of discussion. It is reasonable to anticipate that the value of digital assets will continue to rise over the coming years, particularly

given the fact that members of Generation X have reached the point in their lives when they have families and digital assets to pass on. Hence, it can be predicted that, a huge number of digital assets will form part of deceased estates in the near future and therefore, it is important to govern the existence of digital assets and their legal standing after the owner's death (Noor & Aziz, 2019).

As a result, there is a chance that one's whole digital estate will continue to exist after death. As a result of the one-of-a-kind qualities that they possess, digital assets have complicated the succession and inheritance law system, both of which have historically been centred on individual's tangible assets, financial assets, and real estate. The administration of estates legislation as it stands now appears to fall short of appropriately addressing the rights of heirs and personal representatives to digital assets, particularly the repercussions of a death that was unanticipated or occurred prematurely (Noor & Aziz, 2022).

At this time, there is a lack of clarity on the rights of personal representatives in relation to the management of digital assets of deceased person. It is necessary for personal representatives to have access to deceased individuals' internet accounts in order to carry out their duties as executors or administrators, and this requirement raises the question of how extensive this access should be. As a result of the advancement of technology, the court can find itself having to navigate territory that is unfamiliar to it. As a number of recent instances have demonstrated that the issue on dealing with an individual's social media and email accounts after their death has proven to be one of the most challenging aspects of digital assets inheritability.

**The Challenges**

The advent of the internet has presented the existing legal system with a variety of challenges, one of which is an increased attention on the problems associated with the inheritability of digital assets. In the context of the deceased's estate, there is a lack of a legal framework with regard to the succession of digital assets. This makes it difficult to determine who should inherit digital assets. In many cases, legislative processes are unable to accurately assess the post-mortem status of accounts. (Watkins, 2014). Indeed, many questions have arisen following the emergence of technology, which has remained unanswered by legal and legislation systems. In the context of deceased estates, the following is a list of the legal concerns that arise in connection with digital assets.

Firstly, lack of clear laws relating to inheritability of digital assets in deceased's estate law. There is a lot of grey area around the rights of personal representatives and beneficiaries in relation to digital assets. There are a lot of online services that have their own rules about what to do in the event that a user dies or becomes unable to use their account such as Facebook, Twitter, Linkedin and Instagram but not every website has created an express policies relating to the posthumous account (Beyer & Cahn, 2012).

Secondly, lack of universal definition of digital assets. The question of determining what exactly makes up a digital asset is one of the most critical challenges that arises in the context of the inheritability of digital assets. Although there are a variety of definitions available for digital assets, nobody has yet been successful in determining or explaining precisely what they imply. This is due to the fact that digital assets are a new sort of asset, and as such, they are constantly developing and expanding over time (Grochowski, 2019). The terms "digital assets" and "digital estates" do not yet have a universally accepted definition at this time (Conner,

2010). When it comes to the law in Malaysia, one of the most contentious issues is determining the scope of the deceased person's estate as well as the kinds of property that should be included in it. This must be done before the inheritance can be given to the people who are legally entitled to receive it (Noor & Aziz, 2022). On that premise, the digital assets should be ascertained and defined, to ensure that their value can be deal appropriately (Cahn & Washington, 2014).

Thirdly, no post-mortem access to the digital assets. The topic of the deceased's estates law was also intertwined with the issue of succession over specific assets that were held on their social media account. To be more specific, having access to an account may be a prerequisite for exercising entitlements over specific assets. For instance, having access to an account may be required to download an item that is protected by intellectual property rights, such as a photograph or a video recording. In other words, the problem of digital inheritance exceeds also beyond the traditional domain of private law succession rules (Grochowski, 2019).

## Conclusion

Since the present laws pay very little attention to the issue of inheritability of digital assets, this area of the law may end up being uncertain. The law is silent as regard to the inheritability of digital assets in Malaysia. In the absence of any applicable legal framework, the best approach to help the deceased person's unadministered digital assets is to make a will instructing a personal representative to manage the digital assets. Hence, incorporating digital inheritance within the present estate administration system in Malaysia necessitates changes to the legislation by considering challenges that are currently being faced the interested parties. If policymakers failed to offer suitable standards or legislation regarding the inheritability of digital assets, the issue might contribute to the escalation of unclaimed estates, which have become a national concern and a significant recurring issue in Malaysia.

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# TRENDS AND EVOLUTION OF SUSTAINABLE ELECTRICAL DISCHARGE MACHINING RESEARCH A BIBLIOMETRIC REVIEW

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***Abstract:*** *Electrical Discharge Machining is a widely used non-traditional machining process for high precision manufacturing, particularly for machining hard and difficult to process conductive materials. In recent years, sustainability has become an increasingly important consideration in manufacturing research, including energy efficiency, environmental impact, and resource utilisation. However, sustainability-oriented research in Electrical Discharge Machining is often addressed implicitly through process optimisation and performance improvement rather than explicit sustainability terminology. This study presents a bibliometric analysis of sustainability oriented Electrical Discharge Machining research based on Scopus indexed journal publications. A total of 214 articles published between 1996 and 2026 were analysed using descriptive bibliometric indicators and network visualisation techniques. Publication trends by year, keyword co-occurrence patterns, and country collaboration networks were examined to reveal the evolution, thematic structure, and global research landscape of sustainable EDM studies. The results show a clear growth in sustainability related Electrical Discharge Machining research, with a significant increase in publications observed after 2017 and a pronounced surge from 2020 onwards. Keyword co-occurrence analysis reveals that sustainability is embedded within core EDM research through interconnected themes of energy efficiency, machining performance optimisation, material selection, and dielectric fluid innovation. Country collaboration analysis indicates that while some countries demonstrate high research productivity, international collaboration remains uneven, with opportunities for stronger cross regional partnerships. Overall, this study provides a comprehensive overview of the development and structure of sustainability oriented Electrical Discharge Machining research. The findings offer valuable insights for researchers and practitioners by identifying dominant research themes, collaboration patterns, and potential directions for advancing environmentally responsible and energy efficient EDM technologies.*

***Keyword:*** *EDM; Sustainable Manufacturing, Sustainability, Advanced Manufacturing, Bibliometric Analysis, Scopus Database*

## 1.0 Introduction

Electrical Discharge Machining (EDM) is a sophisticated non-traditional thermal machining process uniquely capable of producing complex geometries in electrically conductive materials, particularly hard-to-machine alloys and composites. The evidence strongly supports this claim across multiple industrial domains. Ghiorghe et al., 2024 confirms EDM's widespread use in aerospace, automotive, and surgical component manufacturing. Gupta et al., 2020 specifically highlights EDM's effectiveness in machining titanium (hardness HRB 70-

74), while André Filipe Varandas Pedroso et al., 2025 demonstrates its capabilities with Metal-Matrix, Polymer-Matrix, and Ceramic-Matrix Composites. Mahajan et al., 2022 further emphasizes its precision in biomedical device surface engineering. The process's key advantage lies in its ability to machine materials irrespective of their mechanical properties, making it an essential technology in advanced manufacturing sectors.

Despite its advantages, EDM is recognized as an environmentally problematic manufacturing process with significant sustainability challenges due to its high energy consumption, toxic emissions, and reliance on harmful dielectric fluids. Multiple studies Valaki et al., 2018 characterize EDM as "one of the most unsustainable machining processes" due to high specific energy consumption, hazardous emissions, and toxic waste generation. Hydrocarbon-based dielectric fluids release carcinogenic pollutants like polycyclic aromatic hydrocarbons, carbon dioxide, and benzene (Pellegrini et al., 2019). Researchers are actively exploring sustainable alternatives, including water-based, gas-based, and bio-oil dielectrics (Bhowmik et al., 2025), which promise to reduce environmental impact while maintaining machining performance. As a result, sustainability has emerged as an increasingly important consideration in the development and application of Electrical Discharge Machining processes.

Sustainable manufacturing emphasizes the reduction of energy consumption, efficient use of materials, minimization of waste, and mitigation of environmental impact throughout the manufacturing life cycle. Within the context of Electrical Discharge Machining, sustainability related objectives are often addressed indirectly through process optimization, performance enhancement, and the development of alternative materials and process strategies. Improvements in material removal rate, surface integrity, tool wear reduction, and energy utilization contribute to sustainability outcomes, even when studies do not explicitly frame their contributions under sustainability terminology.

In recent years, advances in digitalization, intelligent manufacturing, and Industry 4.0 have further strengthened the link between Electrical Discharge Machining and sustainability. The integration of optimization techniques, data driven modelling, and advanced process control has enabled more efficient and environmentally responsible EDM operations. These developments have contributed to a growing and diverse body of literature addressing sustainability related challenges in Electrical Discharge Machining.

Given the expanding scope and interdisciplinary nature of this research field, there is a need for a systematic and quantitative assessment of sustainability oriented Electrical Discharge Machining studies. Bibliometric analysis provides an effective approach for mapping research evolution, identifying dominant themes, and examining global research collaboration patterns. Therefore, this study aims to conduct a bibliometric analysis of sustainability oriented Electrical Discharge Machining research using Scopus indexed journal publications. The findings provide a comprehensive overview of research trends, thematic structures, and international collaboration in sustainable EDM, offering valuable insights for researchers, practitioners, and policy makers.

## 2.0 Literature Review

### *2.1 Electrical Discharge Machining Research Focus*

Early research on Electrical Discharge Machining primarily focused on understanding discharge mechanisms, material removal phenomena, and process stability. Ming et al. (2021)

reported that researchers extensively investigated key performance measures such as material removal rate, surface roughness, and tool wear rate to enhance machining effectiveness. Nahak et al. (2019) further demonstrated that careful selection of process parameters, including pulse current, voltage, and pulse timing, is critical for achieving stable and efficient machining of hard and electrically conductive materials. These studies emphasized improvements in machining accuracy, surface integrity, and productivity through the optimization of electrical parameters, electrode materials, and machining strategies, thereby establishing the fundamental technical principles underpinning modern EDM applications.

Subsequent research expanded towards comprehensive performance optimization, with continued emphasis on material removal rate, surface quality, and tool wear behavior. Both experimental and modelling based approaches were widely adopted to establish quantitative relationships between process parameters and machining responses. Although these studies were not explicitly framed within a sustainability context, their strong focus on efficiency enhancement and process optimization contributed indirectly to sustainable manufacturing objectives by reducing energy consumption, material waste, and machining time.

### *2.2 Sustainability Considerations in Electrical Discharge Machining*

EDM research has increasingly focused on sustainability, addressing environmental impact and energy efficiency through innovative approaches. Researchers have explored strategies including parameter optimization, alternative dielectric fluids, and emission control Ming et al., 2021. A particularly promising area is alternative dielectric fluids. Mishra et al., 2020 demonstrated that vegetable-based bio-dielectrics can reduce aerosol emissions by 17.33% and improve surface finish compared to traditional hydrocarbon fluids. Vincent et al., 2023 further confirmed that trans-esterified vegetable oils offer pollution-free machining with enhanced performance. Key developments include investigating bio-based dielectrics to replace traditional hydrocarbon oils, which can emit harmful substances Bhowmik et al., 2025. While explicit life cycle assessment studies remain limited, the literature shows a clear trend towards more environmentally conscious EDM processes, focusing on dielectric fluid management, electrode wear reduction, and minimizing environmental risks Valaki et al., 2015.

### *2.3 Advanced Materials and Sustainable EDM Applications*

EDM is emerging as a critical sustainable solution for machining advanced materials like titanium alloys and metal matrix composites, despite significant energy and environmental challenges. Multiple studies highlight key sustainability strategies: Arif et al., 2022 propose using bio-dielectrics to reduce environmental pollution, while Ming et al., 2021 recommend optimizing energy distribution and exploring dry-EDM techniques. Singh et al., 2020 emphasize parameter optimization to enhance productivity and reduce energy consumption. The research consistently shows that hybrid approaches, such as powder-mixed EDM and cryogenic-assisted techniques, offer promising paths to balance machining performance with reduced environmental impact Singh et al., 2016. However, the field remains nascent, with ongoing research needed to fully address sustainability concerns in advanced material machining.

### *2.4 Bibliometric Tools for Research Mapping*

Bibliometric analysis is widely used to examine research trends, thematic evolution, and collaboration patterns in manufacturing and sustainability related fields. Previous studies have demonstrated its effectiveness in mapping developments in sustainable manufacturing, advanced machining, and energy efficient production, thereby providing objective insights into complex research landscapes. Despite the extensive literature on Electrical Discharge Machining, bibliometric studies specifically addressing sustainability oriented EDM research remain limited. Existing reviews largely focus on technical advancements and process optimization, with limited systematic analysis of sustainability themes, energy efficiency, and international collaboration. This gap highlights the need for a dedicated bibliometric assessment of sustainability integration in EDM research. To address this gap, this study employs VOSviewer, a widely used bibliometric visualization tool developed by van Eck and Waltman (2023). VOSviewer enables the construction of cluster-based maps of keyword co-occurrence, co authorship, and citation networks, facilitating the identification of thematic structures and collaborative trends in sustainability related research (Rasuman et al., 2023). Its application in this study supports a comprehensive and visually interpretable analysis of sustainability oriented Electrical Discharge Machining research.

## 3.0 Methodology

This study adopts a bibliometric approach to systematically analyze academic literature related to EDM in trending contexts. The methodology comprises three key stages: data collection, data processing, and visualization analysis using VOS viewer and Excel.

### *3.1 Data Source, Search Strategy, and Processing*

The bibliographic data for this study were retrieved from the Scopus database, which is widely recognised for its extensive coverage of high-quality peer reviewed scientific literature. The dataset was obtained using a structured search strategy designed to capture publications situated at the intersection of Electrical Discharge Machining, sustainability, and manufacturing research. The search was conducted on 16 December 2025, using predefined search parameters applied to the title, abstract, and keyword fields to ensure comprehensive coverage of sustainability oriented EDM studies, applying the following parameters:

- **Search Fields**: Article title, abstract, and keywords
- **Search String**: (TITLE-ABS-KEY ("Electrical Discharge Machining" OR "EDM" AND "sustain*" AND "manufacturing"))
- **Language**: English
- **Time Frame**: 2004 to 2026
- **Subject Areas**: Environmental Science, Social Sciences, Energy, Engineering, and Education

A total of 214 records were retrieved and screened. No records were excluded, as all articles matched the inclusion criteria. The bibliometric analysis was conducted on all 214 articles. The entire data acquisition and screening process is summarised in **Figure 1**. Following extraction, the dataset was processed using Microsoft Excel. Data cleaning included:

- Resolving author and country name inconsistencies
- Filtering and grouping publication years
- Generating trend graphs for yearly publication distribution
- Preparing structured tables for co-occurrence analysis

These pre-processed data were subsequently exported to VOSviewer for network visualisation and bibliometric mapping.

### *3.2 VOS Viewer*

VOS viewer (version 1.6.19) was used to perform co-authorship, co-occurrence, and country collaboration analysis. The software constructs visual networks based on link strength and cluster density, enabling the identification of prominent authors, recurring keywords, and institutional partnerships. The analysis settings included:

- Minimum occurrence threshold for keywords: 20
- Normalisation method: Association strength
- Visual outputs: Network maps, density maps, and overlay maps

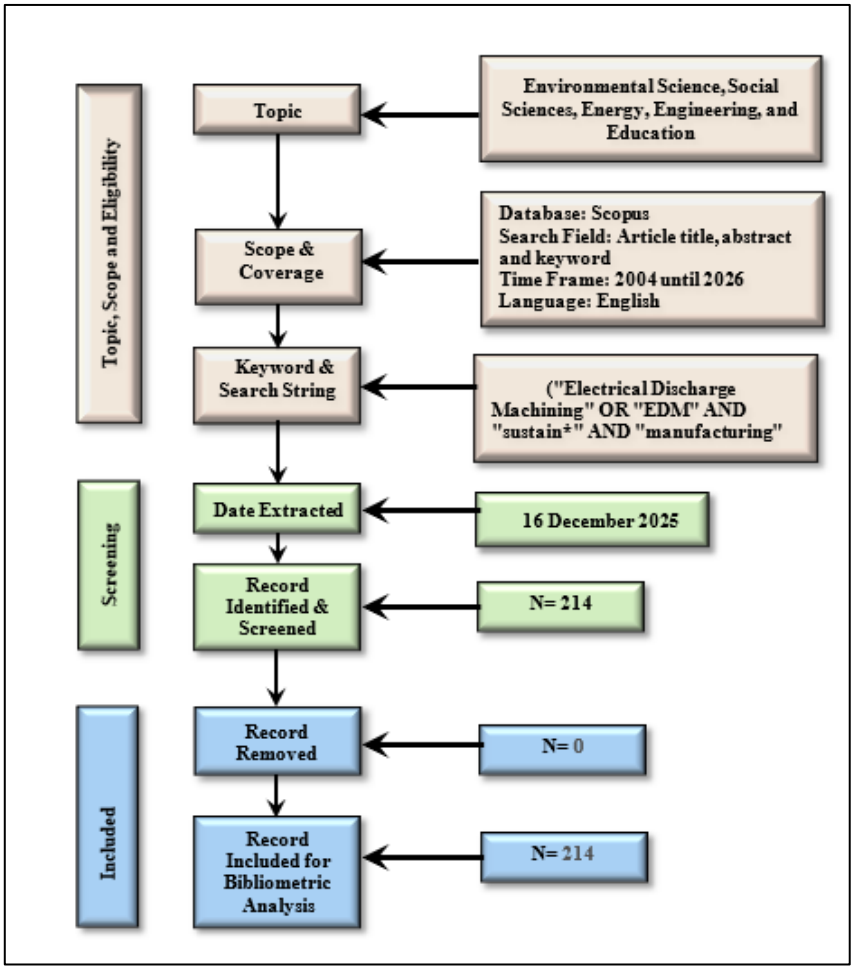



**Figure 6: Workflow of Data Identification, Screening, and Inclusion for Bibliometric Analysis**

## 4.0 Result and Discussion

This section presents a comprehensive analysis of the bibliometric findings derived from Scopus indexed publications on sustainability oriented Electrical Discharge Machining research. The analysis is structured into three main components: publication trends over time,

keyword co-occurrence patterns, and country level research collaboration. Each subsection highlights significant observations based on quantitative bibliometric indicators and network visualisations generated using Excel and VOSviewer.

### *4.1 Article by Years*

#### *Temporal and Geographical Distribution of Publications*

The combined analysis of publication trends by year and country provides important insights into the temporal evolution and global distribution of sustainability oriented Electrical Discharge Machining research. A total of 214 Scopus indexed journal articles published between 1996 and 2026 were analyzed, revealing both a strong growth trajectory over time and a geographically concentrated research landscape. In the early stage of the research period from 1996 to 2010, publication activity was very limited and geographically sparse. During this phase, only a small number of countries contributed sporadically to the literature, reflecting the nascent integration of sustainability considerations within Electrical Discharge Machining research. Sustainability related concepts were not yet widely embedded in manufacturing discourse, and EDM studies largely prioritized machining performance without explicit environmental framing.

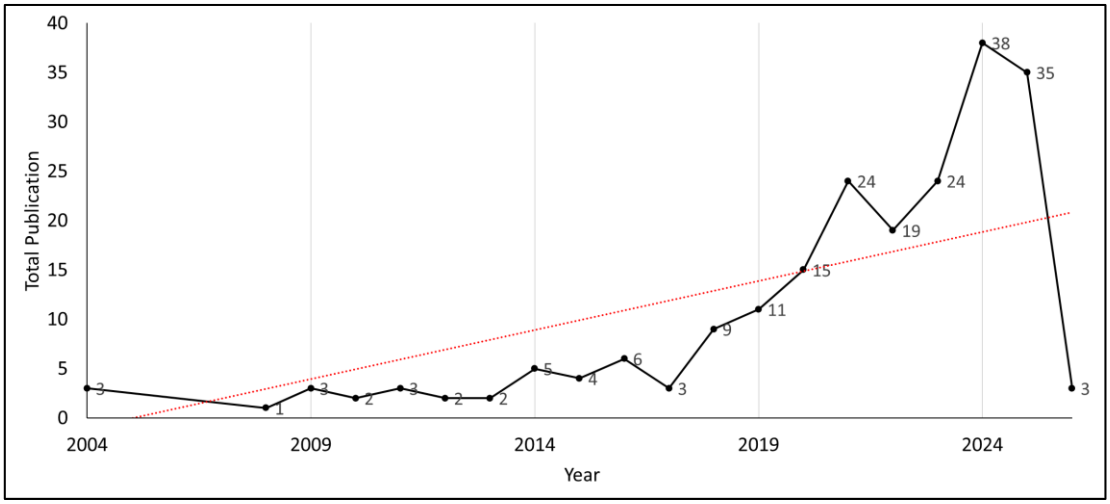



**Figure 2: Publication through years**

A gradual increase in publications was observed between 2011 and 2016. This growth coincided with the broader emergence of sustainable manufacturing as a research priority. Contributions during this period originated primarily from industrialized and emerging manufacturing nations, indicating early recognition of the need to improve resource efficiency and environmental performance in nontraditional machining processes. A significant acceleration in publication output occurred after 2017, with a pronounced surge from 2020 onwards. This period aligns closely with global initiatives on sustainability, energy efficiency, and Industry 4.0. The highest annual publication output was recorded in 2024, followed closely

by 2025, demonstrating sustained research momentum. The continued presence of publications in 2026 further suggests that sustainability oriented Electrical Discharge Machining research remains an active and growing field.

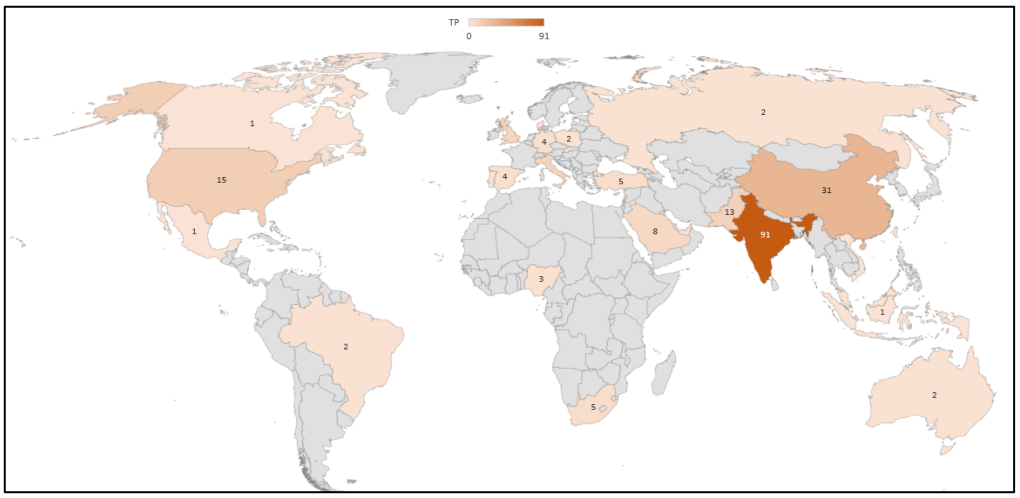



**Figure 3: Countries Mapping with Total Publication**

Geographically, the research output is dominated by a small number of countries. India emerges as the most prolific contributor, accounting for 91 publications, which represents the largest share of the total dataset. This dominance reflects India's strong academic and industrial engagement in Electrical Discharge Machining, particularly in process optimization, alternative dielectric materials, and performance enhancement studies that implicitly support sustainability objectives. China ranks second with 31 publications, indicating substantial research activity aligned with its advanced manufacturing and industrial sustainability initiatives. The United States follows with 15 publications, reflecting steady contributions to sustainable manufacturing and non-traditional machining research. European countries such as Italy, the United Kingdom, Germany, and Spain collectively contribute a significant portion of the literature, highlighting sustained interest in environmentally responsible machining within advanced manufacturing sectors.

Emerging and developing economies also play an important role in shaping the sustainability oriented EDM research landscape. Pakistan contributes 13 publications, while Saudi Arabia, South Africa, Turkey, and Malaysia show moderate but meaningful research activity. These contributions are likely driven by the growing adoption of advanced manufacturing technologies and increasing awareness of sustainable industrial practices. The presence of publications from countries across Africa, Southeast Asia, the Middle East, and South America indicates a gradual global diffusion of sustainability driven EDM research. However, the relatively low publication counts in many regions suggest that sustainability focused EDM studies remain concentrated within a limited number of research-intensive countries.

Overall, the combined temporal and geographical analysis reveals that sustainability oriented Electrical Discharge Machining research has evolved from a marginal topic into a globally recognized research area. The sharp increase in publications after 2020, coupled with strong contributions from both developed and emerging economies, underscores the growing importance of sustainability considerations in nontraditional machining research. These findings highlight opportunities for broader international collaboration and further expansion of sustainability driven EDM studies in underrepresented regions.

### *4.2 Keyword occurrence Keyword Co-Occurrence Analysis*

Keyword analysis provides insight into the thematic structure and intellectual focus of sustainability oriented Electrical Discharge Machining research. In this study, keyword co-occurrence analysis was conducted using VOSviewer to identify high frequency keywords and their interrelationships. Figure 4 presents the keyword co-occurrence network visualisation, while Table 1 summarises the frequency of occurrence and total link strength of the most influential keywords. The VOSviewer analysis reveals several colour coded clusters, each representing a distinct yet interconnected research theme.

1. *Red Cluster*
   Core EDM Process and Sustainability Integration.
   The red cluster represents the core technical foundation of sustainability oriented EDM research.

   i. This cluster is dominated by keywords such as electric discharges, electric discharge machining, electrical discharge machining, and EDM, which record the highest occurrence frequencies and total link strength values.
   ii. The strong centrality of these keywords indicates that sustainability research in EDM is fundamentally grounded in process mechanisms and discharge physics.
   iii. Sustainability related terms including sustainability, sustainable manufacturing, and sustainable development are closely connected to EDM process keywords within this cluster, confirming that sustainability considerations are embedded within the core technical discourse rather than treated as a separate research stream.

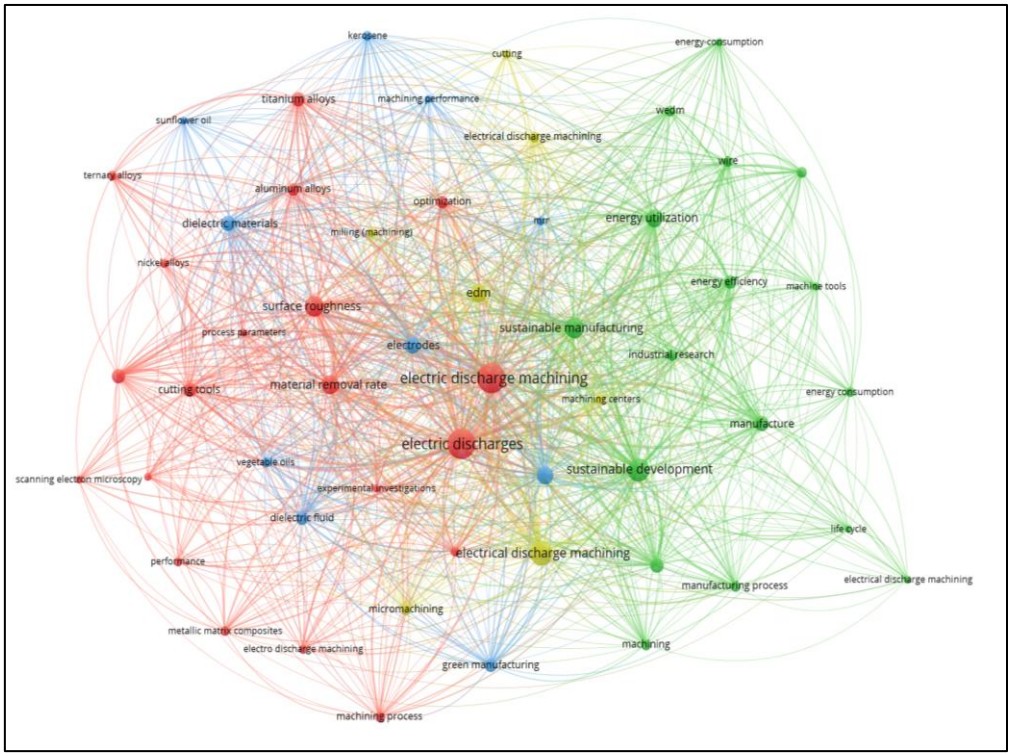



**Figure 4: Keyword Co-occurrence Network Visualization (Generated by VOS viewer)**

**Table 1: Top Keywords by Frequency and Total Link Strength**

| No | Keyword | Occurrence | Link Strength |
|---|---|---|---|
| 1. | electric discharges | 101 | 773 |
| 2. | electric discharge machining | 99 | 756 |
| 3. | electrical discharge machining | 66 | 413 |
| 4. | energy utilization | 34 | 300 |
| 5. | edm | 35 | 227 |
| 6. | electrodes | 28 | 238 |
| 7. | dielectric materials | 25 | 222 |
| 8. | environmental impact | 24 | 195 |
| 9. | cutting tools | 23 | 207 |
| 10. | green manufacturing | 21 | 122 |
| 11. | dielectric fluid | 21 | 155 |
| 12. | energy efficiency | 20 | 177 |
| 13. | aluminium alloys | 19 | 147 |
| 14. | industrial research | 15 | 119 |
| 15. | electrical discharge machining process | 13 | 115 |
| 16. | energy consumption | 11 | 57 |
| 17. | electro discharge machining | 9 | 70 |
| 18. | cutting | 9 | 48 |
| 19. | energy-consumption | 8 | 75 |
| 20. | experimental investigations | 8 | 74 |

2. *Green Cluster*
Machining Performance and Process Optimisation
The green cluster reflects research focused on **performance driven sustainability approaches**.

i. Prominent keywords in this cluster include material removal rate, surface roughness, tool wear rate, machining performance, and process parameters.
ii. These performance indicators exhibit strong interconnections with sustainability and energy related keywords, highlighting their role as practical sustainability proxies.
iii. The emphasis on productivity and quality optimisation suggests that sustainable EDM is often pursued through reduced machining time, improved surface integrity, and enhanced material utilisation.

3. *Blue Cluster*
Energy Efficiency and Resource Utilisation.
The blue cluster captures research addressing **energy related sustainability concerns** in EDM.

i. Keywords such as energy utilization, energy efficiency, energy consumption, and energy-consumption form a well-connected thematic group.
ii. The close linkage between energy related terms and machining performance keywords indicates that energy optimisation is a primary pathway for achieving sustainability in EDM operations.
iii. This cluster reflects growing awareness of energy intensive characteristics of EDM processes and the need for more efficient energy management strategies.

4. *Yellow Cluster*
Materials and Application Oriented Sustainability.
The yellow cluster represents sustainability driven EDM research applied to advanced engineering materials.

i. Key terms include aluminium alloys, titanium alloys, nickel alloys, metallic matrix composites, and ternary alloys.
ii. The presence of these material specific keywords suggests increasing focus on sustainable machining of high value and difficult to process materials.
iii. The linkage between advanced materials and sustainability related terms reflects industrial demand for environmentally responsible manufacturing solutions in critical applications.

5. *Purple Cluster*
Dielectric Fluids and Environmental Impact.
The purple cluster highlights research related to **dielectric media and environmental considerations.**

i. Keywords such as dielectric fluid, dielectric materials, and kerosene represent conventional EDM dielectric research.
ii. The inclusion of vegetable oils and sunflower oil indicates emerging interest in biodegradable and environmentally friendly dielectric alternatives.
iii. This cluster reflects increasing concern for reducing environmental impact, health risks, and hazardous waste associated with traditional dielectric fluids.

***Overall Network Structure and Interpretation***

The keyword co-occurrence network demonstrates a highly interconnected research structure in which sustainability acts as a central linking concept across all colour coded clusters. Energy efficiency, machining performance, material selection, and dielectric innovation are closely coupled rather than treated as isolated research directions. This multidimensional network structure confirms that sustainability oriented Electrical Discharge Machining research integrates technical performance optimisation, environmental considerations, and energy efficiency in a holistic and interconnected manner.Overall, the colour coded keyword clusters reveal that sustainability in Electrical Discharge Machining research is achieved primarily through process optimisation, energy efficiency, material specific applications, and environmentally responsible dielectric development.

### *4.3 Country Collaboration*

Country collaboration analysis was conducted to examine international research linkages in sustainability oriented Electrical Discharge Machining studies. **Figure 5** illustrates the country collaboration network, highlighting the strength and structure of international research connections, while **Table 2** summarises the number of documents, citation counts, and total link strength for the leading contributing countries. This analysis provides insight into how countries collaborate, the intensity of their research networks, and the extent to which sustainability driven EDM research is globally integrated based on publication output, citation impact, and collaborative link strength.

### *4.3.1 Connections Between Countries*

The country collaboration network reveals a moderate level of international cooperation, with several countries demonstrating strong publication output and citation impact but varying degrees of collaborative connectivity. India emerges as the most productive country with 90 documents and the highest citation count of 1865. However, its total link strength remains relatively low at 6, indicating that a substantial portion of its research output is produced through domestic collaborations rather than extensive international partnerships. China records 31 documents with a high citation count of 686 and a total link strength of 16, suggesting a more balanced combination of research productivity and international collaboration. The United States also demonstrates strong research influence, contributing 18 documents and accumulating 728 citations, supported by a total link strength of 12. This indicates consistent engagement in international collaborative research.

European countries show notable collaborative behavior. The United Kingdom contributes 10 documents with 442 citations and a relatively high total link strength of 17, reflecting strong international research linkages. Italy, although contributing a smaller number of documents at 11, demonstrates meaningful collaboration with a total link strength of 3, indicating selective but focused international partnerships. Pakistan exhibits a distinct collaboration profile, contributing 13 documents with 144 citations and the highest total link strength of 20 among all countries. This suggests that Pakistan's sustainability oriented EDM research is strongly driven by international collaborations. Saudi Arabia also shows active collaboration, with 8 documents and a total link strength of 14, reflecting its growing engagement in joint research initiatives. In contrast, countries such as South Africa and Turkey exhibit lower publication output and weaker collaboration strength, indicating limited integration within the global EDM sustainability research network.

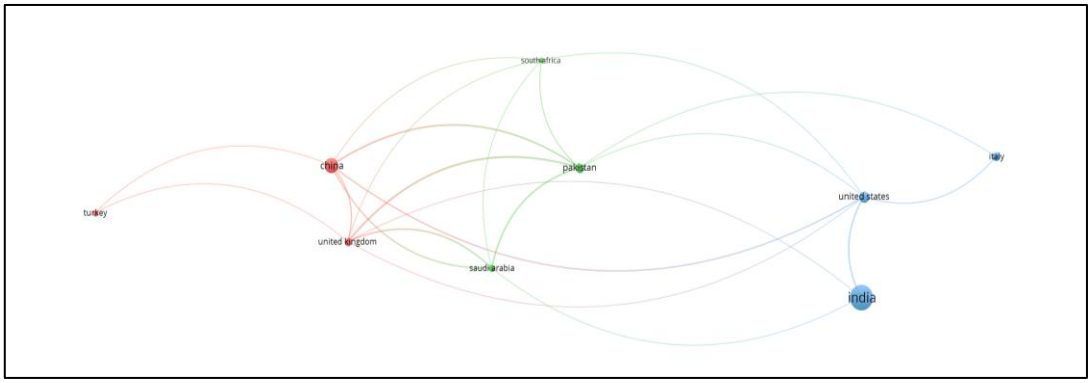



**Figure 5: International Collaboration Network Based on Co-authorship (Generated by VOS viewer)**

**Table 2: Country-wise Documents, Citations, and Collaboration Link Strength**

| Country | Documents | Citations | Total Link Strength |
|---|---|---|---|
| China | 31 | 686 | 16 |
| India | 90 | 1865 | 6 |
| Italy | 11 | 188 | 3 |

| | | | |
|---|---|---|---|
| Pakistan | 13 | 144 | 20 |
| Saudi Arabia | 8 | 105 | 14 |
| South Africa | 5 | 13 | 6 |
| Turkey | 6 | 41 | 2 |
| United Kingdom | 10 | 442 | 17 |
| United States | 18 | 728 | 12 |

#### *4.3.2 Noteworthy Observations:*

Several important observations can be drawn from the country collaboration analysis.

i. High research productivity does not necessarily correspond to strong international collaboration. India demonstrates exceptional publication volume and citation impact but relatively limited collaborative linkage strength.
ii. Countries with moderate publication output, such as Pakistan and the United Kingdom, exhibit strong collaboration intensity, highlighting the strategic role of international partnerships in enhancing research visibility and integration.
iii. Citation impact appears to be influenced by both research volume and collaborative reach. Countries such as the United States and China benefit from balanced productivity and collaboration, resulting in high citation counts.
iv. Fourth, emerging economies increasingly participate in international EDM sustainability research, indicating a gradual diversification of the global research landscape.

#### *4.3.3 Potential Areas of Improvement*

Despite the presence of active international collaboration, several opportunities for improvement are identified.

i. There is a need to strengthen cross regional collaboration between high productivity countries and those with emerging research capacity. Increased cooperation between Asia, Europe, and Africa could enhance knowledge exchange and promote more globally inclusive sustainability driven EDM research.
ii. Encouraging multi country research projects focused on energy efficiency, environmentally friendly dielectric fluids, and sustainable material processing could further strengthen collaborative networks.
iii. Additionally, countries with high domestic research output but limited international collaboration could benefit from increased participation in global research consortia and joint publications. This would improve research visibility, citation impact, and the overall coherence of sustainability oriented EDM research.
iv. Overall, enhancing international collaboration represents a key opportunity to accelerate innovation, improve research quality, and support the global advancement of sustainable Electrical Discharge Machining practices.

## 5.0 Conclusion and Future Direction

This study has presented a comprehensive bibliometric analysis of sustainability oriented Electrical Discharge Machining research using Scopus indexed journal publications. By examining publication trends, keyword co-occurrence networks, and country collaboration patterns, the study provides a structured overview of how sustainability considerations have evolved and been integrated into EDM research over time. The analysis of publication trends reveals that sustainability related EDM research remained limited during the early years but experienced substantial growth after 2017, with a marked increase from 2020 onwards. This growth reflects rising global awareness of sustainable manufacturing, energy efficiency, and environmental responsibility within advanced machining research. The sustained publication output in recent years indicates that sustainability has become an established and continuing research focus in Electrical Discharge Machining. Keyword co-occurrence analysis demonstrates that sustainability in EDM research is not treated as an isolated concept but is embedded within core technical themes. Energy efficiency, machining performance optimisation, material selection, and dielectric fluid innovation emerge as dominant pathways through which sustainability objectives are pursued. The strong interconnections among these themes highlight the multidisciplinary nature of sustainability oriented EDM research, integrating technical, environmental, and energy related considerations. Country collaboration analysis shows that research productivity and collaborative intensity vary significantly across countries.

While some countries contribute a high volume of publications, international collaboration remains relatively limited in certain regions. Conversely, other countries demonstrate strong collaborative networks despite moderate publication output. These findings suggest that enhanced international collaboration could play a critical role in strengthening knowledge exchange, improving research impact, and accelerating innovation in sustainable EDM technologies. In conclusion, this bibliometric study provides valuable insights into the research landscape and development trajectory of sustainability oriented Electrical Discharge Machining. The findings highlight the need for greater integration of energy efficiency, environmental assessment, and collaborative research efforts to advance sustainable non traditional machining practices. Future research may benefit from expanded international partnerships, deeper life cycle assessment studies, and the application of intelligent optimisation techniques to further enhance the sustainability performance of Electrical Discharge Machining processes.

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# POSEGUARD – A REAL-TIME FALL DETECTION AND NOTIFICATION SYSTEM FOR HOSPITAL WARDS USING AI POSE ESTIMATION

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***Abstract:*** *Patient safety is a critical aspect in healthcare, particularly at hospital wards where elderly individuals, post-operative patients, patients receiving psychotropic medication and those with limited mobility are at higher risk of falling. Falls often result in serious injuries, such as fractures, head trauma and spinal cord injury which can lead to prolonged hospital stay and increasing medical costs and workload for the healthcare staff. Despite standard monitoring practices, most hospitals still rely on manual surveillance by nurses, which can be inconsistent and inefficient especially during night shifts or peak hours. To address this limitation, this paper presents PoseGuard, a real-time fall detection and notification system powered by Artificial Intelligence. This project leverages Artificial Intelligence (AI) technology, specifically pose estimation using OpenCV and TensorFlow, to extract skeletal key points and analyse patient posture. The AI model is developed using Teachable Machine web tool and demonstrate that the model achieves a detection accuracy of 95%. A camera is connected to Raspberry pi microprocessor to capture live video feed. When fall is detected, visual alarm is triggered by activating flashing light and notification alert is sent to the healthcare staffs within seconds. These findings suggest that the PoseGuard can significantly mitigate the severity of fall incidents by enabling prompt staff response, thereby enhancing the overall quality and efficiency of hospital care.*

***Keywords:*** *Artificial Intelligence, Fall Detection, Hospital Ward, IoT, Pose Estimation*

## Introduction

According to World Health Organization (WHO), fall is define as an event which results in a person to rest inadvertently on the ground or floor or other lower level(WHO, 2007). In healthcare institution, patient safety is the foremost priority. However, accidental falls remain as the leading cause of accidental injury within hospital environment worldwide(Yasan et al., 2020). The high-risk groups including elderly, post-operative patient especially receiving psychotropic medication and individual with limited mobility or cognitive impairment are the one who should be given the priority for continuous monitoring (Kulurkar et al., 2023; Vassallo et al., 2009).

Factor of fall in hospital setting especially in ward can be categorised into two groups namely intrinsic and extrinsic. The characteristic of intrinsic factors is sex, type of disease, problem in sleeping, cognitive and physical impairment and medication used. In contrast, extrinsic factor involve in slippery floor, unsafe footwear, non-sturdy chair, low lighting and absence of walking aid (Lee et al., 2022; Takase, 2023).

Thus, it is important to detect fall as early as possible because it will affect the delay in response times, which can lead to severe injury such as fractures, head trauma and spinal cord injury which can lead to prolonged hospital stay and increasing medical costs and workload for the healthcare staff.

Currently, hospitals rely on manual monitoring, which is difficult when nurses are overworked and working on night shift. According to a study, falls prevention education was not systematically implemented in the hospital ward. This is due to the lack of staff, heavy workload and limited time(Heng et al., 2022).

In addition, there are wearable devices developed, but patients often forget to wear them or remove them because they are uncomfortable to do their daily activities(Chang et al., 2021). F. Padme (2023) develop a wearable device that able to send SMS when fall is detected. The sensor used is accelerometer to measure the tilt angle and thus predicting the body position. The device is placed at the lumbar area of the patient (Padme et al., 2023).

The development of PoseGuard – A Real-time Fall Detection and Notification System in Hospital Wards using Artificial Intelligence Pose Estimation serves to overcome this issue. The objective of this project is to develop a computer vision system to track human anatomical keypoints using Artificial Intelligence Pose Estimation technique to detect fall and trigger a visual alarm and mobile notification.

Pose estimation is one of the techniques in Artificial Intelligence which uses computer vision to detect human anatomical or keypoint on the body from the digital media like digital picture or digital video. The keypoints include elbow, knee, ankle, hip, shoulder, foot, hand and face. This technique able to track human movement and offers great advantages(Stenum et al., 2021).

## Methodology

The development of PoseGuard was structured into three phases to ensure the effectiveness and robustness of the detection model under real-world conditions. The first process was system design, followed by software development and lastly, hardware integration. These processes were excecuted carefully and systematically to ensure seamless integration between AI and IoT system.

### *System Design*

The system design process focused on defining the architecture and selecting the appropriate components to be used in this project. The block diagram of this project is shown in Figure 1. This project use Raspberry pi as the core processing unit. The camera serves as the visual input to the Raspberry pi. When fall is detected, the system will trigger two outputs which are a flashing light as a visual alarm and a mobile notification to the healthcare staff. The notification will be sent via Blynk apps for its cross-platform compatibility and user-friendly interface.

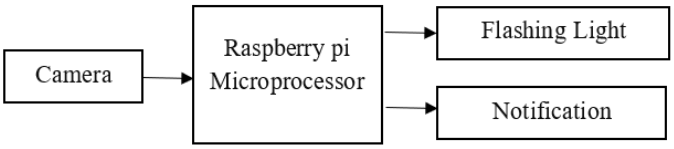



**Figure 1: Block diagram**

***Software development***

In this phase, the core execution where the intelligence was developed. AI model of Pose Estimation technique was deployed in the Python programming which involve computer vision and decision-making logic. The AI model was developed using Teachable Machine platform. The Teachable Machine is a web-based tool developed by Google to create machine learning model fast, easy, accurate and most importantly it is free.

The model was trained using three different postures of dataset which are standing, sitting and falling. 100 of pictures were taken for each of the category and to ensure the model is accurate and robust, a wide variety of dataset was prepared including different genders, heights and environments.

After successfully developed the model, the model was inserted in the programming code. The code was written in Python language. In addition, an instruction was added in the code so that when the fall is detected, a signal will be sent to Blynk server to trigger a notification to mobile phone.

***Hardware development***

The final step involves the deployment of software onto the physical hardware to create a functional product capable of operating in real-world environment. In this phase, the components were connected as shown in Figure 2. The camera was connected to USB port of the Raspberry pi. The relay module was utilized to act like a safety switch. This will allow Raspberry pi to trigger the Flashing Light, which operates on a high voltage. The system was connected to a local Wi-Fi network to enable communication with the Blynk Cloud.

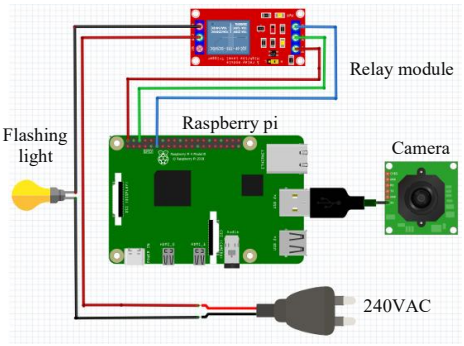



**Figure 2: Circuit connection**

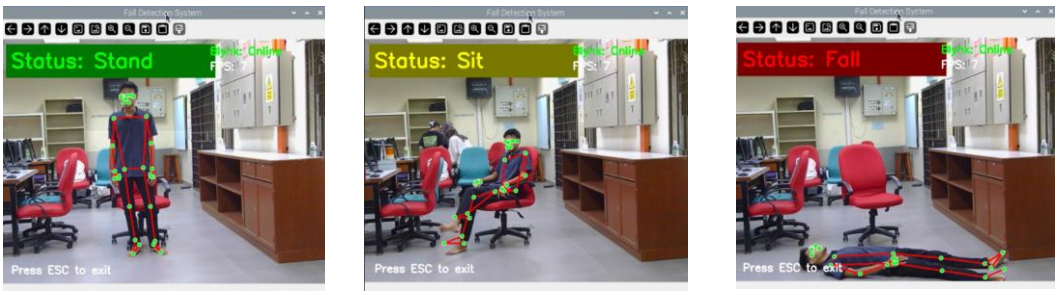
## Result and Discussion

The PoseGuard – A Real-time Fall Detection and Notification System in Hospital Wards using Artificial Intelligence Pose Estimation was successfully developed and tested in the laboratory to ensure the reliability.

### *Fall Detection*

A subject was asked to perform the test on the PoseGuard by performing three different posture which are standing, sitting and falling. Based on the posture of the subject, the outputs of PoseGuard ware observed. As stated in the methodology chapter, the PoseGuard will trigger a visual alarm and mobile notification whenever the fall posture was detected.

The results of the postures were depicted in the pictures below. Figure 3a shows that PoseGuard successfully detected the anatomical keypoints of the subject when he was in standing position. During this position, the visual alarm which is the flashing light is not activated. Similarly, no notification was sent to the mobile phone.




**a)** **b)** **c)**

**Figure 3: a) Standing Detection b) Sitting Detection c) Fall Detection**

The sitting posture was detected when the subject was asked to sit at the chair as shown in Figure 3b. Immediately, the status changed from stand to sit. Again, visual alarm was not triggered and mobile notification was not sent.

Lastly, the subject was asked to be in the falling posture as shown in Figure 3c. The PoseGuard instantly detect fall posture and the status changed to fall. Next, visual alarm is triggered and a notification is sent to the mobile phone.

### *Notification*

The implementation of Internet of Things technology to this project is crucial to monitor the response time upon fall is detected. Faster response times directly correlate with higher survival rates and more effective treatment. The PoseGuard project was integrated with Blynk apps to deliver real-time alert to healthcare staff. The notification will be sent to the nurses' mobile phone displaying "FALL DETECTED! Please check immediately" accompanied by a distinct vibration and alarm sound to ensure immediate attention. The notification sent was shown in the Figure 4.

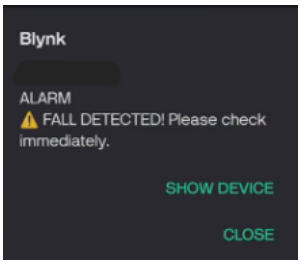



**Figure 4: Notification alert**

## Conclusion

In conclusion, the PoseGuard – A Real Time Fall Detection and Notification System for Hospital Wards using Artificial Intelligence successfully delivered the stated objective. The AI model using Pose Estimation technology was develop to detect fall automatically and triggered visual alarm and mobile notification to alert healthcare staff in the hospital.

The integration between the newest technologies which are Artificial Intelligence (AI) and Internet of Things (IoT) represents the significant innovation in medical technology which will ensure patient safety and able to mitigate the severity of fall incidents by faster staff response thus, enhancing the overall quality and efficiency of hospital system.

PoseGuard provides several advantages to both nurses and hospital. In terms of real time automation, this project removes the needs for constant monitoring from the nurses. Most importantly, it allows nurses to focus on critical care or workload without worrying about unmonitored patient and thus reducing nurses' workload. With the dual-alert system which is visual and mobile notification of this PoseGuard, no fall goes unnoticed and response time will be reduced. This will result in better performance in hospital reputation. The Raspberry pi used in this project is not only affordable yet powerful which is suitable to be deployed in the hospital. The hardware of this project is also easy to install and portable. This project is also aligned with the United Nations Sustainable Development Goals, specifically to support innovation (SDG0), reduce inequalities (SDG10) and develop a sustainable community (SDG11).

In the future, it is recommended to use high resolution, wide range and night vision camera to increase the detection capability especially in the night and low light condition. Moreover, the utilization of powerful microprocessor like mini-PC or Jetson Nano is suggested as to increase the processing rate. The PoseGuard sets a benchmark for innovative project, paving the way for better life in the community.

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# DISASTER PREPAREDNESS: EXPLORING EMERGENCY BAG ADOPTION AMONG UNIVERSITY STUDENTS

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***Abstract:*** *Island communities are highly exposed to climate hazards such as coastal flooding, storm surges, heavy rainfall, which often lead to secondary impacts, including service disruptions. In these settings, university students living on island campuses represent a critical population whose level of preparedness is often limited. One practical measure to strengthen readiness is the use of an emergency bag, commonly referred to as a "bug-out bag" or grab-and-go kit. This study explores how island university students perceive the idea of an emergency bag, the challenges they face in preparing one, and the essential items they consider most relevant to their circumstances. The initial exploration focused on three main aspects which consist of awareness and interpretation of emergency bags, barriers such as affordability, space limitations, and uncertainty about appropriate contents in addition to student-driven suggestions for a realistic starter kit suitable for island living. Findings suggest that while many students were unfamiliar with the formal concept, they recognised its importance when linked to hazards they had personally experienced. The most common barriers identified were cost, lack of storage space in hostels, and limited knowledge of appropriate contents. Students consistently highlighted waterproof phone pouches, portable power banks, ponchos, flashlights, and basic first-aid items as top priorities for a practical starter kit. This study emphasizes the importance of translating disaster preparedness into simple, affordable, and student-friendly practices. By aligning emergency kit recommendations with the lived realities of island youth, universities can play a proactive role in nurturing a culture of safety and resilience among the future generation*

***Keywords:*** *disaster, island, emergency bag, resilient, university*

## Introduction

Natural hazards including coastal flooding, storm surges and intense rainfall pose significant risk to communities worldwide.(Sun et al., 2024) These hazards often generate secondary impacts, including disruptions electricity, water supply, transportation and communication services which affect daily activities and compromise personal safety (Mühlhofer et al., 2024; Taupo et al., 2018). In long term, these hazards can lead to destruction, displacement, and socio-economic challenges underscoring the universal importance of effective disaster preparedness and mitigation strategies (IPCC, 2022). The escalating frequency and intensity of these hazards often exacerbated by climate change, necessitate a good understanding of their impact to vulnerable population (Goniewicz et al., 2023; Ismail-Zadeh, 2022).

Among one of the vulnerable populations are island communities. Island communities are increasingly exposed to climate hazard such as flooding, coastal erosion, heavy rainfall and storm surge (Kelman et al., 2015; Lin et al., 2025). Within these setting university students living on island represent a distinctive yet understudied population. Many students reside in shared accommodation with limited storage space, depend on personal mobility, and assume that disaster response will be managed by institutional authorities (Magni et al., 2019). These conditions may reduce preparedness actions in individual level.

One widely recommended preparedness measure is the use of a personal emergency bag, sometimes referred to as bug out bag or grab and go kit (Gutierrez et al., 2018; Pickering et al., 2018). However most emergency kit guidelines are designed for households or families and may not reflect the spatial, financial, and lifestyle constraints by university students especially in particularly in island environments (Pickering et al., 2018).This study aims to explore island university students perception of emergency bags, identify the barriers they face in preparing one, and document the essential items they consider more relevant to their circumstances. By focusing on student-defined priorities, the study seeks to inform more practical and contest sensitive disaster preparedness strategies for island campus.

## Literature Review

Studies on disaster preparedness consistently highlight the importance of household-level readiness, which includes emergency supplies, communication plans, and early response actions (Khunwishit & Choosuk, 2022; Levac et al., 2012). However, preparedness levels remain uneven across diverse population groups (Ni et al., 2025). Previous research has also shown that island communities face heightened vulnerability to climate-related hazards due to factors such as geographical isolation, limited evacuation routes, and a dependence on centralized infrastructure (Butler et al., 2020; Lin et al., 2025). Their unique characteristics amplify risks and hinder effective recovery from natural disasters (Kelman et al., 2015; Roland, 2024).

Youth and university students have often been found to exhibit lower level of disaster preparedness despite relatively high awareness of environmental risks (Gökçay et al., 2024; Tanner & Doberstein, 2015). This is frequently related to limited financial resources, transient living arrangements, and a perception that preparedness responsibilities lie with families, landlords, or authorities rather than themselves (Magni et al., 2019). Within campus environments, shared facilities and institutional support systems may further reduce students' perceived personal responsibility for preparedness (Ronik Ketankumar et al., 2020).

Emergency bags, or personal emergency kits, are commonly recommended as a basic preparedness measure, particularly in contexts where evacuation or temporary displacement may occur (Pickering et al., 2018). However, most existing guidelines for these kits are designed for households or families and may not adequately reflect the spatial, financial, and mobility constraints experienced by students (Heagele, 2016). This indicates a pressing need for context-specific preparedness strategies that are tailored to the lived realities of university students, especially those living on islands.

## Methodology

This study adopts an exploratory cross-sectional design to examine island university students' perceptions of emergency bags and the barriers influencing preparedness. This approach is appropriate for identifying initial patterns and informing the development of more focused research questions for subsequent empirical studies. Data collection is planned using a structured, self-administered questionnaire targeting undergraduate and postgraduate students residing on an island campus.

The questionnaire captures four main dimensions: personal experience with disasters or hazard-related impacts, including events experienced both on the island and in students' home regions; awareness of island-related hazards and their secondary effects; perceptions and barriers to emergency bag preparation, such as affordability, space limitations, and knowledge constraints; and current preparedness practices and preferred emergency kit items. In addition, the instrument explores students' self-perceived responsibility for their own safety during the first 72 hours following a disaster, recognising a commonly observed gap between perceived responsibility and actual preparedness behaviour (Patel et al., 2023). This exploratory focus seeks to generate insight into the psychological and logistical factors shaping student preparedness rather than statistically generalisable results.

The instrument incorporates multiple-choice, checkbox, Likert-scale, and open-ended questions to support both descriptive and interpretive analysis. Planned analysis includes descriptive statistics to summarise preparedness levels and perceived barriers, alongside thematic summarisation of open-ended responses to identify student-driven priorities for a starter emergency kit. Accordingly, the methods presented in this paper reflect an initial stage of inquiry intended to inform subsequent empirical investigation.

## Exploratory Findings

The exploratory focus of this study highlights several important patterns regarding disaster preparedness among island university students, particularly in relation to emergency bag awareness, perceived barriers, and item prioritisation. First, students' understanding of emergency bags appears to be limited at a conceptual level. While many students are unfamiliar with formal terms such as "bug-out bag" or "grab-and-go kit," they tend to recognize the underlying idea once it is linked to real-life hazard experiences. Students who have previously encountered event such as flooding, prolonged rainfall, or secondary impact of hazards such as power disruptions are more likely to associate emergency bags with practical needs during emergencies, including maintaining communication, staying dry, and access basic medical support. This suggests that lived experience plays an important role in shaping perceived relevance of preparedness measures.

Second, multiple barriers constrain students' ability to prepare an emergency bag, with affordability and spatial limitations emerging as dominant concerns. Students living in hostel or shared accommodation often report limited storage space, making it difficult to keep additional items that are not part of their daily routine. Financial considerations further influence preparedness decisions, as students tend to prioritise academic and daily living expenses over emergency supplies that may not be immediately needed. Uncertainty regarding what items are essential also contributes to delayed or absent preparedness actions, indicating gaps in practical knowledge rather than a lack of concern.

Third, despite these constraints, students demonstrate clear preferences when asked to identify essential emergency items. There is a consistent emphasis on compact, portable, and multifunctional items that align with student mobility and island conditions. Frequently highlighted items include waterproof phone pouches, portable power banks, ponchos or lightweight rain protection, flashlights, and basic first-aid supplies. These choices reflect an emphasis on maintaining communication, mobility, and personal safety during short-term disruptions rather than long-duration evacuation scenarios.

Collectively, these insights suggest that preparedness among island university students is less constrained by attitudes toward safety and more by practical considerations related to cost, space, and knowledge. The findings indicate that emergency preparedness initiatives targeting students may be more effective if they focus on simplified, low-cost starter kits and clear guidance tailored to hostel-based living and island-specific hazards.

**Discussion**

The exploratory understandings from this study contribute to a growing body of research highlighting the gap between disaster awareness and practical preparedness among young adults, particularly within island contexts. Although island university students are frequently exposed to hazard-related information and, in some cases, have experienced flooding or service disruptions, this exposure does not automatically translate into proactive preparedness behaviours such as assembling an emergency bag. This reinforces existing evidence that awareness alone is insufficient to motivate protective action when practical and contextual constraints remain unaddressed.

From a theoretical perspective, these patterns are consistent with Protection Motivation Theory (PMT). Students' recognition of the importance of emergency bags when linked to real experiences reflects elements of threat appraisal, particularly perceived severity and personal relevance. However, preparedness behoviour appears to be more strongly shaped by coping appraisal factors, including perceived response costs and self-efficacy. Financial limitations, lack of storage space in hostel environments, and uncertainty regarding appropriate emergency bag contents collectively reduce students confidence in their ability to prepare effectively, thereby weakening motivation to act despite awareness of potential risks.

The strong preference for compact, portable, and multifunctional items further illustrates how preparedness decisions are shaped by students' everyday realities. Rather than comprehensive household-style emergency kits, students prioritise items that support immediate needs such as communication, mobility, and basic personal safety during short-term disruptions. This finding highlights the limitations of generic preparedness guidelines, which are often designed for households and may not resonate with student populations living in shared accommodation with limited space.

The island setting amplifies the significance of these findings. Geographic isolation, dependence on centralised infrastructure, and limited redundancy in essential services mean that even moderate hazards can result in disproportionate impacts for island residents. For students living on island campuses, temporary service disruptions can rapidly affect wellbeing and safety, particularly when individual preparedness is low. In this context, emergency bags

function not only as practical preparedness tools but also as indicators of personal responsibility and adaptive capacity within a broader institutional safety framework.

These insights have important implications for universities and campus administrators. While institutional emergency response systems are essential, they should be complemented by initiatives that encourage individual preparedness in realistic and attainable ways. Universities can play a facilitative role by promoting low-cost starter emergency kits, providing clear and accessible guidance, and integrating preparedness messaging into student orientation or residential life programmes. Aligning preparedness initiatives with student-defined priorities and constraints may help foster a more inclusive and effective culture of safety and resilience on island campus

## Conclusion

This study contributes to the growing discourse on disaster preparedness by focusing on island university students, a population that is frequently overlooked in preparedness planning despite their exposure to climate-related hazards and associated service disruptions. By exploring students' perceptions of emergency bags, identifying key barriers to preparedness, and documenting student-defined priorities for essential items, the study highlights the importance of translating disaster preparedness into practices that are practical, affordable, and aligned with students' lived realities.

The exploratory insights suggest that preparedness among island university students is shaped less by a lack of concern and more by practical constraints, including affordability, limited storage space in hostel environments, and uncertainty regarding appropriate emergency kit contents. Students' preference for compact and multifunctional items underscores the need for preparedness guidance that moves beyond household-based assumptions and instead reflects the mobility, spatial limitations, and daily routines characteristic of student life on island campuses. From a theoretical perspective, these observations are consistent with Protection Motivation Theory, particularly the influence of perceived response costs and self-efficacy on preparedness behaviour.

Several limitations of this study should be acknowledged. As an exploratory investigation, the findings are not intended to be statistically generalisable and are based on planned and preliminary inquiry rather than completed empirical analysis. In addition, the focus on a single island university context may limit direct transferability to non-island or mainland campuses, where hazard exposure and institutional arrangements differ. The reliance on self-reported perceptions also means that stated preparedness intentions may not fully reflect behaviour during actual disaster events.

Future research should build on this foundation through empirical data collection with larger and more diverse student samples, as well as through longitudinal or mixed-method approaches to examine how preparedness behaviours evolve over time and in response to hazard experience. Further work could also assess the effectiveness of targeted interventions, such as low-cost starter emergency kits, campus-based preparedness campaigns, or integration of preparedness education into student orientation programmes. By strengthening individual preparedness among island university students, universities can play a meaningful role in enhancing campus safety and fostering broader community resilience in disaster-prone island environments.

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# FROM RULES TO GRAPH LEARNING: A REVIEW OF COMPUTATIONAL APPROACHES TO DETECT SUSPICIOUS BANK TRANSACTIONS

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***Abstract:*** *In the early 2000s, automated suspicious transactions detection systems have been introduced to manage the transactions' volume and complexity. Technological advancements have led to the convergence of Artificial Intelligence and Big Data Analytics to analyse transaction data, and this advancement comes at a significant cost. Despite the considerable advancement and expenditure, limitations still exist and need attention to prevent loss. This review maps the approaches used to detect suspicious bank transactions which have evolved, between 2012 and 2025 and analyses the datasets used. Articles collected for this study are from the Scopus-indexed journals and the search term used was "money laundering detection". The collection process was limited to articles from computer science subject area that focus on detecting suspicious bank transactions. The collection of articles was then screened to exclude conceptual profiling, risk assessment, Hawala networks, and fraud. Then, the process continues with extracting problems and limitations, proposed solutions, algorithms, and dataset characteristics from each article. The datasets used in each article were organized into classes of forensic criminal investigations, operational bank Anti-Money Laundering (AML)/ Suspicious Activity Report (SAR)-level data, and synthetic/simulator-based data. Result shows the researchers are moving from rule-based and clustering approaches to machine learning, then to graph-based and deep learning models to detect suspicious transactions but, more than 20% of the sample articles used synthetic datasets in their study. Due to the absence of the detailed forensic insights, analysis using synthetic datasets should be conducted carefully. Besides detection methods and algorithms, datasets realism is also critical, especially when involving public policy and banking practice.*

***Keywords:*** *Suspicious Transaction Detection, Anti-Money Laundering, Bank Transactions, Dataset Tier, Machine Learning*

## Introduction

Suspicious transactions are transactions that involve unusual activity such as amount received that is inconsistent with the customer's profile or complex transactions that involve multiple accounts. This is usually a key indicator of money laundering, prompting s formal Suspicious Activity Report (SAR) as outlined by the Anti-Money Laundering (AML) regulations. Financial institutions around the world adopted the AML program as per required by the respective central banks and regulators. They can be penalized if they fail to report any suspicious transaction.

The banks rely on the rule based and threshold conditions to detect suspicious transactions. For example, the amount value (base amount) for both Transaction A and Transaction B is more

than the defined threshold, Ringgit Malaysia 50 thousand' per transaction. (Bank Negara Malaysia n.d) will get flagged and prompt further investigations. The rule-based and threshold setting are applied because the regulators can interpret them, but the downside of the setting is, they cannot adapt to the changes and complex transactions, purposely planned by the criminals to hide and disguise their true origins and ownership of their illicit funds. This leads to many false alarms, and the perpetrator evaded the law because they successfully exploit the rule and the threshold.

The rule-based systems have been implemented by banks since a decade ago. Bank employees need to spend a lot of time performing manual reviews to identify suspicious transactions (Pambudi et al., 2019). The research literature has tried to improve the detection rate by applying data mining to identify patterns and anomalies in large datasets (Rajaprkash et al., 2025). Machine learning models such as Support Vector Machine (SVM) and Random Forest are adopted and show high detection rate (Tan et al., 2020). Clustering has been used to group the transactions so that any transaction that deviates from the cluster's norm or has distance greater than the threshold is recorded as suspicious thus, needs further investigations (Chen et al., 2021). The Bayesian Networks is adapted to detect transactions that deviates from the baseline scores. Initially, the baseline score is assigned to each customer based on the rules and regulations set by the Central Bank (Imani et al., 2025). Furthermore, the Bayesian Networks can record the probability of related variables to the suspicious transactions. The research literature also explores the performance of two ensemble learning methods, XGBoost and Random Forest. Both methods outperform other machine learning models especially when XGBoost combined with techniques like SMOTE (Uma & Priya, 2023) and Random Forest that has been modified with weighted class (Guo et al., 2025) when dealing with imbalance data. The research on using Graph Neural Networks (GNNs), Graph Attention Network (GAT), and multiagent reinforcement learning to detect suspicious transactions is getting attention in recent years due to the transactions' complexity and evolving fraudulent activities have been identified. The GNNs model financial transactions as graph with the nodes as the account and the edges as the transactions between the accounts. Complex transactions that are usually associated with money laundering such as transferring funds between multiple accounts, can be captured through the graph structure (Wang et al., 2024). Variants of GNNs such as the GAT is used to focus on the relevant parts of the graph to enhance the sensitivity to suspicious transactions (Cui et al., 2025). The combination of GNNs and reinforcement learning allow the model to detect new suspicious patterns by adjusting the detection threshold dynamically (Singh & Gupta, 2025). Furthermore, the reinforcement learning can be integrated with feature importance techniques to identify the features that indicate suspicious transactions and improve the detection's performance (Leon et al., 2022).

However, these literatures pay less attention to the dataset type used to test their study and raise the question: What dataset these models trained and evaluated on? Many articles may have ignored that there are different type of dataset and setting: real bank transactions with actual SAR filing, forensic dataset from investigation, and synthetic dataset from simulators. Thus, results from different dataset type and setting cannot be treated as equivalent. A model that trains on synthetic dataset and performs well may not perform as expected when deployed in a real financial institution. Therefore, the objectives of this review are: 1) To analyse the progression of suspicious transaction detection methods between 2012 and 2025 and 2) To classify the findings based on dataset fidelity, differentiating between: forensic datasets, alert-level datasets, and synthetic datasets. Consequently, this study intends to differentiate findings

using operational validated datasets from the ones using synthetic datasets but with promising prototypes.

## Literature Review

### *Rule-based and Early Data Mining Approaches*

Banking sector relied on rule-based settings with pre-defined threshold in the early AML system. Experts in the AML field are also involved to identify the AML red flag. The indicators considered by the AML system are transaction level indicator such as amount, frequency, and destination. Dreżewski et al. (2012) and Jayasree and Balan (2016) incorporated data mining techniques to improve detection. Their approaches showed that the unsupervised methods could identify unusual transactions beyond fixed rules. However, such systems produced high false-positive rates as they are unable to detect coordinated transactions because of their static nature and dependent on features specified by AML experts.

### *Supervised Machine Learning for AML Detection*

Many researchers started to adopt supervised machine learning models as solutions to the rule-based drawbacks in detecting suspicious transactions. They trained the data from the SAR report with logistic regression, decision tree, support vector machine, and many more. Compared to the traditional approach, supervised machine learning approaches detect more accurate with less false positives (Zhang & Trubey, 2019; Jullum et al. ,2020; Ketenci et al., 2021). However, these approaches face data availability challenges including labelled laundering data, highly imbalance and noise data. Additionally, models trained on institution-specific data will limit their application to various banking systems.

### *Graph-Based and Network-Oriented AML Detection*

Later researchers modelled fund transactions as graphs as they realized that money laundering is an organized and collaborative in nature. A node of the graph represents an account, while the transactions between the accounts are represented by the edges. Researchers can analyse the transactions flow, detect social clusters, and interaction trends thru this representation unlike the transaction-level model. Early literature on graph-based studies relied on Social Network Analysis (SNA). The techniques include centrality measures, community detection, and sub-graph analysis. Mahootiha et al. (2021) demonstrated that network features help analysts better identify money laundering scheme while Sousa Lima et al. (2022) showcased the importance of network-oriented analysis in suspicious transaction detection. However, initial graph-based studies are restricted to manual feature engineering and static graph snapshots. This limits the approach to capture evolving suspicious patterns and maintain performance on larger transactional graph.

### *Graph Neural Networks and Temporal Models*

Recent AML innovations employed GNN-based models to learn the relationships within the transaction graph. Graph Convolutional Networks (GCN), GraphSAGE, and GAT are among the GNN-based model that enable the data propagation throughout the transaction graph. This mechanism allows them to uncover relational patterns and sophisticated money laundering scheme. It is known that in money laundering, historical transactions influence the current ones. Thus, hybrid models with advance techniques such as Long Short-Term Memory (LSTM) and

attention mechanism were introduced to capture intricate spatiotemporal relationships. Xia et al. (2022) demonstrated models that combine spatial and temporal dependencies improve detection's ability while Temporal Aware Graph Attention (TAPA) improves model's ability to recognize indirect relationships over time (Zhang et al., ). While deep learning models offer good potential for detecting suspicious transactions, they encounter limitations in learning intricate patterns within large financial graphs (Sharma & Gupta, 2024), being biased when trained and tested on imbalance dataset (Cui et al., 2025), and interpreting the results (Sharma & Gupta, 2024). Explainability and transparency are very important in the banking sector to maintain clients' confidence and trusts while ensuring regulatory compliance.

### *Challenges Related to Dataset Scarcity and Validation*

Real world transaction data is very limited due to financial institutions restricted the sharing of the data to protect their clients' privacy. In addition, dataset imbalance is common in money laundering detection field where the distribution of the classes is skewed (Jensen et al., 2023). These limit the research and benchmarking to be implemented on real dataset thus, researchers then rely on synthetic datasets. Chen et al. (2021) and Dumitrescu et. al., (2022) combined synthetic dataset and real dataset as their proposed solution to address these limitations. Synthetic dataset often lacks realistic behaviour and criminal intent which may overstate the performance of the systems. The validation of these systems in practical scenarios is restricted due to limited access to investigative data from actual laundering events.

## Methodology

This review intends to examine the evolution of AML detection methods applied to the bank transaction data. The process of conducting the study consists of six major steps (Xiao & Watson, 2019). The search was conducted using Scopus database with the search term "money laundering detection". Once the search is completed, all titles from the results were reviewed to ensure the articles are journal articles published between the year 2012 and 2025. Then, the abstracts from each publication were reviewed to narrow down the selection of the studies to bank transactions. Abstracts are known to provide a summary that highlights the important details from the sections of the publication. Abstracts do not provide the authors with enough details to assess the quality of the publication, including the risk of being biased and the reliability of the result. Therefore, the next step is to review the full text of every publication and identify the methodological trends, dataset origin, and validation gaps. Studies were excluded if they focus on cryptocurrency, hawala, and non-bank transactions. Consequently, the selected publications are analysed and the dataset used in the studies were classified using an evidence-tier framework (Jones & Steel, 2018). Figure 1 shows the process flow of this study according to the steps as suggested by Xiao and Watson (2019).

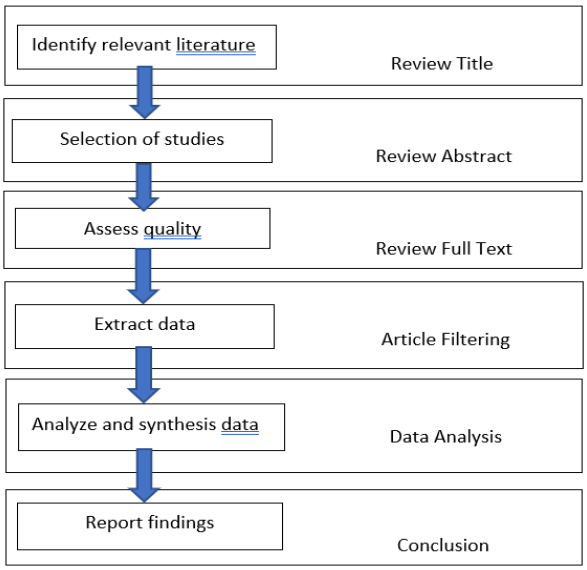



**Figure 1: Study Methodology**

Source: (Xiao & Watson, 2019)

## Findings and Discussion

### *Studies Overview*

A total of 28 studies published between 2012 and 2025 met the criteria. The studies were categorized into four evidence tiers; Tier $A^+$ (Forensic or investigative datasets, n = 3), Tier A (Operational dataset, n =17), Tier B (Hybrid datasets, n=3), and Tier C (Synthetic datasets, n=5). These tiers were classified based on the dataset origin and its evidence strength. Tier A+ is considered as highest evidential value because the datasets are real transactions dataset including from the federal investigations, Financial Investigation Unit (FIU) inquiries or seized financial records. Tier A is also real dataset from financial institutions that have been labelled based on the SAR report. This tier is known as AML operational dataset because it includes dataset that have triggered notification from a monitoring system and client risk dataset. Tier B is known as hybrid studies because dataset used in this tier is a combination of real dataset and synthetic dataset. Synthetic dataset that is generated from real dataset is classified under the similar tier too. The last tier, Tier C is fully synthetic dataset generated by simulators such as AMLSim, PaySim, and Node2Vec-based simulator. Only small number of studies utilised forensic dataset (Tier $A^+$) showing that the access to investigative dataset is very limited. Majority studies utilised AML operational dataset (Tier A) while hybrid datasets (Tier B) and fully synthetic dataset (Tier C) are minority tiers.

### *Methodological Evolution Vs Evidence Tier*

Rule-based systems, clustering, and data mining techniques were the earliest favourable detection methods between 2012 and 2016. These approaches relied on predefined threshold and static rule to flag suspicious transactions. This cause high false-positive because its inability to detect complex and dynamic transactions. Then the focus of studies turned toward supervised machine learning models such as logistic regression, random forest, and SVM to improve detection between 2017 and 2020. The challenge during this period is to handle imbalance data issue and model interpretability. However, the models' performance heavily depended on labelled data which is scarce. Studies began to explore the adoption of graph-

based approaches and SNA from 2020 onward when researchers realized that the transaction data has relational and structural properties. These properties are beneficial to detect complex transactions which are common in money laundering scheme. Early studies focused on community detection and anomaly scoring but ignored how data evolve over time and became inefficient when datasets grew. Between 2022 and 2025, there has been a growing emphasis in the literature on more sophisticated models such as GCN, GAN, GAT and hybrid models combining GNNs with LSTM. These approaches enable the modelling of transactions movement through multiple accounts, changing transaction patterns, and capture the sequential influence of historical transactions on a future event. Nevertheless, these approaches require better data quality and increased computational requirement, leading studies to depend on synthetic and partially synthetic dataset. Model interpretability has become a major challenge as the regulatory bodies require transparent decision-making logic.

The methodologies implemented in the studies varied with the data tiers. Studies involving confirmed laundering structures (Tier $A^+$) favoured graph-based or network analysis. Studies that utilised dataset from institution's operational environment (Tier A) focused on alert prioritization and minimizing false-positive using supervised machine learning, GNNs, and hybrid model. Studies using hybrid dataset, including real data that is augmented with synthetic data (Tier B), implemented methods such as semi-supervised models, autoencoder, and Generative Adversarial Network (GAN) to address class imbalance and anomaly detection. Tier C studies, which utilised synthetic dataset were involved in method benchmarking and scalability testing. These studies reported high precision results yet, the validity of these findings remains unverified against actual laundering operations. Table 1 summarizes the mapping of evidence tier and method types.

**Table 1: Mapping of Evidence Tier and Method Types**

| Evidence Tier | Dataset Characteristics | Method types | Authors |
|---|---|---|---|
| $A^+$ | Forensic or investigative datasets | Graph-based analysis, SNA, Temporal network analysis | 24, 28,36 |
| A | Operational dataset | Supervised machine learning, GNNs, hybrid risk model | 1,3,11,15,17,18 19,20,21,23,25,27 30,32,33,40,44 |
| B | Hybrid dataset | Semi-supervised models, autoencoder, GAN enhanced machine learning | 5, 8, 42 |
| C | Synthetic dataset | Deep learning, GNNs, simulation-based method | 4,7,12,16,39 |

Source: Authors' interpretation

## Conclusion

This review demonstrates that studies related to detecting suspicious bank transactions has undergone methodological transition over the past decade, surpasses the data availability for

robust evaluation. Early studies were dominated by the rule-based systems, clustering, and data mining techniques. Then, studies shifted to supervised machine learning, GNNs and hybrid risk model driven by the availability of operational dataset including dataset from SAR reports. Due to increasing recognition that laundering behaviour is relational, dynamic and evolving, GNNs, temporal-graph hybrids, and simulation-based adversarial frameworks are emphasized in the studies between 2020 and 2025. The models demonstrate improvements in detecting complex transactions, but the validations are limited by the availability of dataset with evidential value. This is because Tier $A^+$ dataset derived from law enforcement investigations remain inaccessible to most of the researchers. Meanwhile, studies that relied on synthetic datasets for benchmarking and prototyping must interpret their results cautiously as this dataset lack of operational fidelity. Besides regulating synthetic datasets with minimum validation protocol, regulators should provide incentives for generating privacy preserving datasets that can be shared for scientific verification.

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# POSITIONING BIM X CHAIN AMONG BIM-SCM INTEGRATION FRAMEWORKS: A COMPARATIVE ANALYSIS FOR DISPUTE REDUCTION IN PUBLIC CONSTRUCTION PROJECTS

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***Abstract:*** *Public construction projects are frequently affected by disputes caused by fragmented communication, weak coordination, and inefficiencies within complex supply chains, leading to delays, cost overruns, and strained stakeholder relationships. Although Building Information Modelling (BIM) and Supply Chain Management (SCM) have been widely implemented to enhance transparency and collaboration, existing BIM–SCM integration frameworks largely prioritise performance, logistics, or sustainability rather than explicitly targeting dispute prevention. This study proposes BIMxCHAIN, a conceptual BIM–SCM integration framework that positions dispute reduction as its core objective in public construction projects. Grounded in systems theory and collaboration theory, the study adopts a conceptual research methodology supported by an extensive literature review and a comparative analysis of six established BIM–SCM integration frameworks. Based on this analysis, a prototype framework comprising three interrelated modules is developed: a BIM Core Module to ensure lifecycle information integrity, an SCM Module to enhance procurement and logistics transparency, and a Dispute Resolution Engine that embeds audit trails, communication records, and accountability mechanisms. The comparative findings indicate that while existing frameworks improve collaboration and supply chain visibility, they inadequately address dispute prevention as a primary design consideration. BIMxCHAIN advances current knowledge by embedding transparency, traceability, and accountability directly into BIM–SCM workflows, offering a proactive approach to dispute reduction in public sector construction projects.*

***Keywords:*** *Building Information Modelling; Construction Disputes; Public Construction Projects; Supply Chain Management; BIM-SCM Integration*

## Introduction

Public construction projects are inherently complex due to the involvement of multiple stakeholders, extensive contractual arrangements, and significant public investment. As a result, these projects are particularly vulnerable to disputes arising from fragmented communication, poor coordination, resource inefficiencies, and contractual ambiguities (Doloi, 2012). Such disputes frequently lead to project delays, cost overruns, and strained stakeholder relationships, ultimately undermining efficiency, accountability, and public trust in government-funded construction projects.

Building Information Modelling (BIM) has been widely recognised as a digital approach capable of improving information management, coordination, and decision-making throughout the construction project lifecycle (Bryde et al., 2013). Through shared data environments and enhanced visualisation, BIM supports collaboration among project participants and reduces design-related errors (Wu & Xu, 2014). In parallel, Supply Chain Management (SCM) plays a critical role in coordinating procurement, logistics, and information flows across construction supply networks. Effective SCM practices enhance transparency and operational efficiency, which are essential for managing the complexities of public construction projects (Irizarry et al., 2013).

Recent studies highlight that integrating BIM with SCM can extend the benefits of digitalisation beyond design coordination to include procurement transparency, logistics monitoring, and accountability across supply chain actors (Papadonikolaki et al., 2015; Papadonikolaki et al., 2017). Despite these advancements, disputes remain a persistent challenge, particularly in public sector construction. Existing BIM–SCM integration frameworks primarily focus on collaboration, logistics efficiency, trust-building, or sustainability outcomes, while dispute reduction is often treated as an indirect benefit rather than a central design objective (Ahmadian et al., 2017).

In the Malaysian construction context, dispute risks are further intensified by uneven BIM adoption, limited organisational readiness, inconsistent implementation standards, and the high costs associated with digital transformation (CIDB Malaysia, 2022). Although national policies promote BIM implementation in public projects, structured mechanisms for leveraging BIM–SCM integration as a proactive dispute prevention tool remain underdeveloped. Moreover, while emerging digital technologies such as blockchain and digital audit trails have renewed interest in dispute prevention, the literature lacks holistic frameworks that systematically integrate BIM, SCM, and dispute prevention within a single conceptual model.

To address this gap, this study proposes BIMxCHAIN, a conceptual BIM–SCM integration framework that explicitly positions dispute reduction as its core objective. The objectives of this study are to: (i) identify essential BIM and SCM features required to reduce disputes in public construction projects; (ii) develop a prototype BIM–SCM framework designed to minimise dispute occurrence; and (iii) position the proposed framework through comparative analysis with existing BIM–SCM integration models.

## Literature Review

### *Disputes in Public Construction Projects*

Disputes are a recurring issue in public construction projects due to their inherent complexity, rigid contractual arrangements, and the involvement of multiple stakeholders with differing objectives. Common causes of disputes include design changes, delays, poor communication, and inadequate coordination among project participants (Doloi, 2012). In public sector projects, these challenges are often exacerbated by bureaucratic procedures, strict compliance requirements, and heightened accountability for the use of public funds.
Disputes frequently result in financial losses, schedule overruns, and deteriorating stakeholder relationships, ultimately undermining public confidence in project delivery (Kalogeraki et al., 2024).

As a result, recent research increasingly emphasises the importance of shifting from reactive dispute resolution toward proactive dispute prevention mechanisms embedded within project delivery systems.

### *BIM–SCM Integration and Its Limitations*

Building Information Modelling (BIM) enhances information integration, coordination, and collaboration throughout the construction project lifecycle by enabling stakeholders to access consistent and up-to-date project information within a shared digital environment (Bryde et al., 2013). While BIM adoption reduces design-related errors and improves coordination (Wu & Xu, 2014), it does not sufficiently address disputes arising from procurement processes, supply chain fragmentation, and contractual accountability.

Supply Chain Management (SCM) focuses on improving coordination, transparency, and information flow across construction supply networks. Weak SCM practices have been linked to disputes related to material delays, cost escalation, and responsibility allocation (Papadonikolaki et al., 2017). Consequently, several BIM-SCM integration frameworks have been proposed to enhance collaboration, logistics efficiency, trust-building, and sustainability outcomes (Papadonikolaki et al., 2015; Irizarry et al., 2013; Ahmadian et al., 2017). However, these frameworks typically treat dispute reduction as an indirect benefit rather than an explicit design objective.

### *Digital Technologies and Research Gap*

Emerging digital technologies such as blockchain, smart contracts, and digital audit trails offer new opportunities to enhance transparency, traceability, and accountability in construction projects (Kalogeraki et al., 2024). When integrated with BIM and SCM systems, these technologies can support systematic documentation of decisions, transactions, and communications, thereby reducing uncertainty and opportunistic behaviour among project participants.

Despite these advances, the literature reveals a lack of holistic frameworks that explicitly integrate BIM, SCM, and dispute prevention mechanisms within a single conceptual model tailored to public construction projects. This gap highlights the need for a framework that embeds dispute prevention principles directly into BIM-SCM workflows, forming the basis for the proposed BIMxCHAIN framework.

## Methodology

This study adopts a conceptual research methodology to develop and position a BIM-SCM integration framework aimed at reducing disputes in public construction projects. A conceptual approach is appropriate as the study focuses on synthesising existing theories, frameworks, and empirical findings to propose an integrative model rather than testing hypotheses through empirical methods. Similar approaches have been widely adopted in BIM and construction management research involving framework development.

The methodological foundation of the study is informed by systems theory and collaboration theory. Systems theory conceptualises construction projects as complex socio-technical systems comprising interdependent actors, processes, and information flows, where disputes

emerge from fragmented interactions and misaligned information. Collaboration theory emphasises trust, communication, and shared objectives as critical factors in mitigating conflict among project stakeholders.

The research process comprises four main stages. First, essential BIM-, SCM-, and dispute-related features were identified through a comprehensive review of prior studies on BIM implementation, construction supply chain management, and dispute management. Second, these features were synthesised to conceptually develop the BIMxCHAIN framework, structured into three interrelated modules: a BIM Core Module, an SCM Module, and a Dispute Resolution Engine. Third, the proposed framework was positioned through comparative analysis with six established BIM–SCM integration frameworks reported in the literature. Finally, the framework was refined through qualitative evaluation supported by expert insights, with emphasis on transparency, traceability, and alignment with recognised information management standards such as ISO 19650.

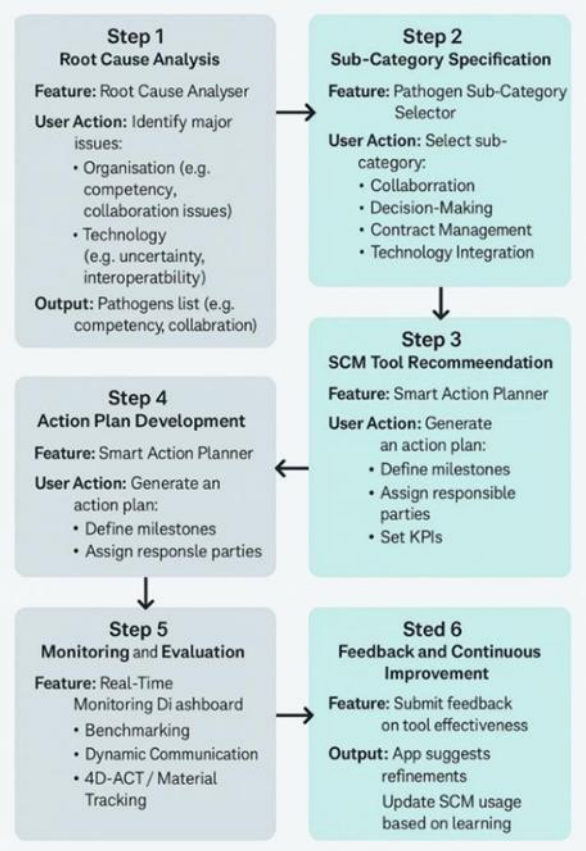



**Figure 1: The BIMxCHAIN App Workflow**

## Results and Discussion

This section presents the findings of the comparative analysis and discusses the positioning of the proposed BIMxCHAIN framework within the existing landscape of BIM-SCM integration models. The discussion focuses on how BIMxCHAIN addresses dispute-related challenges in public construction projects, which are often underemphasised in prior frameworks.

The comparative analysis indicates that existing BIM-SCM integration frameworks predominantly aim to improve collaboration, information integrity, logistics efficiency, trust-building, or sustainability performance. For instance, Papadonikolaki et al. (2015) proposed graph-based BIM–SCM models that enhance understanding of product, process, and organisational relationships within supply chains. While these models improve coordination and visibility, dispute prevention is not explicitly embedded as a primary design objective.

Similarly, the collaborative BIM framework by Wu and Xu (2014) prioritises lifecycle information integrity and process consistency. Although such information-centric approaches reduce design errors and miscommunication, disputes related to procurement decisions, contractual responsibilities, and supply chain accountability remain insufficiently addressed. Logistics-oriented frameworks integrating BIM with GIS technologies (Irizarry et al., 2013) enhance material tracking and delay monitoring but provide limited mechanisms for managing dispute-related risks beyond operational efficiency.

Frameworks emphasising relational dimensions, such as trust and informal interactions within BIM-enabled supply chain partnerships (Papadonikolaki et al., 2017), offer valuable insights into social dynamics. However, these approaches often lack structured digital workflows capable of systematically documenting decisions, transactions, and responsibilities. Sustainability-focused BIM–SCM frameworks (Ahmadian et al., 2017) further expand the scope of integration but prioritise environmental and social outcomes rather than conflict prevention.

In contrast, BIMxCHAIN explicitly positions dispute reduction as its core objective. As illustrated in Figure 2 and summarised in Table 1, the framework integrates transparency, traceability, and accountability directly into BIM–SCM workflows. The BIM Core Module enhances data accuracy and consistency, reducing ambiguities that frequently trigger disputes. The SCM Module improves procurement and logistics transparency, enabling traceability of materials, decisions, and responsibilities across supply chain actors. The Dispute Resolution Engine embeds proactive mechanisms such as audit trails, communication logs, and transparency dashboards, supporting early identification and mitigation of potential conflicts. By integrating technical and relational dimensions within a structured digital architecture, BIMxCHAIN advances existing BIM–SCM integration models from performance-oriented systems toward proactive dispute prevention mechanisms tailored to public construction projects.

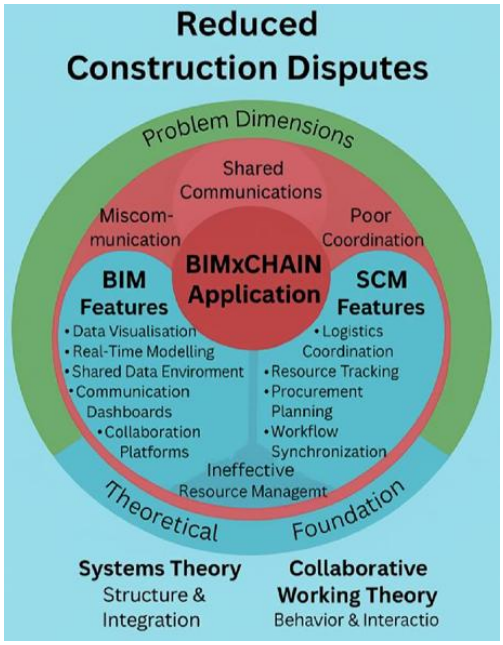



**Figure 2: Conceptual Integration of BIM and SCM Attributes to Address Dimensions of Construction Disputes**

## Conclusions

This study proposed BIMxCHAIN, a conceptual BIM–SCM integration framework that explicitly positions dispute reduction as its primary objective in public construction projects. Through a comprehensive literature review and comparative analysis of existing BIM–SCM integration frameworks, the study demonstrated that while prior models enhance collaboration, logistics efficiency, trust-building, and sustainability outcomes, they inadequately address dispute prevention as a central design consideration.

BIMxCHAIN addresses this gap by embedding transparency, traceability, and accountability into BIM–SCM workflows through three interrelated modules: a BIM Core Module, an SCM Module, and a Dispute Resolution Engine. By integrating audit trails, communication records, and transparency dashboards, the framework supports a proactive approach to dispute prevention rather than reactive dispute resolution. From a theoretical perspective, the study extends systems theory and collaboration theory by operationalising dispute prevention within a socio-technical construction environment. From a practical standpoint, BIMxCHAIN offers public sector stakeholders a structured digital approach to improving governance, reducing claims, and enhancing stakeholder trust in government-funded construction projects.

Despite its contributions, this study is limited by its conceptual nature and the absence of empirical validation. Future research should focus on pilot implementations and case studies to evaluate the practical feasibility and effectiveness of BIMxCHAIN in reducing disputes. Further studies may also explore the integration of emerging digital technologies, such as blockchain-enabled smart contracts, and assess the scalability of the framework across different regulatory and institutional contexts.

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# CORPORATE SOCIAL RESPONSIBILITY AND GRASSROOTS BADMINTON DEVELOPMENT: A COMPARATIVE STUDY OF INDONESIA AND MALAYSIA

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***Abstract:*** *Corporate Social Responsibility (CSR) is widely recognized as essential to corporate sustainability and is frequently utilized as a public relations instrument to shape corporate image, alongside its function of fulfilling corporate responsibilities toward society. This applies in both Indonesia and Malaysia. This study aims to analyze and compare the governance, coordination, and evaluation mechanisms of CSR in these two countries. The subjects of the study are the Daihatsu ASTEC badminton development programme in Indonesia and the Maybank Junior Badminton Development Programme in Malaysia. The findings indicate that CSR in Indonesia is mandatory, serving to strengthen regulatory control and institutional alignment with national badminton development objectives. In contrast, CSR in Malaysia is predominantly voluntary, granting greater autonomy to sponsors and ensuring long-term programme sustainability through partnerships between corporations and sport federations. Accordingly, this study emphasizes the importance of clear regulatory standards, transparency mechanisms, and structured collaboration between federations and corporations to ensure sustainable badminton talent development. In conclusion, the differences in CSR frameworks between the two countries reflect variations in governance models and stakeholder coordination rather than the normative superiority of one system over another.*

***Keywords:*** *Corporate Social Responsibility; Sport Governance; Badminton Development*

## Introduction

Corporate Social Responsibility (CSR) has become a global issue closely associated with the moral and legal responsibilities of corporations toward society and the environment. As global awareness of the importance of corporate contributions to social and environmental issues has increased, CSR programmes are increasingly regarded as more concrete obligations (Feronika, E. S., Silvia, K. R., & Raharjo, 2020). A substantial body of literature has examined the nature, role, and dynamics of corporate social responsibility, and more recently, scholarly attention has shifted toward the need to regulate CSR and clarify its legal dimensions (Abah, 2016; Situ, H., Tilt, C. A., & Seet, 2018; Malesky, E., & Taussig, 2019). However, the application of regulatory frameworks to corporate CSR faces significant challenges, particularly due to the lack of consensus regarding the nature and extent of obligations imposed on businesses under existing CSR models. In addition, multidisciplinary literature has sought to reflect on both the

benefits and limitations of CSR as a mechanism for promoting various aspects of social and economic development (Blowfield, 2005; Frynas, 2007).

Several studies suggest that CSR for development can function as a *win–win solution* across multiple sectors, including sport (Levermore, 2010). Within the business community, CSR has emerged as a central theme and a benchmark for evaluating the moral, financial, and ethical dimensions of corporate activity (Windsor, 2013). At the same time, both the potential and the limitations of CSR as a vehicle for achieving social and economic development have been widely debated, with sport identified as one of the most prominent domains for CSR implementation. CSR in sport initially emerged from the notion that charitable efforts and community outreach programmes could enhance fan support and increase revenue, contributing to its growing prevalence within the sport industry (Kishore, 2016).

Sport is now increasingly recognised as a strategic instrument for social development, nation-building, and international representation (Schumacher, 2016). One Olympic sport with a long historical tradition and relatively rapid development is badminton. Badminton can be traced back more than 2,000 years to the game of battledore and shuttlecock played in India, Greece, and China. The modern name "badminton" derives from Badminton House in Gloucestershire, the residence of the Duke of Beaufort, where the sport was played (Sigit Nugroho, 2020).

In several countries, badminton holds strong cultural, political, and economic significance, making the sustainability of grassroots development systems a critical factor in maintaining long-term competitive success. Accordingly, badminton also contributes to economic development by enhancing community well-being. Sport is not limited to what occurs on the field, among players, or within associations; rather, it operates within broader social, strategic, and commercial contexts. From a strategic and commercial perspective, CSR within the sport industry has increasingly been used as an innovative instrument for value creation. CSR also functions as a governance instrument that shapes institutional coordination, accountability structures, and development priorities within the sport sector (Robertson & Walzel, 2019).

This shift raises important questions regarding the regulatory design, effectiveness, and sustainability of CSR-based sport development programmes. Several studies have examined CSR as a governance instrument influencing decision-making authority (Godos-Díez et al., 2018; Saleem, 2025), resource allocation (Jia, 2020; Harwood, 2015), accountability mechanisms (Rainero & Modarelli, 2020; Tamvada, 2020), and inter-organisational coordination within national sport development systems (Trendafilova, Ziakas, & Sparvero, 2017; Rowe, Karg, & Sherry, 2019). Consequently, CSR has become a major concern for sport organisations, given their strong societal ties and the importance of stakeholder relationships. Nevertheless, grassroots sport development continues to face structural challenges, including limited public funding, governance constraints, and uneven institutional capacity. The effectiveness of grassroots development systems directly affects elite performance and national competitiveness in international badminton competitions.

Several comparative studies have examined cross-country differences in CSR regulation, corporate obligations, and the effectiveness of CSR implementation. For example, Abdifatah Ahmed Haji et al. (2023) investigated the economic and behavioural consequences of CSR reporting regulations, specifically assessing their impact on (1) reporting quality, (2) capital markets, and (3) corporate behaviour. Nikolina Markota Vukić (2015) analysed differences in CSR reporting across selected European Union countries, finding statistically significant

variations among them. Similarly, Dina El-Bassiouny and Noha El-Bassiouny (2019) examined the influence of organisational-level factors—particularly corporate governance structure and diversity—on CSR reporting practices in both developing and developed country contexts, including Egypt, Germany, and the United States. Their study suggests that the organisational drivers of CSR reporting differ substantially between developed and developing economies.

Based on the existing literature, this study seeks to examine the comparative regulatory frameworks governing statutory CSR obligations, corporate responsibilities, and the effectiveness of CSR implementation in Indonesia and Malaysia. These two countries are selected for comparison due to their status as leading badminton nations in Southeast Asia. Accordingly, the central research question of this study is: how do CSR governance, coordination, and evaluation mechanisms differ between Indonesia and Malaysia.

## Literature Review

### *Corporate Social Responsibility*

The principles and practices of Corporate Social Responsibility (CSR) have been the subject of sustained scholarly attention for more than three decades. In practice, for over a century, businesses across various sectors have integrated CSR concepts into their organizational strategies. Although CSR scholarship has been strongly influenced by the CSR pyramid framework (Carroll, 2016; Baden, 2016), the diversity of CSR conceptualizations has provided the field with broad analytical scope. CSR is now a well-established and rapidly evolving field of knowledge that has explored issues of trust, rights and responsibilities, and decision-making (Aguinis & Glavas, 2012). CSR is widely understood as an organization's responsibility to behave ethically and respond responsibly to the needs of society and its stakeholders (Bradish & Cronin, 2009). Aguinis (2011) defines CSR as "context-specific organizational actions and policies that take into account stakeholders' expectations and are grounded in three core dimensions: economic, social, and environmental performance."

Based on these definitions, CSR can be understood as a management concept through which companies integrate social and environmental concerns into their business operations and interactions with stakeholders. CSR reflects the way firms seek to balance economic, environmental, and social needs—commonly referred to as the *triple bottom line* approach—while simultaneously meeting the expectations of shareholders and stakeholders (Shirotriya, 2015). A central element of CSR is the recognition that businesses bear responsibilities toward society or communities while engaging in socially beneficial activities. This perspective highlights the interdependence between business and society, emphasizing that firms should act in the broader public interest.

Contemporary CSR scholarship has increasingly adopted a governance-oriented perspective, emphasizing that CSR contributes to sustainability when embedded within formal organizational structures. Wu and Jin (2022) argue that CSR strengthens long-term development outcomes when integrated into corporate governance systems, including internal control mechanisms, managerial decision-making processes, and accountability frameworks. This perspective positions CSR as an instrument that shapes organizational behaviour and policy alignment, rather than merely a symbolic expression of corporate benevolence.

CSR operates as a governance instrument in different ways, most notably through **mandatory** and **voluntary** frameworks (Alderbas, 2021). Whether CSR remains voluntary or becomes mandatory, the role of government in shaping CSR practices cannot be denied. Governments may encourage voluntary CSR through preferential treatment, licensing arrangements, monitoring mechanisms, subsidies, or deregulation (Dentchev & van Balen, 2015). Mandatory CSR refers to legal obligations imposed on corporations to undertake social and environmental responsibility, particularly in sectors related to natural resource exploitation. In Indonesia, CSR is regulated under Law No. 40 of 2007 on Limited Liability Companies, which requires companies to allocate and account for CSR expenditures as corporate costs and provides for sanctions in cases of non-compliance (Akim, 2017). Proponents of mandatory CSR argue that legislation is intended to assess corporate self-regulation performance (Lückerath-Rovers, 2011) and to enhance stakeholder interaction, thereby influencing policy-making processes (Mathis, 2007). However, a key limitation of mandatory CSR lies in weak institutionalization due to limited auditing and enforcement mechanisms. This governance gap constrains CSR's effectiveness in producing structured and sustainable development outcomes.

Voluntary CSR, by contrast, refers to corporate commitments to act ethically and contribute positively to society and the environment beyond legal obligations. Such commitments are driven by moral and ethical considerations aimed at creating shared value and encompass responsibilities toward a broad range of stakeholders, including employees, consumers, and local communities, rather than focusing solely on financial performance. Voluntary CSR literature argues that such initiatives may enhance economic performance by increasing market value (Simpson & Kohers, 2002), reducing economic risk (Diemont, Moore, & Soppe, 2016), and creating value for individuals and organizations alike (Backhaus, Stone, & Heiner, 2002).

The distinction between mandatory and voluntary CSR frameworks reflects differing governance logics and models of stakeholder coordination. These differences provide the analytical foundation for the comparative examination of CSR-based grassroots badminton development in Indonesia and Malaysia.

***Early Childhood Badminton Development***

One of the fundamental means of enhancing human resources and an integral part of human life is sport. The development of human experience and knowledge, which cannot be separated from daily life, consists of two interrelated dimensions: the physical and the spiritual. When these two dimensions develop and grow harmoniously, they contribute to balanced human development. Physical development serves as a medium for enhancing movement skills. In sport, the highest objective pursued by every athlete is the attainment of athletic achievement.

Several factors determine the improvement of athletic performance (Bangsbo, 2015), including: (1) biological factors, such as innate potential (basic physical capacity), organ and nervous system function, as well as body structure and function (Hoffman, 2014); (2) psychological factors, including intellectual capacity, motivation, and personality traits (Đurović, Aleksić Veljković, & Petrović, 2020); (3) environmental factors, such as social environment, facilities and infrastructure, climate and weather conditions, and family support (Anggriawan, Doewes, & Purnama, 2018); and (4) supporting factors, including coaches, well-designed and systematic training programmes, funding, and reward systems (Mulyana et al., 2022).

One sport that has achieved significant athletic success and is played worldwide is badminton. Badminton is a racket sport played by two or four players that relies heavily on physical capacity and is characterised by short-duration, high-intensity actions. The sport comprises five competitive disciplines: men's singles, women's singles, men's doubles, women's doubles, and mixed doubles, each of which requires specific preparation in terms of technique, control, and physical fitness (Phomsoupha & Laffaye, 2015). Badminton is among the most popular sports globally, with an estimated 200 million participants and fans worldwide (Kwan, Cheng, & Tang, 2010).

In sport development, the early-age category typically includes children aged 6–10 years. At approximately six years of age, talent identification and athlete development programmes are initiated by government and sport organisations, while children aged 8–10 years are generally considered ready to participate in structured competition (Anggriawan, Doewes, & Purnama, 2018). Competitive sport training often begins as early as six years of age and increases progressively, with peak developmental stages occurring between the ages of 11 and 13 (Eime et al., 2016). Early childhood represents a critical period for acquiring fundamental motor skills, during which children develop a broad repertoire of movements that form the foundation for sport proficiency and skilled motor performance later in life (CS., 2023).

This developmental stage coincides with a period of remarkable neuroplasticity, as the preschool-aged brain exhibits exceptional adaptability and compensatory capacity. This creates an optimal window for the maturation of the central nervous system and the development of sensory integration, reinforcing the importance of early, structured sport engagement for long-term athletic development.

***Corporate Social Responsibility and Sport Development in Early Age***

Sport represents a unique sector because it combines both social and economic dimensions. As such, sport—with its dual orientation—is particularly well suited to interpret CSR principles and to implement business practices grounded in Corporate Social Responsibility (Sheth & Babiak, 2009). Consequently, in recent years, CSR has gained global recognition as a strategic instrument for promoting sport development. The concept of CSR in sport has been widely acknowledged as a means of enhancing sport growth. CSR can provide significant momentum for accelerating sport development at the community level and has become increasingly prevalent within the sport industry (Godfrey, 2009).

The relationship between sport and CSR is often discussed through the lens of *cause-related sport marketing*, in which partnerships are formed between sport organizations and charitable causes, supported by strategic communication efforts. In addition, CSR is closely linked to sporting events, where sport entities can articulate their commitment to social responsibility through civic engagement and community-based activities (Filo, Funk, & O'Brien, 2008; Babiak, 2007). Sport entities—including leagues, clubs, mega-events, and nonprofit organizations—are embedded within local communities and broader stakeholder networks, enabling them to exert wide-ranging social influence.

In sectors with high public visibility such as sport, CSR has evolved in response to growing demands for accountability, transparency, and stakeholder engagement. Sport organizations operate within complex stakeholder environments, making CSR an essential instrument for managing institutional responsibilities that extend beyond purely commercial objectives

(Walters, 2010). CSR plays a distinctive role in the sport sector due to the strong social embeddedness of sport and its capacity to generate community-based benefits. Anna (2024) notes that sport-based CSR initiatives commonly focus on youth development, social inclusion, education, and health promotion, reflecting sport's unique potential to create social value. However, the effectiveness of such initiatives depends heavily on governance arrangements, particularly stakeholder coordination and transparency mechanisms.

Accordingly, in the context of grassroots sport development, CSR-based programmes influence resource allocation, athlete development pathways, and institutional coordination. When CSR initiatives are aligned with sport federation policies and supported by stable corporate partnerships, they are more likely to contribute to sustainable development outcomes rather than short-term or fragmented interventions.

## Methodology

The objective of this study is to analyse and compare CSR governance, coordination, and evaluation mechanisms in Indonesia and Malaysia. The research employs a **comparative qualitative approach** to examine CSR as a governance instrument in grassroots badminton development. The units of analysis are Indonesia and Malaysia. These two countries are selected because they share strong badminton traditions at the international level while operating under different CSR regulatory frameworks. This comparison allows for an analysis of how variations in regulatory design shape governance arrangements and stakeholder coordination within national sport development systems, particularly in badminton.

Data collection in this study adopts a **normative juridical approach** combined with a **literature-based review**. In legal research, this approach relies on secondary data sources to establish an analytical foundation, particularly by examining legal materials and scholarly literature relevant to the research problem (Soekanto & Mamudji, 2001). The data sources for this study consist of three categories: 1) statutory and regulatory legal materials related to CSR implementation, including corporate law and government regulations 2) policy documents and official publications issued by relevant organisations in both countries (Indonesia and Malaysia), which are used to identify governance priorities, development strategies, and institutional roles in grassroots sport development. 3) publicly available corporate CSR reports and programme documentation related to badminton development in both countries, which are analysed to examine development strategies and institutional involvement in grassroots programmes.

Data analysis is conducted using a **qualitative comparative analytical approach**. The analytical process involves thematic coding of documents to identify key governance dimensions, including regulatory obligations, institutional alignment, stakeholder coordination, programme sustainability, and accountability mechanisms. These themes are then compared across the Indonesian and Malaysian cases to identify similarities and differences in how CSR functions as a governance instrument in grassroots badminton development.

To enhance analytical rigor, the study applies **triangulation** across legal texts, federation policies, and corporate programme documentation. This triangulation enables cross-validation of findings and reduces reliance on a single data source.

## Discussion

This study aims to compare statutory CSR regulations, corporate obligations, and the effectiveness of CSR implementation in Indonesia and Malaysia. The findings will highlight comparative differences in governance structures, coordination mechanisms, and evaluation processes between the two countries.

### *CSR Governance Diference Between Indonesia and Malaysia*

CSR implementation in Indonesia operates within a mandatory legal framework that provides formal legitimacy for corporate involvement in social development, including sport. This is illustrated by the Daihatsu ASTEC programme, which enables institutional alignment with national badminton development objectives established by the Badminton Association of Indonesia (PBSI). The Daihatsu ASTEC programme functions as an early-stage talent identification and development initiative, creating pathways for young athletes to enter regional and national training systems.

However, the findings indicate that the success of the programme has not translated into strengthened systemic governance capacity. Decisions regarding programme design, geographic focus, and continuity are largely determined through direct relationships between corporations and the sport federation, without standardized cross-actor policy mechanisms. As a result, the impact of CSR at the grassroots level is geographically fragmented and heavily dependent on corporate initiative. The absence of binding operational standards concerning geographic coverage, programme duration, or integration with local clubs reflects a policy orientation focused on programme implementation rather than long-term governance capacity building. This pattern demonstrates a phenomenon of **means–ends decoupling**, whereby formal compliance with mandatory CSR obligations is achieved without corresponding functional integration into community-level sport development systems. Consequently, mandatory CSR implementation in Indonesia has proven more effective in mobilizing resources than in creating the institutional interoperability required for equitable and sustainable grassroots athlete development.

By contrast, CSR in Malaysia's sport sector has evolved within a predominantly voluntary framework grounded in corporate disclosure and reputational incentives. The Maybank Junior Badminton Development Programme illustrates how long-term partnerships between corporations and the Badminton Association of Malaysia (BAM) can generate relatively stable grassroots development structures. The programme provides consistent access to training, clearly defined talent development pathways, and strong integration with national competition calendars and elite academy systems.

Nevertheless, despite producing more consistent outcomes than the Indonesian case, CSR governance in Malaysia remains highly dependent on the commitment of specific corporate actors rather than on nationally binding rules or standardized procedures. Programme success does not automatically translate into national sport policy or replicable standards for other federations. Dependence on corporate goodwill creates sustainability risks in the event of changes in corporate strategy or sponsor priorities. Thus, while the Malaysian model demonstrates strengths in continuity and relational integration, partnership-based governance also exhibits structural limitations in scaling and stabilizing the impact of sport-related CSR beyond the involvement of key actors.

### *CSR Coordination and Mechanisms in Indonesia versus Malaysia*

From a coordination perspective, both countries exhibit similar patterns. Coordination among actors—whether through state legitimacy in Indonesia or sponsor commitment in Malaysia—functions effectively as long as partnership relationships are maintained. However, because these arrangements are not supported by standardized role allocation or institutionalized procedures, coordination remains fragile in the face of actor turnover and is difficult to replicate across regions or other sports. This limitation reflects a common characteristic of network-based governance systems that rely heavily on key actors.

Evaluation mechanisms also display comparable weaknesses in both contexts. The success of sport-related CSR programmes is typically assessed based on programme continuity or athlete performance outcomes, rather than through evaluations that examine their contribution to strengthening the broader sport development system. In the absence of structured, learning-oriented evaluation frameworks, effective CSR practices are not systematically documented and therefore cannot serve as a basis for policy improvement or programme replication.

These limitations in decision-making, coordination, and evaluation directly affect programme development and expansion. Successful sport-related CSR initiatives tend to remain isolated projects rather than evolving into transferable models supported by governance frameworks that enable scaling across contexts. As a result, the effectiveness of grassroots sport development continues to depend on the initiative of specific actors rather than on replicable and expandable system capacity.

These findings reinforce the argument that the effectiveness of CSR as a governance instrument in grassroots sport development is not determined by its legal status—mandatory or voluntary—but by the ability of governance systems to integrate programmes functionally into national sport development structures. Indonesia demonstrates strengths in legitimacy and resource mobilization but faces weaknesses in coordination and standardization. Malaysia demonstrates strengths in relational integration and programme continuity but remains vulnerable to actor dependence and limited replicability.

Accordingly, effective sport-related CSR requires a shift from a focus on individual programme success toward the development of **systemic governance capacity**, in which sport federations act as integrative institutions capable of aligning state interests, corporate resources, and community-level sport development. Without this shift, CSR in sport will continue to generate programmes that operate successfully in isolation but fail to produce governance arrangements that genuinely support sustainable grassroots development.

## Conclusion

Based on the findings and discussion above, this study concludes that the contribution of Corporate Social Responsibility (CSR) to grassroots sport development is determined more by the governance mechanisms that integrate CSR into the national sport system than by its legal status alone. The findings indicate that CSR can make a meaningful contribution to grassroots badminton development only when it is embedded within governance structures that ensure coordination, accountability, and long-term integration. While law plays an important role in

shaping the initial conditions for CSR engagement, governance capacity ultimately determines whether these conditions translate into sustainable grassroots development outcomes.

This is evident from the finding that CSR in Indonesia operates under a mandatory framework, providing formal legitimacy and facilitating alignment between corporate initiatives and national badminton development objectives. However, the study reveals that legal obligation alone does not guarantee effective grassroots development outcomes in Indonesia. Weak enforcement mechanisms, limited standardization, and fragmented coordination constrain programme reach, continuity, and equitable access, resulting in CSR initiatives that often function as stand-alone projects rather than as components of a coherent grassroots development system.

In contrast, CSR in Malaysia is predominantly voluntary and demonstrates how long-term partnerships between corporations and sport federations can generate more stable grassroots development outcomes without legal compulsion. Programmes supported by Maybank benefit from relational governance mechanisms such as trust, reputational incentives, and joint strategic planning. These mechanisms enable programme continuity, clearer talent development pathways, and stronger institutional integration with the Badminton Association of Malaysia.

The comparison shows that each CSR regime reflects a distinct governance logic, each with its own strengths and vulnerabilities. Consequently, effective grassroots badminton development requires more than appropriate legal design; it depends on the capacity of governance systems to coordinate actors, standardize practices, and embed CSR programmes within broader development frameworks. Future research is encouraged to extend empirical investigation through fieldwork or to broaden comparative analysis to other sports or jurisdictions in order to deepen understanding of CSR as a governance instrument in sport development.

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# AMANAH-DRIVEN STRATEGIC MANAGEMENT IN MUSLIM SMEs

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***Abstract:*** *This study investigates the role of amanah (trustworthiness), a central prophetic value, in shaping the strategic management practices of Muslim-owned small and medium enterprises (SMEs) in Malaysia. Although Muslim SMEs play a significant role in the halal-driven economy, limited research has explored how Islamic ethical principles influence strategic decisions. Using a qualitative design, semi-structured interviews were conducted with seven Muslim entrepreneurs in the manufacturing sector in the Klang Valley. The data were analysed using thematic analysis supported by ATLAS.ti 9.0. The findings show that amanah informs all phases of strategic management. During strategy formulation, entrepreneurs emphasised social responsibility, halal assurance, and contributing to the economic wellbeing of the Muslim community. In the implementation phase, amanah was reflected through ethical business conduct, including keeping promises, responsible behaviour, transparency, fairness, reliability, and operational independence. In the evaluation phase, amanah guided corrective actions that placed stakeholder interests above short-term profitability. Overall, the study highlights amanah as an ethical foundation that strengthens strategic decision-making and contributes to sustainable business practices within Muslim-led SMEs.*

***Keywords:*** *Amanah; Islamic Ethical Values; Strategic Management; Muslim SMEs; Prophetic Leadership*

## Introduction

Small and medium enterprises (SMEs) are critical contributors to the Malaysian economy, particularly within the rapidly expanding halal sector. Muslim-owned SMEs, in particular, play a significant role in shaping the ethical landscape of business activities due to their emphasis on Islamic values and ethical practices. However, despite their importance, limited scholarly attention has been given to how Islamic ethical principles influence strategic management processes within Muslim-led SMEs. One of the central prophetic ethical values emphasised in Islamic teachings is *amanah* (trustworthiness), which encompasses honesty, responsibility, transparency, justice, reliability, and accountability. While previous studies have explored Islamic business ethics and Muslim entrepreneurship, the specific role of *amanah* in guiding strategic formulation, implementation, and evaluation remains underexplored.

This study addresses this gap by examining how *amanah* is practiced by Muslim entrepreneurs throughout the strategic management process. Focusing on SMEs in the manufacturing sector in the Klang Valley, this study provides empirical insights into how ethical obligations toward customers, suppliers, society, and the environment shape strategic decisions. The findings contribute to the field of Islamic management by demonstrating the operationalisation of *amanah* within real business settings.

## Literature Review

### *Islamic Business Ethics and Prophetic Values*

Islamic business ethics emphasise moral conduct rooted in the Qur'an and Sunnah, with prophetic values providing a normative framework for ethical business behaviour. Among these values, *amanah* (trustworthiness) functions as a foundational ethical principle that governs both individual integrity and organisational responsibility (Antonio, 2020). Contemporary Islamic business scholarship highlights that ethical conduct in Muslim enterprises is not merely regulatory but is spiritually anchored in accountability to Allah and society, reinforcing transparency, justice, and social responsibility (Beekun & Badawi, 2005; Solihati et. al., 2023). Within the prophetic leadership framework, *amanah* operates in synergy with *siddiq* (truthfulness), *fathonah* (wisdom), and *tabligh* (effective communication), guiding ethical judgement and strategic behaviour in Muslim SMEs (Abd Rahman & Md Shamsudin, 2025; Abd Rahman, Nadzri, & Che Senik, 2024).

Recent studies further demonstrate that prophetic values enhance organisational legitimacy and stakeholder trust, which are critical for long-term business sustainability. Islamic ethical values provide a moral governance system that influences how firms manage risk, treat stakeholders, and pursue growth (Islam et. al., 2024; Solihati et. al., 2023). Empirical evidence from Muslim SMEs shows that adherence to *amanah* and related prophetic traits improves customer loyalty, employee commitment, and reputational capital, thereby contributing to competitive advantage in increasingly values-driven markets (Abd Rahman et al., 2024).

### *Amanah in Islamic Management*

In Islamic management, *amanah* refers to the ethical obligation to fulfil responsibilities faithfully, uphold trust, and exercise honesty and integrity in all organisational activities (Mohamed, Abdul Razak, & Taib, 2019). It extends beyond personal morality to include leaders' responsibilities towards employees, customers, shareholders, and society. Contemporary Islamic leadership literature conceptualises *amanah* as a governance mechanism that disciplines managerial behaviour by embedding accountability to Allah and moral duty into organisational decision-making (Kasim et al., 2020; Solihati et. al., 2023). When internalised at the organisational level, *amanah* reduces opportunistic behaviour, enhances transparency, and strengthens stakeholder trust.

Recent empirical studies show that leaders who demonstrate *amanah* are more consistent, ethical, and stakeholder-oriented in their strategic decisions. For example, Fijawi et. al., (2023) found that trust-based leadership significantly improves ethical climate and decision quality in Malaysian organisations. Similarly, Rahman and Noor (2023) reported that entrepreneurs who prioritise *amanah* exhibit stronger contract compliance, more responsible risk-taking, and higher levels of stakeholder satisfaction.

### *Strategic Management and Ethical Values*

Strategic management is widely conceptualised as a continuous process consisting of strategy formulation, implementation, and evaluation (David, David, & David, 2023). Contemporary strategy scholarship increasingly recognises ethics and values as critical drivers of strategic effectiveness, organisational legitimacy, and long-term sustainability (Freeman et al., 2020). Rather than being external constraints, ethical values shape managerial cognition, strategic

priorities, and stakeholder engagement, particularly in environments characterised by uncertainty and reputational risk.

From an Islamic perspective, ethical values such as *amanah* provide a normative compass that governs how strategies are conceived, executed, and assessed. Ethical decision-making serves as a mediating mechanism between business integrity and responsibility, ultimately influencing organisational performance. Leaders who adopt Islamic values-based approaches foster an environment that promotes ethical behaviour, transparency, and stakeholder trust (Panakaje et al., 2025). Empirical evidence from Muslim-owned firms further shows that ethical leadership enhances strategic alignment, employee commitment, and organisational resilience, thereby strengthening the effectiveness of strategy implementation and evaluation (Rahman & Noor, 2023).

## Research Methodology

This study employed a qualitative research design to explore how *amanah* is practiced by Muslim SMEs in their strategic management processes. This study uses a purposive sampling method where the selection of the study sample is based on several parameters that have been identified (Chua Yan Piaw 2020; Merriam 2009). Semi-structured interviews were conducted with seven Muslim entrepreneurs who are actively involved in the management of their businesses. The location of the SME is in the Klang Valley, which covers the states of Selangor and Kuala Lumpur, Malaysia. The sector involved is the manufacturing sector and the type of business is food or beverage products, clothing, and health or beauty care products.

All interviews were audio-recorded, transcribed verbatim, and analysed using thematic analysis. ATLAS.ti 9.0 software was utilised to organise codes, identify patterns, and generate themes. The coding process followed Braun and Clarke's (2006) six-step approach, enabling systematic examination of the data. Throughout the data analysis procedure, the process of re-examining, defining, and re-categorizing always occurred in order to obtain concrete and meaningful analysis (Creswell & Poth 2018).

## Findings

This study explores the practice of *amanah* by Muslim SME entrepreneurs in the strategic management process that covers three phases: strategy formulation, strategy implementation, and strategy evaluation. Table 2 summarizes the profile of the SMEs.

**Table 1: Profile of the SMEs**

| Code | Sector/ Category | Product | Year |
|---|---|---|---|
| **PK1** | Food and beverage | Yong tau foo | 1999 |
| **PK2** | Food and beverage | Cooking sauce, packed food | 1986 |
| **PK3** | Food and beverage | Biscuit, cakes, instant flour | 1984 |
| **PK4** | Textile | Uniform (school, corporate and government agencies) | 1995 |
| **PK5** | Textile | Muslim attire (school uniform, casual, pilgrimage) | 1993 |
| **PK6** | Textile | Malay traditional costume and accessories | 1976 |
| **PK7** | Health and beauty | Food supplement and beauty products | 2004 |

The findings demonstrate that *amanah* plays a pivotal role across all three phases of strategic management among Muslim SME entrepreneurs.

***Strategy Formulation: Responsibility and Social Commitment***

Responsibility refers to an individual's willingness to assume and fulfil duties and obligations conscientiously toward oneself, toward others, and toward Allah SWT (Antonio, 2013). At the strategy formulation phase, it was generally found that all Muslim SME entrepreneurs in this study regarded their involvement in entrepreneurship as a form of *amanah* that carries responsibilities to be fulfilled. This was identified through the analysis of interviews and company vision or mission statements, which reflect a sense of responsibility in setting strategies related to organisational processes and operations.

Muslim SME entrepreneurs in this study felt responsible for fulfilling the obligation of *fardhu kifayah* by undertaking social responsibility through the formulation of their company missions, such as: *"...Produce high quality food products that are competitive, safe, and fulfill market demands."* (PK3) and *"...offering the community high quality, affordable products while fulfilling the communal fardhu kifayah obligation."* (PK7), as well as through the following statements:

*"This work is worship. Whatever I do, I always pray to Allah to make things easy for me. I do this not for myself but for many people, in my own way..."* (PK4)

*"...I am doing business now not merely for profit but because of my social responsibility to society and to my family..."* (PK6)

Some Muslim SME entrepreneurs also expressed their responsibility to provide halal products, particularly for the Muslim community, as stated below:

*"What is important is that we can help people by providing halal food sources, so the public does not have to doubt buying our products..."* (PK1)

*"Halal is very important. This is a major issue for Malaysia. Compared with Japan, what can we offer Japan? Japan has many technologies. The one thing we can offer is halal..."* (PK2)

In addition, Muslim SME entrepreneurs stated their responsibility to fulfil *fardhu kifayah* by contributing to the economic development of the community:

*"I want to focus on my struggle to build the Malay economy through manufacturers' associations and chambers of commerce."* (PK4)

*"...we want to help strengthen the Muslim economy. Currently, besides producing and selling Islamic clothing to fulfil the requirement of covering the aurah, we are also campaigning for another business area, namely gold investment."* (PK5)

Accordingly, it can be concluded that the strategy formulation of Muslim SME entrepreneurs places strong emphasis on responsibility, particularly toward the Muslim community, in empowering the religion and the economic well-being of the ummah.

### *Strategy Implementation*

In the strategy implementation phase of the strategic management process, six *amanah* sub-themes emerged from the analysis conducted.

#### *Fulfilling Promises*

At the strategy implementation phase, Muslim SME entrepreneurs are found to demonstrate *amanah* by fulfilling their promises, that is, honouring and completing agreements as committed (Antonio, 2013, p. 31). The analysis reveals that this dimension of *amanah* is particularly evident in strategic activities related to product manufacturing and the payment of raw materials to suppliers.

*"With suppliers, we must be honest and keep our promises. If we say we will pay a certain amount, we pay that amount. That means we do not run away or delay… Product specifications also cannot be changed…"* (PK3)

*"Basically, if you want to succeed, you must be trustworthy: produce quality products, try to keep your promises, and take care of your debts. That is what has enabled us to supply our main customers for more than 20 years… If we promise certain product specifications, we fulfil them…"* (PK5)

Therefore, it can be concluded that the strategy implementation of Muslim SME entrepreneurs prioritises the value of keeping promises, which facilitates smooth business operations through the trust gained from stakeholders and business partners.

#### *Responsibility*

This study further reveals that *amanah*, manifested as a sense of responsibility among Muslim SME entrepreneurs. It is embedded in the implementation of their business strategies, particularly in relation to three core dimensions: ethical conduct, social responsibility, and environmental stewardship. In terms of ethics, Muslim SME entrepreneurs are found to be responsible for maintaining business ethics by ensuring that the products they produce comply with established specifications. This is evidenced by the following interview excerpts:

*"Under the Food Act, at least 70 to 80 percent fish content is required for a product to be called fish balls, and we comply with this."* (PK1)

*"If we are unable to supply, we pay compensation… If there is a product defect, we replace it."* (PK5)

Interestingly, the findings at the strategy implementation phase reveal that Muslim SME entrepreneurs do not neglect their social responsibility to society, particularly in addressing social issues such as poverty, as illustrated by the following examples:

*"We hire 100 percent Bumiputera Malaysians…not Bangladeshis, not Pakistanis…We employ Malays (as tailors)…the poor, single mothers, people from Kelantan, women."* (PK4)

*"We give back to society through our foundation…we donate, perform charitable acts, and give alms."* (PK7)

At the strategy implementation stage, environmental protection from industrial waste emerges as a critical priority for manufacturing firms. This study shows that Muslim SME entrepreneurs, particularly in the food manufacturing sector, give significant attention to environmental sustainability by adopting eco-friendly and disposable packaging. Moreover, they demonstrate *amanah* in safeguarding the environment through responsible waste management practices and compliance with regulatory requirements, as illustrated below:

*"…this 'retort' packaging technology is a better packaging method than cans… it uses flexible pouches… is lighter and has a longer shelf life than cans…"* (PK2)

*"Starting this year, we will change our plastic to recyclable types. Costs will increase by about 15 percent, but we are willing to bear the cost to protect the environment…"* (PK3)

*"We comply with ISO standards and have GMP certification. We do not pollute the environment, and our carbon usage is low."* (PK7)

Based on all the statements above, it can be concluded that the strategy implementation of Muslim SME entrepreneurs strongly emphasises *amanah* in the form of responsibility, particularly towards stakeholders such as customers and suppliers, as well as the wider community and the natural environment.

***Transparency***

Transparency refers to openness in communication and accountability, that is, not concealing information that should be disclosed (Antonio, 2013). At the strategy implementation phase, transparency is identified as a business practice that supports the execution of business strategies among Muslim SME entrepreneurs. The analysis shows that in implementing business strategies, Muslim SME entrepreneurs demonstrate transparency when conveying information to agents and employees, as illustrated below:

*"In the early days, we did not make our own yong tau foo sauce; we bought it from a Chinese supplier. When new agents (Malay traders) came to collect goods, we gave them a list of all items in the shop. We told them which products we produced ourselves, which we bought from Malay suppliers, and which from Chinese suppliers…"* (PK1)

*"If there is a problem in the company, I will call all staff together and explain everything so that everyone understands…"* (PK3)

Transparency is also practised in dealings with customers. The following excerpts show how Muslim SME entrepreneurs provide accurate and detailed information about their products or services to enable customers to make informed purchasing decisions:

*"Nowadays clothing sizes have been reduced by one size to cut costs. What used to be L is now M. But we still use the sizes from 30 years ago. Customers sometimes get confused. For example, they ask for XL, but we give them L, so we have to explain. We also provide a size chart online… We also state product quality in terms of yarn weight for the material."* (PK5)

*"When I enter a project, I offer the best price. If people approach me, I tell them honestly what services I can provide."* (PK6)

All of the above statements show that transparency in communication is essential for ensuring that employees understand the company's current situation. This trait also helps build trust among all parties who deal with the company.

***Fairness***

Fairness refers to justice, balance, and the protection of the rights of others by placing things in their proper place, as well as fulfilling one's obligations to Allah SWT (Antonio, 2013, p. 8). In this study, Muslim SME entrepreneurs are found to practise fairness in implementing business strategies, particularly in two areas: conflict management and reward allocation. The analysis identifies the practice of fairness among Muslim SME entrepreneurs in managing conflicts with partners, suppliers, and employees, as illustrated below:

*"I have two partners, one Chinese and one Malay. When the Malay partner took goods without paying, I made a firm decision: 'If you want the goods, you must pay first.' I had to be fair to my Chinese partner…"* (PK1)

*"We deal with many overseas companies, so we form a tender committee to check suppliers' backgrounds… This is to ensure fairness in supplier selection."* (PK2)

Meanwhile, in implementing reward strategies, Muslim SME entrepreneurs practise fairness by providing rewards based on employee performance, as reflected below:

*"Most of my current employees have been with me for more than 10 years. I gave them shares in my Subang branch."* (PK1)

*"We reward employees like other companies do… bonuses, increments… all based on their performance."* (PK2)

*"We are fair to our employees. When performance is good, long-serving employees receive Umrah tickets as bonuses. Newer employees receive cash."* (PK5)

Thus, in implementing business strategies, Muslim SME entrepreneurs practise *amanah* in the form of fairness by fulfilling their obligations to partners, suppliers, and employees.

***Reliability***

At the strategy implementation stage, the analysis highlights the practice of *amanah* among Muslim SME entrepreneurs, particularly in relation to payments for raw material supplies. The findings indicate that these entrepreneurs place strong importance on honouring their financial commitments to suppliers. This is illustrated in the following interview excerpts:

*"When suppliers are happy, it becomes easy to ask for their help. For example, when we are in a tight situation and ask, 'Can you give us 60 days of credit terms?' they say, 'Yes, no problem,' because they know we are good with payments. Even the price will be slightly better."* (PK3)

*"Recently we ordered fabric from Indonesia. They mistakenly gave the wrong account name and number, so we could not transfer the payment. When we informed them, they realised it was their mistake. They immediately sent the fabric without receiving payment first because they knew that we would pay, as we always do…"* (PK5)

*"Their (the supplier's) treatment is slightly different. I do not know if they treat us differently from others, but they trust us. To gain that trust, payments must always be well managed."* (PK6)

***Operational Independence***

Operational independence refers to the ability to carry out tasks or entrusted responsibilities independently, without undue influence from external parties (Antonio, 2013). In strategy implementation, Muslim SME entrepreneurs practise operational independence in two main aspects: company production or operations, and business practices that support strategic execution. In implementing business strategies related to production or operations, Muslim SME entrepreneurs demonstrate *amanah* by developing and executing strategies on their own, particularly when they receive limited support from government agencies or financial institutions, as illustrated below:

*"In this country we have many universities, MARDI, and SIRIM, which are said to be technologically advanced, but they are not fully utilised… In the end, I did it myself. I experimented, made adjustments… I learned the hard way… trying and doing until it worked..."* (PK1)

*"In the past there was no government assistance. There was no SME bank, no draft books, no government capital programmes…nothing…we did it ourselves…To build the factory, my Japanese partner and I invested our own money…getting a bank loan was extremely difficult!"* (PK2)

*"When I first took over this company, it was difficult to gain the bank's trust. After all, it was a RM44 million loss-making company…We had to struggle…"* (PK4)

In addition, some Muslim SME entrepreneurs practise operational independence by choosing not to apply for government assistance in order to avoid political interference in their companies, as stated below:

*"In terms of funding, we have never applied for assistance from agencies like MARA… All our machines were purchased gradually from sales revenue."* (PK3)

*"We do not apply for any government assistance. We only get opportunities when the government appoints us based on our own merit…We have no politicians or politically connected individuals on our board of directors. We compete like everyone else."* (PK7)

Accordingly, the operational independence demonstrated by the majority of Muslim SME entrepreneurs in this study reflects their strong commitment and perseverance in business. This trait is essential for ensuring the sustainability of their companies in facing any future challenges.

***Strategy Evaluation: Corrective Actions Guided by Ethical Responsibility***

During the strategy evaluation phase, Muslim SME entrepreneurs demonstrate the trait of responsibility by undertaking corrective actions and revising strategies that prove ineffective. Notably, they are prepared to forego potential profits in order to protect the interests of key stakeholders, such as supermarket operators and employees, as evidenced in the following excerpts:

*"Many Chinese applicants want to work as promoters in supermarkets, but we do not want to hire Chinese; we hire Malay workers. However, the problem with Malays is frequent absenteeism and low commitment. For example, if an outlet in Penang starts operating at 9 a.m. and the promoter does not show up, the supermarket headquarters will call me. I am in Kuala Lumpur, far away, and it is difficult to monitor. So now I no longer sell in supermarkets. There are many challenges."* (PK1)

*"I have been considering downsizing and even closing the Kelantan factory due to rising costs. Outsourcing production to countries such as Indonesia, China, Vietnam, Cambodia, or Bangladesh could increase margins by 10 to 15 percent, as local production is more expensive. However, I remain hesitant because our workforce consists largely of Malay tailors from Kelantan, many of whom are economically disadvantaged, including single mothers and women who depend on this employment for their livelihood." (PK4)*

**Discussion**

This study demonstrates that *amanah* functions as a unifying ethical foundation that shapes strategic management across all three phases of formulation, implementation, and evaluation among Muslim SME entrepreneurs. At the strategy formulation stage, *amanah* is expressed primarily through a deep sense of responsibility and social commitment. Entrepreneurs in this study do not view strategy merely as a profit-driven exercise but as a moral undertaking grounded in their obligations to Allah, the Muslim community, and society at large. Their vision and mission statements, together with interview narratives, reflect a strong orientation towards *fardhu kifayah*, particularly through the provision of halal products, affordable goods, and economic opportunities for the ummah. This finding reinforces Islamic strategic management theory, which argues that Muslim entrepreneurs embed moral purpose and communal welfare into strategic intent, thereby redefining business objectives beyond financial performance alone (Abd Rahman & Md Shamsudin, 2025; Mhd Sarif & Ismail, 2024).

In the strategy implementation phase, *amanah* becomes operationalised through multiple interrelated practices, including fulfilling promises, responsibility, transparency, fairness, reliability, and operational independence. These dimensions translate ethical values into

concrete managerial behaviours that directly support strategic execution. For instance, entrepreneurs' commitment to delivering products according to agreed specifications, honouring payment terms, and maintaining honest communication with suppliers, employees, and customers creates a high-trust business environment. Such trust-based relationships facilitate smoother operations, more flexible credit terms, and stronger long-term partnerships, all of which enhance strategic effectiveness. At the same time, the strong emphasis on social responsibility such as hiring poor and marginalised workers, supporting local communities, and providing halal products demonstrates that *amanah* extends beyond transactional ethics to encompass moral stewardship over people and resources. This supports contemporary Islamic business ethics literature which posits that ethical conduct rooted in *amanah* strengthens organisational legitimacy and stakeholder loyalty, thereby reinforcing competitive advantage (Abd Rahman et. al., 2024; Rahman & Noor, 2023; Panakaje et. al., 2025).

Environmental stewardship further illustrates how *amanah* is embedded in strategic implementation. The willingness of Muslim SME entrepreneurs to incur higher costs in order to adopt recyclable packaging, comply with ISO and GMP standards, and minimise environmental harm reflects a form of ethical responsibility that transcends regulatory compliance. These practices indicate that environmental protection is not treated as an external obligation but as part of the moral trust entrusted to the firm. In Islamic ethics, the natural environment is viewed as an *amanah* from Allah, and the proactive efforts observed in this study demonstrate how this belief is translated into strategic choices that support sustainability. This aligns with recent SME sustainability literature showing that ethically driven environmental practices can generate long-term operational and reputational benefits, including improved market acceptance and stakeholder confidence (Wahyuni et al., 2024; Din et al., 2025).

At the strategy evaluation stage, *amanah* is reflected in the willingness of Muslim SME entrepreneurs to revise or abandon strategies that harm stakeholders, even when such strategies could generate higher profits. The decision to withdraw from supermarket distribution due to workforce constraints, or to postpone factory closure despite cost pressures in order to protect the livelihoods of poor and single-mother employees, demonstrates that ethical responsibility guides strategic review and corrective action. These findings indicate that performance evaluation among Muslim SME entrepreneurs is not based solely on financial indicators but is filtered through moral considerations of justice, welfare, and social impact. This confirms the role of *amanah* as a higher-order ethical compass in strategic management, ensuring that business sustainability is pursued in a manner that preserves human dignity, social equity, and long-term trust (Abd Rahman & Md Shamsudin, 2025; Minh et al., 2025). Figure 1 illustrates the role of *amanah* in the strategic management process of Muslim SMEs.

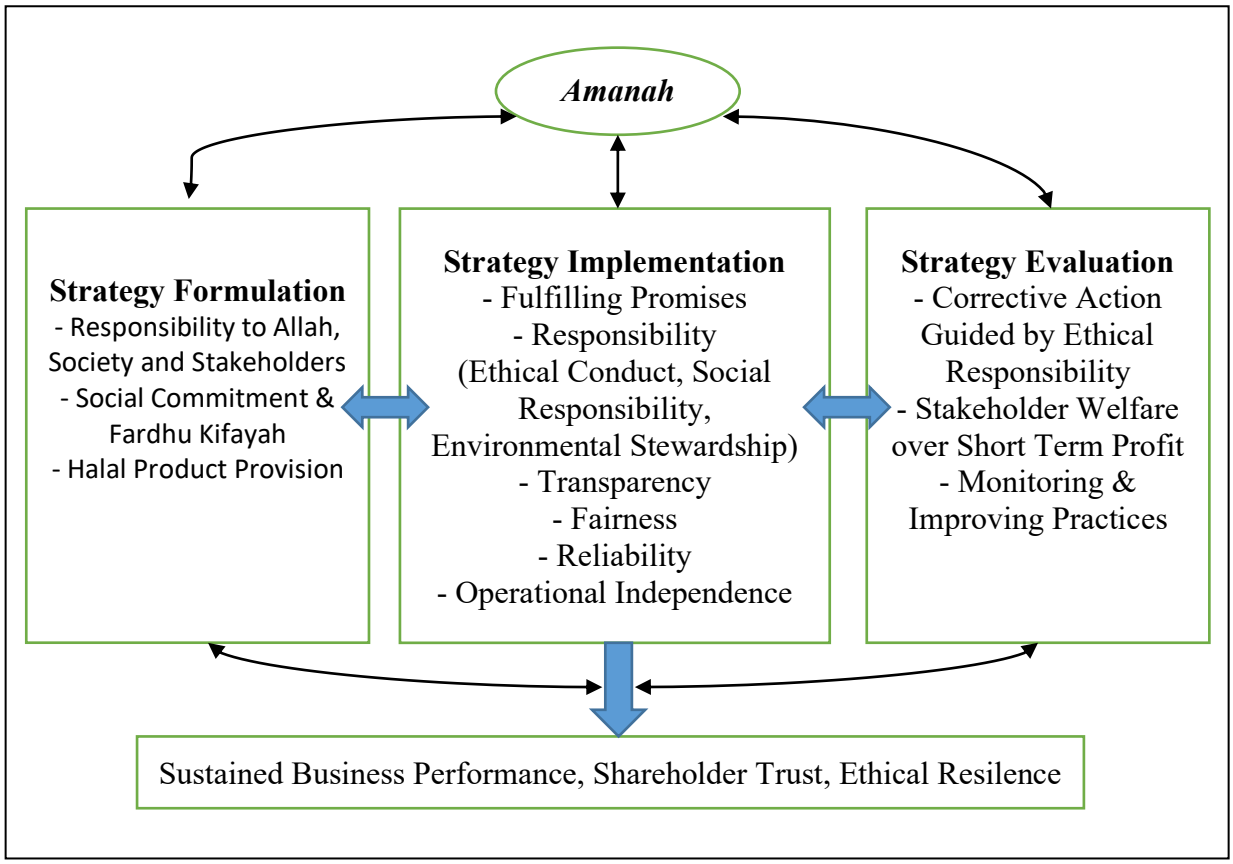



**Figure 1: The Role of *Amanah* Across Strategic Management Phases in Muslim SMEs**

## Conclusion

This study demonstrates that *amanah* is a core ethical principle guiding strategic management among Muslim SME entrepreneurs across strategy formulation, implementation, and evaluation. In formulation, *amanah* is reflected in social commitment, responsibility to Allah and the community, and ethical mission setting. During implementation, it is operationalised through fulfilling promises, transparency, fairness, environmental stewardship, and social responsibility, ensuring that business strategies are executed ethically and sustainably. In evaluation, entrepreneurs exercise ethical responsibility by adjusting or abandoning strategies that may harm stakeholders, prioritising long-term welfare over short-term profit.

Embedding *amanah* into strategic processes strengthens stakeholder trust, ethical resilience, and overall business performance. The findings underscore that Islamic ethical values can coexist with competitive entrepreneurship, producing operational, social, and environmental benefits. Future research could investigate quantitative measures of *amanah*-driven practices and their impact on SME performance, as well as explore broader applications in corporate governance to promote ethical entrepreneurship in Muslim and global business contexts.

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# SUSTAINABLE MANAGEMENT OF UNDERWATER CULTURAL HERITAGE: POLICY GAPS AND OPPORTUNITIES IN SOUTHEAST ASIA

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***Abstract:*** *Underwater Cultural Heritage (UCH) represents a critical yet often overlooked dimension of sustainable ocean governance, particularly within Southeast Asia, a region rich with shipwrecks, submerged landscapes, and maritime cultural assets. Despite its cultural, scientific, and socio-economic value, the management of UCH remains fragmented due to varying national policies, limited enforcement mechanisms, and competing interests, including marine development, tourism, and salvage operations. This paper examines the current policy landscape governing UCH in Southeast Asia and identifies key gaps that hinder sustainable and coherent regional management. Through a comparative analysis of Malaysia, Indonesia, Thailand, and the Philippines, this study highlights policy inconsistencies related to legal definitions of UCH, differing levels of adoption of the UNESCO 2001 Convention, weak cross-agency coordination, and limited integration of UCH within broader marine spatial planning and sustainability agendas. The findings reveal that inadequate stakeholder engagement, insufficient funding for conservation, and a lack of standardized in situ preservation guidelines further exacerbate threats to UCH sites. However, significant opportunities exist to strengthen UCH sustainability pathways. These include harmonizing regional policy frameworks, developing shared standards for documentation and conservation, enhancing capacity-building initiatives, and leveraging digital technologies such as photogrammetry and AI-driven monitoring systems. Moreover, aligning UCH management with Sustainable Development Goals, specifically SDG 14 (Life Below Water) and SDG 11 (Sustainable Cities and Communities), offers a strategic platform to integrate heritage protection into national and regional sustainability policies. This paper argues that addressing these policy gaps and capitalizing on emerging opportunities can position Southeast Asia as a leader in sustainable UCH management. A coordinated, policy-driven approach not only safeguards cultural heritage but also strengthens maritime identity, supports responsible tourism, and contributes to long-term ocean sustainability.*

***Keywords:*** *Underwater Cultural Heritage, Southeast Asia, Marine Spatial Planning, SDG 14, SDG 11, Digital Heritage Management, UNESCO 2001 Convention.*

## 1. Introduction

The maritime landscape of Southeast Asia is one of the most historically significant in the world. These waterways were the main route for trade between the East and the West for millennia, and as a result, shipwrecks, ceramics, and submerged villages can be found all over

the seabed(Miksic, 2021). These assets, collectively known as Underwater Cultural Heritage (UCH), are integral to understanding the region's shared history and maritime identity.

However, the rapid expansion of the "Blue Economy", characterized by offshore energy extraction, intensive fisheries, and coastal tourism, places UCH under unprecedented stress (Sampaolo, 2022). Unlike terrestrial heritage sites, which are frequently visible and clearly marked, UCH sites are hidden, leaving them vulnerable to accidental destruction by trawlers or deliberate looting by commercial salvage operators.

This research investigates the link between UCH management and sustainable ocean governance. While the region has enormous potential for heritage-led development, the current regulatory environment is fragmented and dominated by competing interests. This study compares Malaysia, Indonesia, Thailand, and the Philippines to map policy landscapes and identify anomalies in legal terminology and jurisdiction. Identify major gaps, particularly the lack of UCH in Marine Spatial Planning (MSP) and ineffective inter-agency collaboration. Propose practical options, such as using digital technology (AI and photogrammetry) and aligning UCH management with the UN Sustainable Development Goals (SDGs).

## 2. UCH and the Sustainable Development Agenda

It is crucial to place UCH within the larger framework of global sustainability to move beyond the conventional understanding of it as just "archaeology." Maritime archaeology is a field related to ships and objects that sank many years ago on the seabed and have historical value, encompassing the culture and lifestyle of earlier societies (Hariry, Mokhtar, et al., 2021). Sustainable Development Goal 14 emphasizes the conservation and sustainable use of oceans (Kirkfeldt & Frazão Santos, 2021).

SDG 14 specifically addresses the management of marine resources, even though it is frequently seen as a biological requirement. UCH locations frequently sustain marine biodiversity by functioning as man-made reefs. Therefore, when a shipwreck is conserved, the surrounding marine environment is often de facto protected. Together, historical conservation and Marine Protected Areas (MPAs) create a dual-benefit system that simultaneously safeguards natural and cultural resources.

The Underwater Cultural Heritage (UCH) of Southeast Asia takes on new significance within the framework of SDG Target 11.4, which calls for the preservation of global heritage (Wang et al., 2018). These submerged sites are more than just artifacts for local coastal people; they are essential to their identity and future prosperity. Therefore, a dual strategy is required for sustainable management: stopping the destructive looting that depletes historical treasures and putting in place responsible tourism programs that give these communities long-term economic stability.

## 3. Comparative Policy Analysis: A Fragmented Landscape

The management of UCH in Southeast Asia is complicated by the varying degrees to which nations have adopted international standards, specifically the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage. The 2001 Convention is still not widely adopted in the region. None of the focal nations has accepted the convention in its entirety; however, Cambodia (which is not included in this comparison) has (Garcia, 2023). This

reluctance is often driven by concerns over sovereignty in contested waters and a desire to retain control over potential economic assets found in shipwrecks.

### 3.1 Country-Specific Frameworks

- Malaysia: The National Heritage Act 2005 provides a robust framework for protection, declaring underwater heritage as property of the federal government (Nik Hariry & Haji Mokhtar, 2024). However, tension exists with the Merchant Shipping Ordinance, which historically viewed wrecks through the lens of salvage(Hariry, 2021). Recent efforts have moved towards stricter preservation, yet enforcement in its vast EEZ remains a challenge.
- Indonesia: As an archipelagic state, Indonesia possesses vast UCH resources. Law No. 11/2010 on Cultural Heritage offers protection, but the country has historically struggled with the tension between preservation and the issuance of licenses for commercial salvage (though a moratorium was placed on commercial exploitation)(Djukardi et al., 2020). The sheer scale of its waters makes policing extremely difficult.
- Thailand: The Fine Arts Department manages UCH, but specific comprehensive legislation for underwater sites is less developed compared to terrestrial sites (Lertrit, 2000). Thailand has been active in underwater archaeology training, but faces pressure from ongoing trawling activities that damage sites before they can be documented.
- Philippines: The National Cultural Heritage Act of 2009 protects UCH, yet the legacy of treasure hunting permits remains a contentious issue(Gumiran & Solano, 2022). The geography of the Philippines, similar to Indonesia, poses immense logistical challenges for the National Museum and coast guard agencies to monitor remote sites effectively.

## 4. Critical Policy Gaps

Despite national laws, several systemic gaps hinder effective regional management.

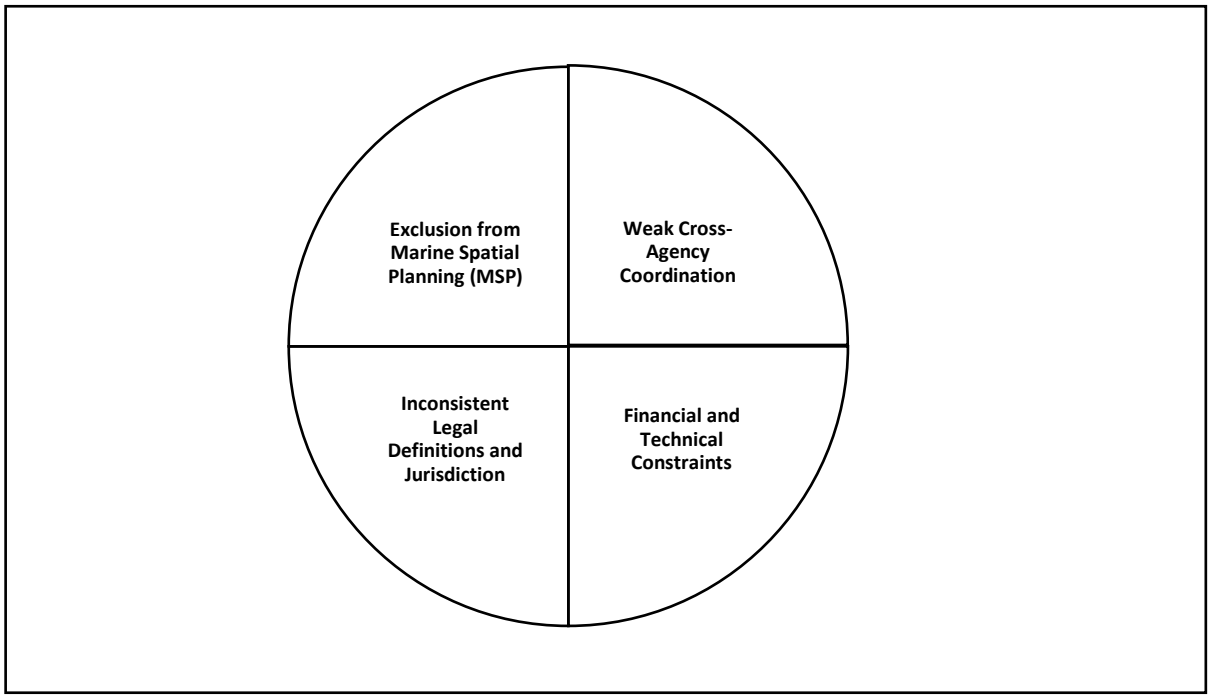



**Figure 1: Critical Policy Gaps**

### *4.1 Inconsistent Legal Definitions and Jurisdiction*

There is no unified definition of UCH across the four nations. While the UNESCO Convention defines UCH as traces of human existence strictly over 100 years old, national laws vary. This inconsistency creates loopholes where a vessel 90 years old might be protected in one jurisdiction but considered "scrap metal" in a neighboring one, facilitating cross-border illicit trade.

The absence of a unified definition of Underwater Cultural Heritage (UCH) across the UK's four nations, England, Scotland, Wales, and Northern Ireland, creates a critical legal vulnerability that threatens maritime history (Calantropio & Chiabrando, 2023). Since the UK has not ratified the 2001 UNESCO Convention, which automatically protects traces of human existence over 100 years old, management is left to a fragmented mix of devolved statutes (such as the Protection of Wrecks Act 1973 versus the Marine (Scotland) Act 2010) that often clash with the commercial salvage principles of the UK-wide Merchant Shipping Act 1995. This regulatory inconsistency generates loopholes where "modern" heritage, particularly undeclared World War II wrecks, falls into a grey area; a 90-year-old vessel might be strictly preserved in one jurisdiction or, if specifically designated, yet treated merely as "scrap metal" or lost property in a neighboring zone. Consequently, this disparity facilitates cross-border illicit trade, enabling salvagers to exploit jurisdictional boundaries to strip vessels of valuable metals and artifacts, effectively erasing historical context under the guise of legitimate commercial recovery before the law can intervene.

### *4.2 Exclusion from Marine Spatial Planning (MSP)*

Marine spatial planning is gaining traction in Southeast Asia as a tool to manage ocean spaces (Mcateer et al., 2022). However, UCH is frequently omitted from MSP maps. Zoning often

accounts for shipping lanes, oil blocks, and fishing grounds, often issued over significant UCH sites simply because the data was not part of the planning layer.

United Nations Sustainable Development Goal Target 11.4, which mandates the strengthening of efforts to protect the world's cultural and natural heritage, provides a critical framework for addressing the unique challenges facing Southeast Asia's coastal settlements (Wang et al., 2018). For these communities, Underwater Cultural Heritage (UCH) constitutes far more than scattered archaeological remnants; it serves as a tangible link to a shared maritime identity and a vital repository of regional history. Consequently, achieving sustainable management in this context requires a paradigm shift away from the illicit salvage and looting that irrevocably strips these populations of their cultural legacy for short-term gain (Kerselt & Gerstenbliht1, 2024). Instead, stakeholders must focus on developing responsible tourism models that emphasize in situ preservation, transforming submerged heritage sites into renewable economic assets. These programs, which integrate UCH into the local economy through sustainable heritage diving and teaching, can provide the long-term economic stability required to ensure the sustainability of these coastal cities and people.

### *4.3 Weak Cross-Agency Coordination*

Underwater cultural heritage (UCH) is a significant asset that is currently being threatened by the blue growth trend, which is difficult to reconcile with preserving and promoting UCH. (Papageorgiou, 2019). While the obligation for historical preservation rests with Ministries of Culture or Arts, the physical locations are located in a marine area managed by the Navy, Coast Guard, or Fisheries (Simms, 1999). In many of the countries studied, these institutions operate in silos, lacking the inter-ministerial coordination required for efficient governance. This fragmentation is particularly evident during enforcement operations; the lack of Standard Operating Procedures (SOPs) means that maritime patrols intercepting looters frequently lack the standards necessary to appropriately manage recovered artifacts. Such mismanagement inevitably disrupts the chain of custody, contaminating evidence and seriously diminishing the possibility of successful prosecution.

### *4.4 Financial and Technical Constraints*

The conservation of underwater artifacts presents a formidable financial and technical challenge, as the process is inherently resource-intensive and require long-term commitment.(Perry et al., 2021). Upon recovery, submerged objects face immediate physical and chemical destabilization, such as salt crystallization and oxidation, which demand prolonged treatment in specialized laboratories to survive the transition to a terrestrial environment. However, most nations in the region lack sufficient funding to sustain these sophisticated facilities or to effectively monitor sites *in situ*. Consequently, without the infrastructure to stabilize them, excavated artifacts frequently suffer rapid and irreversible deterioration, leading to a significant loss of heritage shortly after they are brought to the surface.

## 5. Opportunities and Pathways for Sustainability

Addressing these gaps requires a shift from reactive policing to proactive, technology-driven management

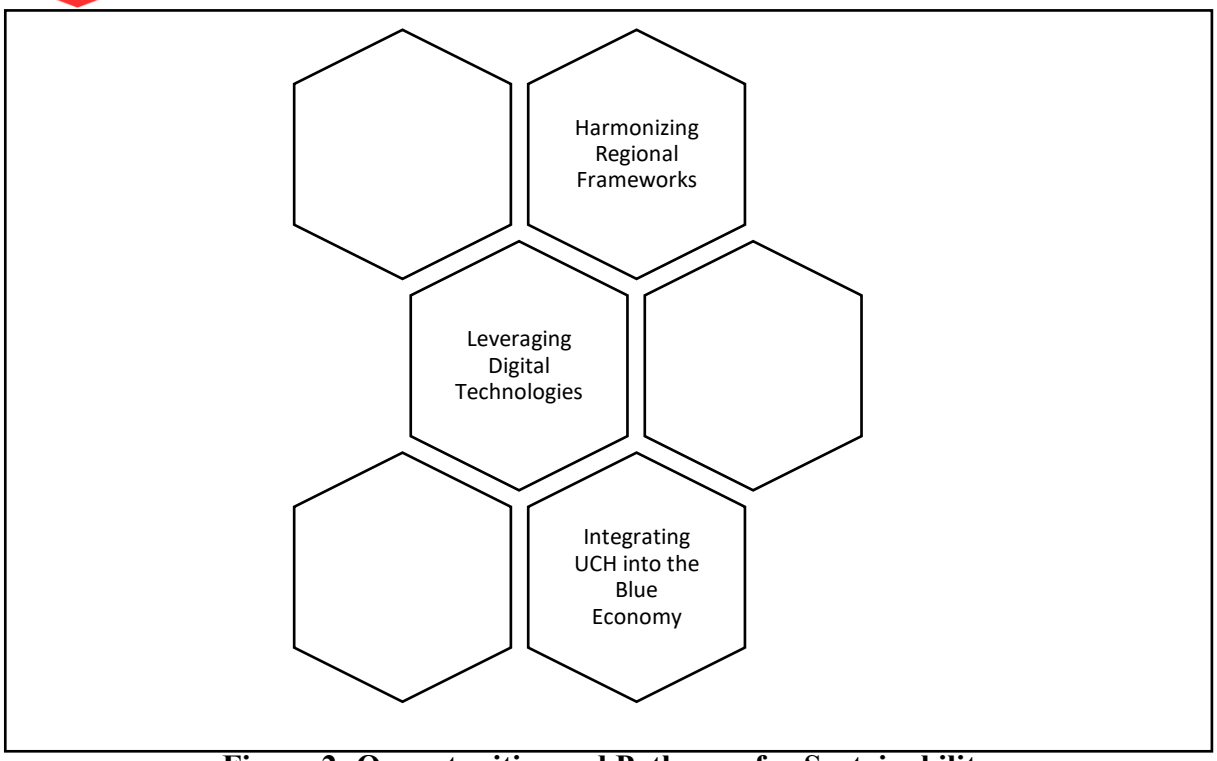



**Figure 2: Opportunities and Pathways for Sustainability**

### *5.1 Harmonizing Regional Frameworks*

ASEAN offers a platform to harmonize policies without necessitating the immediate ratification of the UNESCO convention. A "Regional Guideline on UCH" could standardize the 100-year definition and establish protocols for cross-border cooperation in interdicting illicitly trafficked artifacts.

### *5.2 Leveraging Digital Technologies*

The high cost of physical excavation can be mitigated by digital alternatives.

- Photogrammetry: Researchers and the public can "visit" shipwrecks online without physically disturbing them thanks to the creation of high-resolution 3D models. The in-situ preservation obligation is supported by this.
- AI-Driven Monitoring: Artificial intelligence can be combined with satellite imagery and Automatic Identification Systems (AIS) to detect suspect vessel behavior near known wreck sites (for example, a vessel lingering in a non-fishing zone), serving as a force multiplier for enforcement organizations.

### *5.3 Integrating UCH into the Blue Economy*

Integrating Underwater Cultural Heritage (UCH) into the Blue Economy entails a strategic expansion of ocean management frameworks to recognize submerged historical resources as sustainable economic assets rather than passive relics.(Kyvelou et al., 2025). This integration requires shifting beyond traditional maritime industries—such as fisheries and shipping—to cultivate heritage-based sectors like responsible dive tourism and underwater museums, which generate revenue while directly funding conservation efforts. By embedding UCH within

national economic planning, coastal states can align the preservation of cultural identity with financial resilience, ensuring that the protection of the past actively contributes to the sustainable development of the future.

## 6. Conclusion

Southeast Asia's underwater cultural heritage is at a crossroads. Current management techniques, which are marked by policy fragmentation and a lack of integration into larger ocean governance, are insufficient to safeguard these nonrenewable resources. However, there is a clear road forward. Nations may exploit the developmental potential of heritage while preserving it by connecting UCH management with SDG 14 and SDG 11.

A coordinated regional strategy that incorporates marine spatial planning and makes use of digital tools like photogrammetry and artificial intelligence must become the main focus. The Philippines, Malaysia, Indonesia, and Thailand have the chance to spearhead this change. Southeast Asia can guarantee that its buried history continues to educate and enrich future generations, acting as a cornerstone of a truly sustainable Blue Economy, by bridging policy gaps and emphasizing sustainable, data-driven governance.

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# UNMANNED AERIAL VEHICLE (UAV) IN SLOPE MONITORING FOR EARLY DETECTION OF SLOPE INSTABILITY

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***Abstract:*** *This study aims to assess and classify slope gradients within the campus of Politeknik Tuanku Sultanah Bahiyah using drone-based aerial photogrammetry. The research focuses on producing high-resolution topographic data to support effective slope evaluation for safety, monitoring, and development planning. A DJI Phantom 4 Version 2 drone was deployed to capture aerial imagery following a predefined flight plan designed to ensure adequate overlap, consistent coverage, and high spatial accuracy. The captured images were processed using standard photogrammetric techniques to generate both an orthomosaic and a Digital Elevation Model (DEM), which served as the primary datasets for subsequent terrain analysis. GIS tools were then utilised to calculate slope gradient values across the study area, after which the slopes were systematically classified according to recognised gradient categories. The results reveal detailed variations in slope intensity throughout the campus, allowing for the identification of potentially vulnerable or high-risk zones. Overall, the findings contribute valuable spatial information that supports informed decision-making related to slope management, hazard mitigation, and future infrastructure planning within the campus environment.*

***Keywords:*** *Aerial Mapping, Drone, Slope Classification*

## 1. Introduction

Slope monitoring is an important aspect of managing the risk of landslides, soil erosion, and the stability of hilly areas. With the increasing significance of climate change and the rapid development of slope areas, the risk of geotechnical disasters is increasing, making continuous slope monitoring a critical requirement. Traditionally, slope monitoring has been carried out through manual field observations, installation of ground sensors, or satellite imagery. However, these methods have certain limitations such as high cost, limited access, and efficient.

In the past decade, the use of Unmanned Aerial Vehicles (UAVs) or drones has become an effective alternative in environmental monitoring. UAVs allow for continuous acquisition of high-resolution imagery and topographic data at lower cost and with more flexible access, especially in difficult-to-access slope areas. UAVs also enable integration with technologies such as photogrammetry, LiDAR, and GIS-based image processing, thus improving the accuracy of slope assessment and detection of changes over time.

This study aims to evaluate the effectiveness of UAVs in slope monitoring, including aspects of measurement accuracy, ability to identify changes in slope geometry, and the potential of UAVs as a disaster risk management support tool. By utilizing UAV technology, it is hoped that slope monitoring can be carried out more efficiently, safely, and provide data that can be used for more effective preventive actions and development planning.

## 2. Literature Review

### *2.1 Potential of UAV*

Unmanned Aerial Vehicle (UAV) is a small unmanned aircraft that is programmed for more dynamic flight. According to Masiri Kaamin, (2020) This study was conducted to take images of slopes via UAV on Jalan Kuala Pilah at an altitude of 60 meters. Before the aerial data collection process, planning needs to be done first before the flight activity is carried out. This can ensure that the research works well and obtains accurate information. Several parameters need to be explained during the flight planning stage when carrying out slope data collection work.

Based on Farhan (2020), the application of unmanned aerial vehicles for mapping and its important parameters including perimeter, area and volume of certain selected areas. Overall, the application of unmanned aerial vehicles for photogrammetry along with slope mapping and slope hazard monitoring can be considered as a reliable modern technology that facilitates the work with the assurance of correct analysis due to its advancement and powerful technology.

Nowadays, the instruments used for data acquisition in geological topography have been rapidly improved using UAVs. From the study of Zolkepli (2021), UAV photogrammetry provides information used for image stitching. The autopilot system guarantees the planned flight path in the preparation of the slope data acquisition route, the camera is triggered by

automatic control to take pictures at each point of the route. By using UAVs, the effectiveness of soil slope monitoring along with existing infrastructure can be carried out in a short period of time compared to conventional techniques, especially for urgent cases such as natural disasters.

### *2.2 Slope Monitoring Using UAV*

Rock mass characterization represents the first stage in the definition of rock mass quality and stability. Based on N Bar (2021) when dealing with high and or inaccessible slopes, both natural and man-made, rock mass characterization becomes challenging. Photogrammetric surveys were conducted using UAV technology to obtain high-resolution digital outputs (digital surface models - DSM and orthophotos) for use in rock mass classification. The presented results incorporate the use of UAV photogrammetry for rock mass classification using Q-slope. Due to safety risks associated with rock fall and limited physical access to the physical, UAV surveys were conducted to improve the amount and quality of data available for analysis.

Steep hills constitute approximately 64% of the total area of South Korea. These hills have a high distribution ratio of granite masses with low strength, increasing the risk of disasters such as landslides and debris flows. From the study of Namgyun Kim (2023) said that UAV photogrammetry and geographic information system (GIS) are effectively used to estimate

ground displacement. UAV photogrammetry has been adopted to monitor ground displacement occurring on the slope under the coal waste rock dump.

Research on slope deformation monitoring has become an important topic in both academia and industry. From the study of Mingpeng Li (2021) in industrial photogrammetry, artificial markers such as coded or uncoded targets can be used to improve accuracy and enrich surface texture. The flight path of the UAV in the experimental area was planned, and the first image collection was performed. Then all the markers on the slope were moved a few millimeters, and the displacements of three checkpoints were recorded before collecting images. Thus, UAV with industrial photogrammetry technology, the method is able to easily monitor large-scale structural deformation with lower cost and higher accuracy than conventional methods.

### *2.3 Slope Failure*

Slope failure occurs when a section of a slope collapses under the influence of gravity, often triggered by rainfall or earthquakes. From the study of Omid Ghorbanzadeh (2019) we used optical data from unmanned aerial vehicles (UAVs) in two separate study areas. The only spectral information we used was obtained from UAV remote sensing images. According to the different accuracy assessment metrics used in this study, using only optical data produced a larger number than using a combination of optical and slope data.

Slope failure is a serious geological hazard for many countries in the world including Malaysia. To prevent slope failure, dangerous symptoms can be detected early in the slope monitoring process using UAVs.

Based on Norhayati Ngadiman (2019) , the importance of using UAV technology in mapping slopes and hard-to-reach geographical areas. In this context, their study shows how UAVs such as the DJI Phantom 4 Pro can be used to produce high-quality orthophotos, which provide up-to-date and detailed images of the study area. This UAV technique replaces large format

cameras with small digital cameras, allowing for accurate mapping without the need for direct on-site control. This approach is considered particularly useful in assessing slopes or structures that change periodically, such as campus areas or areas prone to erosion.
Slope failure occurs when the soil or rock structure on a slope cannot withstand the pressure or load, causing the soil or rock to collapse and slide downward. From the study by Fairul and Zulhelmi (2022) Slope failure is a natural disaster that causes significant losses, for example, giving a negative impact to society and the country. It is capable of increasing the threat to human life and property destruction. Exposure to various human activities such as tourism, development, forestry and logging increases the disaster of slope failure.

### *2.4 Uses of UAVs For Mapping Purposes*

According to a study by Juraidi (2020), the use of Unmanned Aerial Vehicles (UAVs) in topographic mapping found that UAVs are efficient tools in obtaining geospatial data with high accuracy and lower operating costs. In his study, Juraidi evaluated the accuracy of photogrammetry based on variations in flight altitude (250, 300, and 350 meters) and camera resolution (12 and 24 megapixels) for the production of orthophotos, Digital Terrain Models (DTM), contour lines, and topographic maps. The results of the study showed that increasing flight altitude and camera resolution also increased data accuracy, especially in terms of

planimetry and elevation. In conclusion, UAVs show great potential as an alternative technology in topographic mapping and map updating, especially in situations that require high efficiency and flexibility for geospatial purposes, with better altitude accuracy when using high camera resolution. This study proves that UAVs can be a practical and effective choice in mapping applications compared to traditional methods that are more expensive and complicated to implement.

## 3. Methodology

The authors have employed a comprehensive approach in aerial data acquisition by using Unmanned Aerial Vehicles (UAVs). This approach provides an effective and cost-efficient solution through the systematic procedures.

### *3.1 Study Design and Preliminary Planning*

The research commenced with careful planning and study design. The appropriate UAV specifications such as camera resolution, flight altitude, and image processing software was selected to ensure data accuracy and reliability.

### *3.2 Field Data Acquisition*

A UAV equipped with a high-resolution camera was deployed at a predetermined flight altitude over the PTSB slope area. Ground Control Points (GCPs) were established using a Global Navigation Satellite System (GNSS) to provide accurate coordinate references for the captured images. The UAV collected high resolution aerial images required for generating slope models and orthophotos. The field data acquisition process involved conducting a site reconnaissance to identify safe and suitable locations for UAV operations, marking four preliminary Ground Control Points (GCPs) within the study area using GNSS, preparing the flight plan with the Pix4Dcapture software and performing pre flight checking to executing the UAV flight operations.

### *3.3 Data processing*

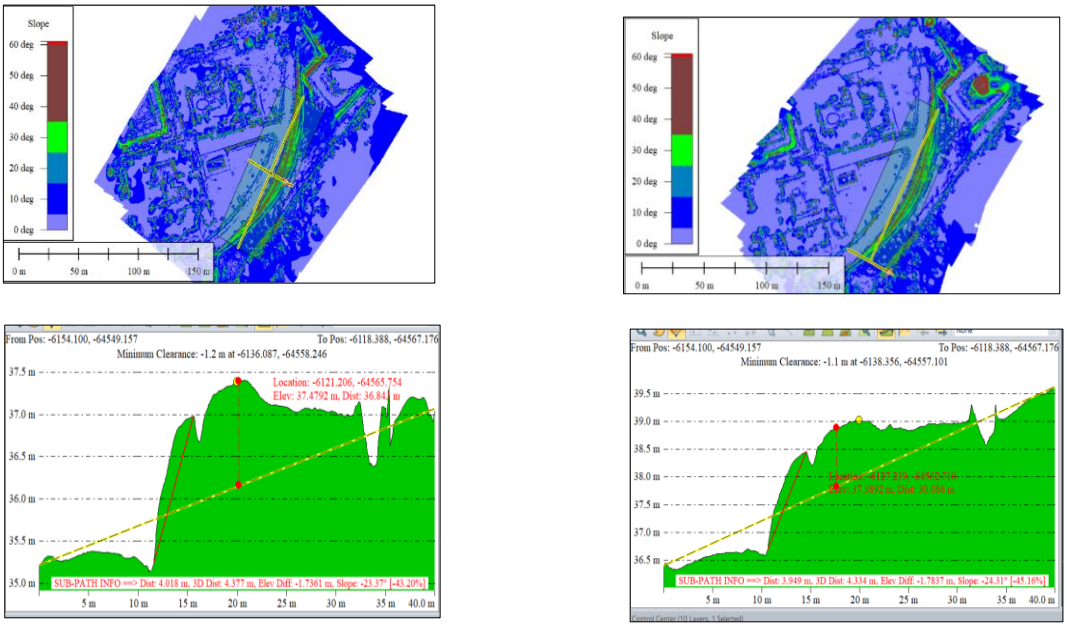
The UAV images were processed using Pix4D and Agisoft Metashape to generate orthophotos and terrain products. The processing include point clouds, 3D meshes, Digital Elevation Models (DEM), and Digital Terrain Models (DTM). A total of 98 pre monitoring and 115 postmonitoring images were used to obtain clear slope representations. These outputs enabled detailed slope analysis, including the identification of potential risk areas and assessment of slope stability.

## 4. Analysis & Discussion

### *4.1 Difference of Slope Angle*

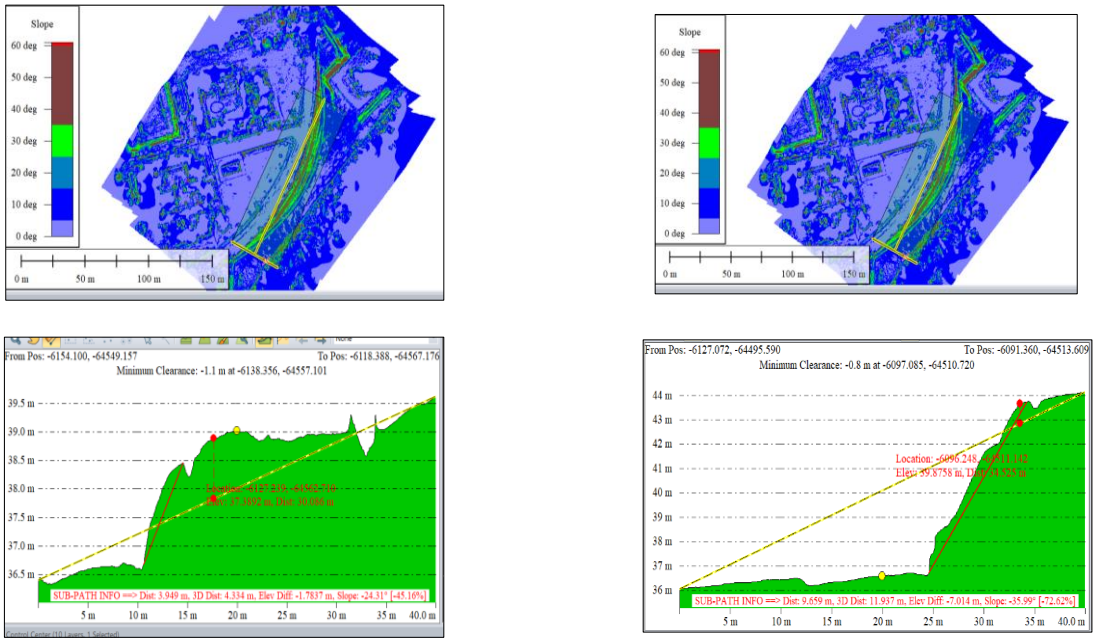
The difference slope angle was analyzed using Global Mapper software by comparing the pre-monitoring and post-monitoring DTM images. To perform the analysis systematically, the DTM images are divided into thirteen cross-sectional segments, each spaced 10 meters apart along the slope.This approach allows us to determine the slope angles at various points across the study area and to detect any changes that may indicate instability or erosion over time. The methodology was adapted from previous studies and follows the approach used in research

conducted by University Tun Hussein Onn in 2024.By analyzing these slope differences, researcher can define the slope behaviour and identify the areas that need to prevent or further monitoring.



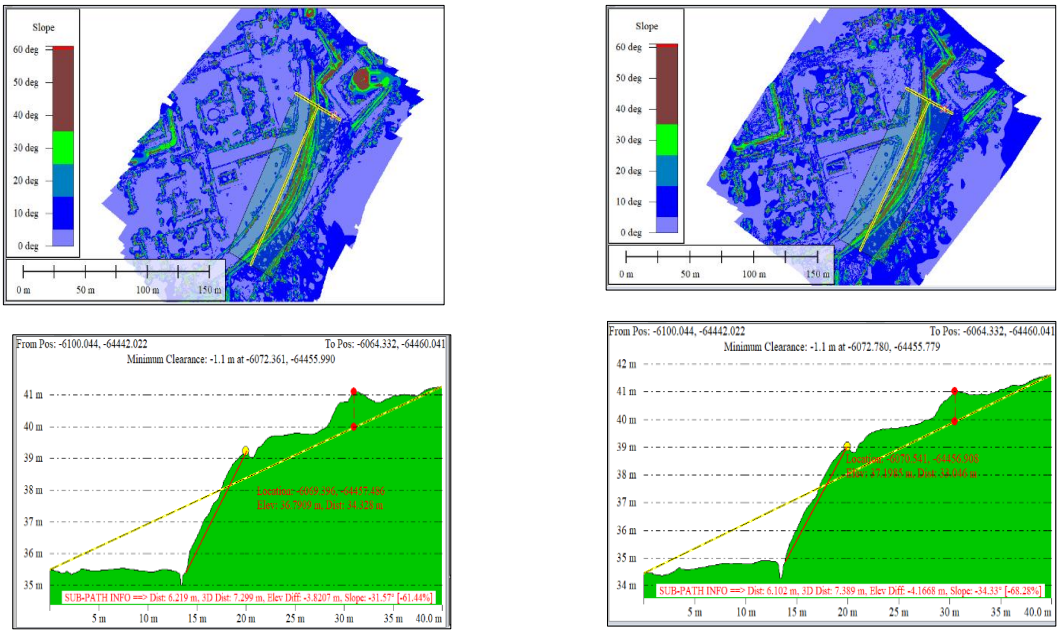

(a) (b)

**Figure 1.0 Cross-Section 1, Pre-Monitoring (a) And Post-Monitoring (b)**




(a) (b)

**Figure 2.0 Cross-Section 7, Pre-Monitoring (a) And Post-Monitoring (b)**




(a) (b)

**Figure 2.0 Cross-Section 13, Pre-Monitoring (a) And Post-Monitoring (b)**

Table 1 and 2 represent the slope cross-section data classified into four classes: Class I, Class II, Class III, and Class IV. These classes represent good, moderate, poor, and high-risk slope conditions, respectively.

**Table 1: Pre-Monitoring Classification**

| Cross section | Slope Degree (°) | Class | Slope |
|---|---|---|---|
| 1 | 23.37° | I | Good |
| 2 | 29.96° | II | Moderate |
| 3 | 34.07° | II | Moderate |
| 4 | 38.86° | IV | Risk |
| 5 | 35.53° | IV | Risk |
| 6 | 32.58° | II | Moderate |
| 7 | 34.72° | II | Moderate |
| 8 | 35.57° | IV | Risk |
| 9 | 34.24° | II | Moderate |
| 10 | 32.39° | II | Moderate |
| 11 | 32.20° | II | Moderate |
| 12 | 33.11° | II | Moderate |
| 13 | 31.57° | II | Moderate |

Source: Department of Mineral and Geoscience

Table 1 represents 13 slope cross-sections analyzed in this study. The results indicate that one cross section falls under Class I (good slope condition), nine cross-sections are classified as Class II (moderate slope condition), and three cross-sections are categorized as Class IV

(high-risk slope condition). Most of the slopes exhibit inclination angles exceeding 30°, indicating that the study area is generally characterized by steep terrain.

**Table 2: Post Monitoring Classification**

| Cross section | Slope Degree (°) | Class | Slope |
|---|---|---|---|
| 1 | 24.31° | I | Good |
| **2** | 31.91° | II | Moderate |
| **3** | 38.28° | IV | Risk |
| **4** | 39.03° | IV | Risk |
| **5** | 37.08° | IV | Risk |
| **6** | 35.09° | III | Poor |
| **7** | 35.99° | IV | Risk |
| **8** | 37.53° | IV | Risk |
| **9** | 36.20° | IV | Risk |
| **10** | 34.65° | II | Moderate |
| **11** | 33.31° | II | Moderate |
| **12** | 34.85° | II | Moderate |
| **13** | 34.33° | II | Moderate |

Source: Department of Mineral and Geoscience

Table 2 represents the slope cross section data obtained in eight days after the pre monitoring stage. The results show that one cross-section remains in Class I (good slope condition), five cross sections are classified as Class II (moderate slope condition), one cross section falls under Class III (poor slope condition), and six cross sections are categorized as Class IV (high-risk condition). Most slopes exhibit inclination angles greater than 30°, indicating that the study area is generally steep. Table 3 represents the differences between pre monitoring and post monitoring slope conditions.

### *4.2 Slope Clasification*

Table 3 represents the differences in slope cross sections between pre monitoring and post monitoring. All of 13 cross-sections, the largest difference was observed in cross-section 3, with a value of 4.21°, while the smallest difference was recorded in cross section 4, at 0.17°. Most of the data show differences of 1.5° or more, indicating significant changes over the two week period. According to Department of Mineral and Geoscience slopes in Class I and II are typically inspected every six months, while Class III slopes are inspected every 12 months. From the results of this study, it is shown that the slopes in the study area have the potential to fail and require the action.

**Table 3: Differences Between Pre Monitoring and Post Monitoring Slope**

| Cross Section | Slope Differences *pre-monitoring* dan *post-monitoring* |
|---|---|
| 1 | 0.94° |
| 2 | 1.95° |
| 3 | 4.21° |
| 4 | 0.17° |

| | |
|---|---|
| 5 | 1.55° |
| 6 | 2.51° |
| 7 | 1.27° |
| 8 | 1.96° |
| 9 | 1.96° |
| 10 | 2.26° |
| 11 | 1.11° |
| 12 | 1.74° |
| 13 | 2.76° |

### *4.2 Orthophoto Map*

The Figure 3 shows a orthophoto processed using Agisoft Metashape. It's providing a high resolution, georeferenced representation of the study area. It serves as a primary dataset for generating the Digital Terrain Model (DTM), enabling accurate slope analysis, cross sectional calculations and elevation assessment. By integrating the orthophoto with DTM data in Global Mapper, both visual inspection of surface features such as erosion, drainage, slope boundaries and precise numerical analysis. The orthophoto are possible to help effective slope monitoring and early detection of potential instability.




**Figure 3: Orthophoto Map of Study Area**

## 5. Conclusion

This study demonstrates the effectiveness of using UAVs combined with modern mapping software for monitoring slope failure risks in vulnerable areas. The findings indicate significant changes in slope angles over a one week period, suggesting physical alterations to the slopes, potentially caused by weather conditions or soil characteristics. These changes were measured across multiple slope cross sections, with notable differences observed in cross-sections 1, 7, and 13. Such variations provide early indications that these slopes have a high potential for failure, especially if left without further monitoring.

The study highlights the importance of regular UAV based monitoring to detect and track slope changes. It is recommended that UAV monitoring be adopted as a standard practice in Malaysia, particularly in areas with unstable soils or regions prone to natural hazards like landslides. Frequent monitoring enables long-term analysis of slope patterns, early

identification of potential risks, and prevention of serious slope failures, thereby enhancing public safety and supporting safer, more resilient development planning.

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# THERMAL STABILITY ANALYSIS OF AZ91–CNT MAGNESIUM NANOCOMPOSITES UNDER CONTROLLED THERMAL EXPOSURE

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***Abstract:*** *Thermal stability is a key requirement for magnesium-based materials intended for applications involving prolonged exposure to elevated temperatures. This study presents a comprehensive Thermal Stability Analysis (TSA) of AZ91–CNT magnesium nanocomposites subjected to controlled thermal exposure. Building upon DSC-identified thermal events, the stability of microstructure and mechanical response of AZ91–CNT nanocomposites was evaluated within critical temperature ranges. The results indicate that CNT reinforcement significantly enhances the thermal stability of AZ91 by suppressing the premature dissolution of the β-$Mg_{17}Al_{12}$ phase and extending the stable operating temperature window. Thermal exposure within the range of 150–200 °C resulted in retained hardness and stable microstructural features, whereas higher temperatures led to the onset of thermal degradation. The TSA framework effectively correlates thermal exposure with phase stability and mechanical performance, highlighting the role of CNT as a thermal stabilising agent. This study provides a stability-based assessment of AZ91–CNT nanocomposites and establishes practical thermal limits for their use in high-temperature engineering applications.*

***Keywords:*** *Thermal stability analysis; AZ91 magnesium alloy; carbon nanotubes; thermal exposure; phase stability*

## Introduction

The increasing demand for lightweight materials capable of operating under elevated temperatures has intensified research on magnesium alloys for automotive and aerospace applications. Magnesium alloys offer significant advantages in terms of low density and high specific strength; however, their limited thermal stability restricts their use in components subjected to prolonged thermal exposure (Mordike & Ebert, 2001; Pollock, 2010).

Among commercial magnesium alloys, AZ91 is widely utilised due to its favourable mechanical properties and castability. Nevertheless, its thermal stability is strongly influenced by the β-$Mg_{17}Al_{12}$ intermetallic phase, which tends to dissolve or coarsen at intermediate temperatures, leading to deterioration of mechanical performance (Luo, 2002; Kim et al., 2009). Understanding and improving the thermal stability of this phase is therefore essential for extending the service temperature range of AZ91 alloy.

Recent studies have demonstrated that carbon nanotubes (CNTs) can enhance the mechanical and thermal performance of magnesium-based composites by improving load transfer, restricting dislocation motion, and modifying diffusion behaviour (Zhang et al., 2006; Rashad et al., 2014). While Differential Scanning Calorimetry (DSC) has been widely used to identify thermal events and phase transformation temperatures, DSC alone does not fully describe material behaviour under prolonged thermal exposure.

Thermal Stability Analysis (TSA) provides a complementary approach by evaluating the stability of microstructure and mechanical properties after controlled thermal exposure. TSA enables the identification of safe operating temperature windows and the onset of thermal degradation under service-like conditions.

The present study aims to perform a systematic TSA of AZ91–CNT magnesium nanocomposites subjected to controlled thermal exposure. By correlating thermal exposure temperature with microstructural stability and hardness retention, this work establishes practical thermal limits and highlights the role of CNTs as thermal stabilising agents.

## Literature Review

### *Thermal Stability of AZ91 Magnesium Alloy*

The thermal stability of AZ91 magnesium alloy has been extensively investigated due to its industrial relevance. Previous studies have shown that the thermal behaviour of AZ91 is dominated by the stability of the β-$Mg_{17}Al_{12}$ phase, which tends to dissolve or coarsen at temperatures above 150 °C (Zhou & Xu, 1997; Kim et al., 2009). This phase instability is closely associated with the degradation of mechanical properties such as hardness and creep resistance.

Luo (2002) reported that prolonged exposure to intermediate temperatures accelerates microstructural degradation in AZ91, resulting in reduced load-bearing capability. Zhu et al. (2011) further demonstrated that the dissolution and redistribution of aluminium within the matrix significantly influence the long-term thermal stability of magnesium alloys.

### *CNT Reinforcement and Thermal Stability Enhancement*

Carbon nanotube reinforcement has been widely studied for improving the mechanical properties of magnesium alloys. Hassan and Gupta (2006) reported enhanced hardness and strength in CNT-reinforced magnesium composites due to effective load transfer and grain refinement. Beyond mechanical enhancement, CNTs have also been suggested to improve thermal stability by acting as diffusion barriers and pinning sites for dislocations and grain boundaries (Rashad et al., 2014).

Tjong (2013) highlighted that CNTs can significantly retard microstructural coarsening in metal matrix nanocomposites, thereby enhancing resistance to thermal softening. However, systematic investigations focusing on the thermal exposure behaviour and stability window of AZ91–CNT composites remain limited.

### *Need for Thermal Stability Analysis (TSA)*

While DSC provides valuable information on transformation temperatures and thermodynamic behaviour, it does not account for time-dependent degradation mechanisms under sustained thermal exposure. TSA addresses this limitation by evaluating material stability after controlled thermal exposure, enabling a more realistic assessment of service performance (Singh & Srivastava, 2015).

Despite its importance, TSA-based studies on CNT-reinforced AZ91 magnesium alloys are scarce. This gap motivates the present study, which integrates DSC-informed temperature selection with systematic TSA to establish practical thermal limits.

## Materials And Methods

### *Materials and Composite Fabrication*

Commercial AZ91 magnesium alloy powder was used as the matrix material, while multi-walled carbon nanotubes were employed as reinforcement. The composites were fabricated using a powder metallurgy route to ensure uniform CNT dispersion. Unreinforced AZ91 samples were prepared using identical processing conditions for comparison.

### *Controlled Thermal Exposure Procedure*

Thermal Stability Analysis was conducted by subjecting samples to isothermal exposure at 150, 175, 200, 225, and 250 °C for a fixed duration under an inert atmosphere. These temperatures were selected based on critical thermal events identified from DSC analysis. The overall Thermal Stability Analysis (TSA) procedure adopted in this study is schematically illustrated in Figure 1.

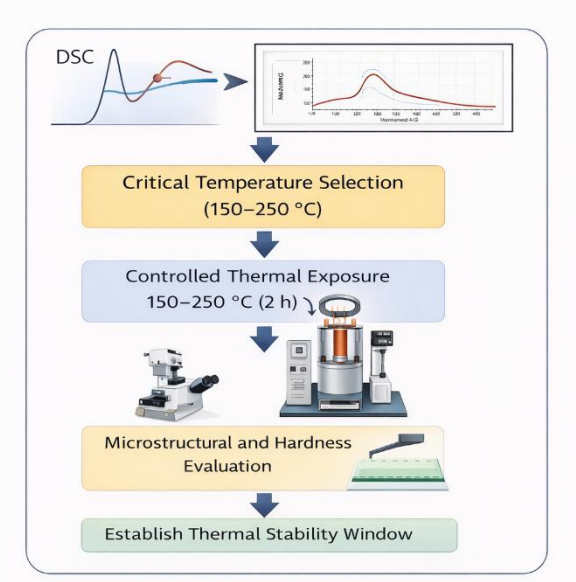



**Figure 1: Schematic of Thermal Stability Analysis (TSA) Framework**

As shown in Figure 1, critical thermal exposure temperatures were first identified based on DSC results, followed by controlled thermal exposure and subsequent evaluation of microstructural stability and hardness retention.

The thermal exposure conditions employed for the Thermal Stability Analysis are summarised in Table 1.

**Table 1: Thermal Exposure Conditions for TSA**

| Sample | Exposure Temperature (°C) | Duration (h) | Atmosphere |
|---|---|---|---|
| AZ91 | 150 | 2 | Argon |
| AZ91 | 175 | 2 | Argon |
| AZ91–CNT | 200 | 2 | Argon |
| AZ91–CNT | 225 | 2 | Argon |
| AZ91–CNT | 250 | 2 | Argon |

***Microstructural Characterisation***

Following thermal exposure, samples were prepared using standard metallographic techniques and examined using optical microscopy. Particular attention was given to the morphology, continuity, and distribution of the β-$Mg_{17}Al_{12}$ phase.

***Hardness Measurement***

Vickers microhardness tests were performed to assess mechanical stability after thermal exposure. Multiple indentations were taken for each sample to ensure statistical reliability.

**Results And Discussion**

***Hardness Evolution under Thermal Exposure***

The hardness of AZ91–CNT nanocomposites remained relatively stable up to 200 °C, whereas unreinforced AZ91 exhibited a noticeable reduction even at 175 °C. This behaviour indicates improved resistance to thermal softening due to CNT reinforcement. The variation in hardness of unreinforced AZ91 alloy and AZ91–CNT nanocomposites as a function of thermal exposure temperature is shown in Figure 2.

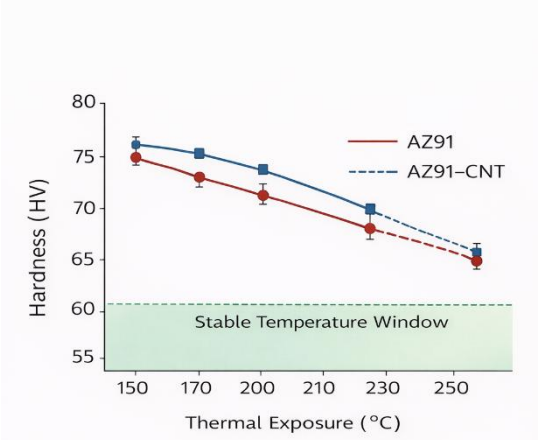


**Figure 2: Hardness Retention vs Thermal Exposure Temperature**

The hardness values and corresponding retention percentages of AZ91 and AZ91–CNT samples after thermal exposure are summarised in Table 2.

**Table 2: Hardness Retention after Thermal Exposure**

| Sample | Temperature (°C) | Hardness (HV) | Retention (%) |
|---|---|---|---|
| AZ91 | 150 | 72 | 96 |
| AZ91 | 200 | 61 | 81 |
| AZ91–CNT | 150 | 78 | 98 |
| AZ91–CNT | 200 | 74 | 93 |

***Microstructural Stability and Phase Behaviour***

Microstructural observations revealed that CNT-reinforced samples retained a finer and more stable β-phase distribution after exposure up to 200 °C. In contrast, unreinforced AZ91 showed significant β-phase coarsening and partial dissolution at lower temperatures. The microstructural features of unreinforced AZ91 alloy and AZ91–CNT nanocomposites after thermal exposure at selected temperatures are shown in Figure 3.

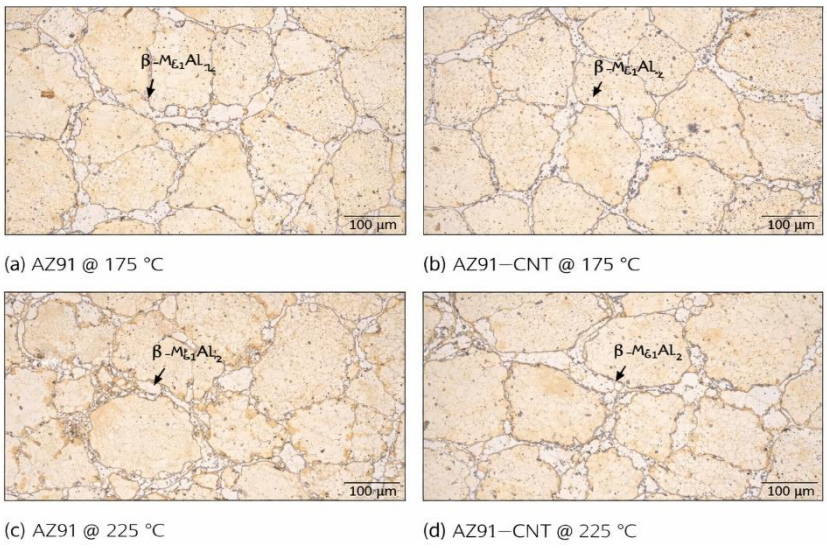



**Figure 3: Optical micrographs showing the microstructural stability**

As illustrated in Figure 3, the microstructure of the AZ91–CNT nanocomposites remain relatively stable after thermal exposure at 175 °C, with a continuous and finely distributed β-$Mg_{17}Al_{12}$ phase along the grain boundaries. In contrast, unreinforced AZ91 alloy exhibits noticeable β-phase coarsening and partial dissolution at higher exposure temperatures. At 225 °C, the CNT-reinforced samples show delayed microstructural degradation, confirming the stabilising role of CNTs during thermal exposure.

### *TSA-Based Stability Window*

Based on combined hardness and microstructural results, a stable operating temperature window up to 200 °C was established for AZ91–CNT nanocomposites. Beyond this temperature, thermal degradation becomes significant. Based on the combined hardness and microstructural results, the thermal stability window of the AZ91–CNT nanocomposites is summarised in Figure 4.

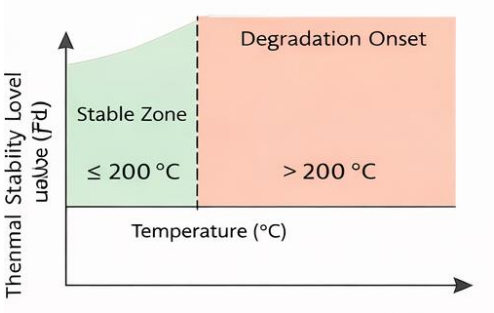



**Figure 4: Thermal Stability Window Diagram**

As illustrated in Figure 4, the AZ91–CNT nanocomposites exhibit a stable operating temperature window up to approximately 200 °C, beyond which the onset of thermal degradation becomes evident. This stability window is significantly wider than that of unreinforced AZ91 alloy, highlighting the effectiveness of CNT reinforcement in enhancing thermal resistance under prolonged thermal exposure.

A summary of the thermal stability assessment for AZ91 and AZ91–CNT nanocomposites based on TSA results is presented in Table 3.

**Table 3: Optical micrographs showing the microstructural stability**

| Material | Stable Temperature Range (°C) | Degradation Onset (°C) | Dominant Mechanism |
|---|---|---|---|
| AZ91 | ≤175 | ~180 | β-phase dissolution |
| AZ91–CNT | ≤200 | ~225 | Delayed β-phase instability |

### *Correlation with DSC Findings*

The TSA results are consistent with DSC observations, confirming that CNT reinforcement delays β-phase instability and extends thermal stability under service-like conditions.

### *Limitations and Future Work*

Although this study provides valuable insights into the thermal stability of AZ91–CNT nanocomposites, it is limited to short-term thermal exposure and hardness-based evaluation.

Future work should include long-term creep testing, tensile evaluation after thermal exposure, and advanced characterisation techniques such as SEM and TEM.

## Conclusions

This study has presented a comprehensive Thermal Stability Analysis (TSA) of AZ91–CNT magnesium nanocomposites subjected to controlled thermal exposure, with the objective of evaluating their suitability for applications involving prolonged operation at elevated temperatures. By integrating DSC-informed temperature selection with systematic thermal exposure, microstructural examination, and hardness evaluation, this work provides a holistic assessment of thermal stability beyond conventional thermal analysis techniques.

The results clearly demonstrate that carbon nanotube reinforcement plays a significant role in enhancing the thermal stability of AZ91 magnesium alloy. In comparison with unreinforced AZ91, the AZ91–CNT nanocomposites exhibited improved resistance to thermal softening and delayed degradation of the β-$Mg_{17}Al_{12}$ intermetallic phase. The presence of CNTs effectively suppressed premature β-phase dissolution and coarsening, which are commonly associated with mechanical property deterioration during thermal exposure. This stabilising effect is attributed to the ability of CNTs to act as diffusion barriers and microstructural pinning sites, thereby restricting atomic mobility and phase instability at elevated temperatures.

Thermal exposure within the temperature range of 150–200 °C resulted in minimal changes to both microstructure and hardness for the AZ91–CNT nanocomposites, indicating a stable operating regime under these conditions. In contrast, unreinforced AZ91 alloy exhibited noticeable hardness reduction and microstructural degradation at comparatively lower temperatures. At exposure temperatures of 225 °C and above, both materials showed signs of thermal degradation; however, the onset and severity of degradation were significantly reduced in the CNT-reinforced samples. These findings confirm that CNT reinforcement effectively extends the usable temperature window of AZ91 magnesium alloy.

The TSA-based approach employed in this study establishes a clear correlation between thermal exposure temperature, phase stability, and mechanical response. Unlike DSC, which primarily identifies transformation temperatures under continuous heating, TSA captures the time-dependent stability of materials under service-like conditions. The agreement between TSA outcomes and DSC-identified thermal events further validates the reliability of this integrated assessment framework.

From an application perspective, the results provide practical guidance for the use of AZ91–CNT nanocomposites in temperature-sensitive engineering components, particularly in automotive and lightweight structural applications where prolonged exposure to intermediate temperatures is unavoidable.

The establishment of a stable operating temperature window up to approximately 200 °C offers a valuable design reference for material selection and component reliability assessment. Overall, this study demonstrates that Thermal Stability Analysis is an effective and application-relevant methodology for evaluating the high-temperature performance of magnesium-based

nanocomposites. The enhanced thermal stability observed in AZ91–CNT nanocomposites highlights the potential of carbon nanotube reinforcement as a viable strategy for overcoming the thermal limitations of conventional magnesium alloys. The findings of this work are expected to contribute to the future development, optimisation, and predictive modelling of thermally stable magnesium nanocomposites for advanced engineering applications.

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# THERMAL PROPERTIES AND PHASE TRANSFORMATION BEHAVIOUR OF AZ91–CNT MAGNESIUM NANOCOMPOSITES

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***Abstract:*** *Understanding the thermal properties and phase transformation behaviour of magnesium alloys are essential for their reliable application in temperature-sensitive engineering environments. In this study, the thermal response of AZ91 magnesium alloy reinforced with carbon nanotubes (CNTs) was systematically investigated using Differential Scanning Calorimetry (DSC). AZ91-CNT nanocomposites were fabricated via a powder metallurgy route, and their thermal behaviour was compared with that of unreinforced AZ91 alloy. The DSC results revealed distinct endothermic and exothermic peaks associated with the precipitation, dissolution, and melting of the β-$Mg_{17}Al_{12}$ intermetallic phase, as well as the melting of the α-Mg matrix. The incorporation of CNTs resulted in noticeable shifts in transformation temperatures and variations in enthalpy values, indicating altered phase transformation characteristics. In particular, CNT reinforcement delayed the onset of β-phase dissolution and modified the thermal transition behaviour within the intermediate temperature range relevant to automotive service conditions. These findings demonstrate that CNTs significantly influence the intrinsic thermal properties and phase stability of AZ91 magnesium alloy. The results provide a valuable thermal baseline for assessing thermal stability and for developing predictive models of AZ91-CNT magnesium nanocomposites.*

***Keywords:*** *AZ91 magnesium alloy, carbon nanotubes, differential scanning calorimetry, phase transformation, thermal stability*

## Introduction

The demand for lightweight structural materials has increased significantly in recent decades, particularly in the automotive and aerospace industries, where weight reduction directly contributes to improved fuel efficiency and reduced emissions. Magnesium alloys have emerged as promising candidates due to their low density, high specific strength, and good machinability (Mordike & Ebert, 2001; Pollock, 2010). Among commercial magnesium alloys, AZ91 is one of the most widely used because of its favourable castability and balanced mechanical properties (Friedrich & Mordike, 2006).

Despite these advantages, the application of AZ91 alloy in temperature-sensitive environments remains limited by its relatively poor thermal stability and degradation of mechanical properties at elevated temperatures (Luo, 2002). The microstructure of AZ91 alloy mainly

consists of an α-Mg matrix and a β-$Mg_{17}Al_{12}$ intermetallic phase distributed along grain boundaries. The β-phase plays a crucial role in governing the thermal and mechanical behaviour of the alloy, particularly during thermal exposure and service at intermediate temperatures (Kim et al., 2009).

Phase transformations involving the precipitation, dissolution, and melting of the β-$Mg_{17}Al_{12}$ phase significantly affect the dimensional stability, creep resistance, and overall service performance of AZ91 alloy (Zhou & Xu, 1997; Singh & Srivastava, 2015). Therefore, a thorough understanding of the thermal behaviour and phase transformation characteristics of AZ91 alloy is essential for its reliable application in engineering components.

In recent years, carbon nanotubes (CNTs) have attracted considerable attention as reinforcement materials for metal matrix composites due to their exceptional mechanical strength, high thermal conductivity, and excellent thermal stability (Zhang et al., 2006; Rashad et al., 2014). Several studies have reported improvements in mechanical properties, wear resistance, and corrosion behaviour of magnesium-based composites reinforced with CNTs (Hassan & Gupta, 2006; Gupta & Nai, 2011). However, the influence of CNT addition on the thermal properties and phase transformation behaviour of AZ91 magnesium alloy remains insufficiently explored.

Differential Scanning Calorimetry (DSC) is a widely used thermal analysis technique for investigating phase transformations and thermal transitions in metallic materials. DSC provides quantitative information on transformation temperatures, enthalpy changes, and reaction kinetics, making it a powerful tool for assessing thermal stability and phase evolution (Singh & Srivastava, 2015).

The objective of the present study is to systematically investigate the thermal properties and phase transformation behaviour of AZ91–CNT magnesium nanocomposites using DSC analysis. The thermal behaviour of CNT-reinforced composites is compared with that of unreinforced AZ91 alloy to elucidate the effect of CNT reinforcement on phase stability and thermal response. The findings aim to provide fundamental insights for the design and application of AZ91–CNT nanocomposites in temperature-sensitive engineering environments.

## Literature Review

### *Thermal Behaviour of AZ91 Magnesium Alloy*

AZ91 magnesium alloy has been extensively studied due to its widespread use in lightweight structural applications. Previous research has established that the thermal behaviour of AZ91 alloy is strongly influenced by the presence and stability of the β-$Mg_{17}Al_{12}$ intermetallic phase (Zhou & Xu, 1997). Differential Scanning Calorimetry (DSC) studies have consistently reported multiple thermal events corresponding to β-phase precipitation at lower temperatures, followed by dissolution and melting at elevated temperatures (Singh & Srivastava, 2015).

Kim et al. (2009) reported that the dissolution of the β-$Mg_{17}Al_{12}$ phase typically occurs within the temperature range of 380–420 °C, which is critical for determining the high-temperature performance of AZ91 alloy. The instability of the β-phase at intermediate temperatures has

been linked to degradation in creep resistance and dimensional stability, limiting the alloy's suitability for elevated-temperature service (Luo, 2002).

Several studies have also highlighted the role of aluminium diffusion and grain boundary segregation in governing the precipitation and dissolution behaviour of the β-phase (Zhou & Xu, 1997). These findings underscore the importance of understanding thermal phase transformations when designing AZ91 alloy components for temperature-sensitive environments.

***Carbon Nanotube Reinforcement in Magnesium Alloys***

Carbon nanotubes (CNTs) have been widely investigated as reinforcement materials in metal matrix composites due to their exceptional mechanical strength, high elastic modulus, and thermal stability (Zhang et al., 2006). In magnesium-based composites, CNTs have been shown to enhance mechanical properties such as tensile strength, hardness, and wear resistance (Hassan & Gupta, 2006; Rashad et al., 2014).

Gupta and Nai (2011) reported that the addition of CNTs can refine grain structure and improve load transfer efficiency in magnesium matrices. The dispersion and interfacial bonding of CNTs play a critical role in determining the effectiveness of reinforcement. Poor dispersion or agglomeration can adversely affect composite performance, highlighting the importance of processing routes such as powder metallurgy (Gupta & Nai, 2011).

Although the mechanical benefits of CNT reinforcement in magnesium alloys are well documented, fewer studies have focused on their influence on thermal properties and phase transformation behaviour. Rashad et al. (2014) suggested that CNTs may act as diffusion barriers, thereby affecting phase stability during thermal exposure. However, detailed DSC-based investigations on CNT-reinforced AZ91 alloy remain limited.

***DSC Studies on Magnesium-Based Composites***

DSC has been extensively used to investigate phase transformations and thermal stability in magnesium alloys and composites. (Singh and Srivastava, 2015) demonstrated that DSC analysis provides reliable information on transformation temperatures and enthalpy changes associated with β-phase reactions in AZ-series magnesium alloys.

(Zhou and Xu, 1997) conducted one of the earliest DSC studies on magnesium alloys and identified characteristic endothermic and exothermic peaks related to β-phase transformations. Subsequent studies have confirmed that variations in alloy composition, processing route, and reinforcement can significantly alter DSC peak characteristics (Kim et al., 2009).

Despite the growing interest in magnesium matrix nanocomposites, systematic DSC studies examining the effect of CNT reinforcement on the thermal behaviour of AZ91 alloy are scarce. Most existing studies focus primarily on mechanical performance, with limited emphasis on fundamental thermal properties and phase transformation mechanisms.

### *Research Gap and Motivation*

Based on the reviewed literature, it is evident that while the thermal behaviour of AZ91 alloy and the mechanical properties of CNT-reinforced magnesium composites have been widely investigated, there remains a lack of comprehensive studies focusing on the influence of CNT reinforcement on the phase transformation behaviour of AZ91 alloy using DSC analysis.

Specifically, limited information is available regarding the effect of CNTs on β-$Mg_{17}Al_{12}$ phase stability, transformation temperatures, and enthalpy changes during heating. Furthermore, the implications of these thermal modifications for intermediate-temperature applications have not been fully addressed.

Therefore, the present study aims to fill this research gap by providing a systematic DSC-based investigation of the thermal properties and phase transformation behaviour of AZ91–CNT magnesium nanocomposites. The findings are expected to contribute to a deeper understanding of CNT–matrix interactions and their role in tailoring the thermal performance of magnesium alloys.

## Materials And Methods

### *Materials*

Commercial AZ91 magnesium alloy powder was used as the matrix material in this study. The nominal chemical composition of AZ91 alloy consists of approximately 9 wt.% aluminium, 1 wt.% zinc, and trace amounts of manganese, with magnesium as the balance. This alloy was selected due to its widespread industrial use and well-documented thermal behaviour (Friedrich & Mordike, 2006).

Multi-walled carbon nanotubes (MWCNTs) were employed as the reinforcement material owing to their excellent thermal stability and mechanical properties. The CNTs used in this study had an average outer diameter of 10–20 nm and a length ranging from 5 to 15 μm. The CNT content was maintained at a low weight fraction to minimise agglomeration and ensure effective dispersion within the magnesium matrix, as recommended in previous studies on magnesium-based nanocomposites (Zhang et al., 2006; Rashad et al., 2014).

### *Powder Blending and Composite Preparation*

AZ91 powder and CNTs were blended using a mechanical mixing process to achieve a homogeneous distribution of CNTs within the magnesium matrix. Prior to mixing, the CNTs were dried to remove moisture and reduce the risk of oxidation during processing. Mechanical blending was carried out for a fixed duration to promote uniform dispersion while avoiding excessive damage to the CNT structure.

The blended powders were subsequently cold-compacted using a uniaxial hydraulic press to form cylindrical green compacts. Compaction was performed at room temperature under a controlled pressure to ensure sufficient green density while preventing excessive work hardening of the magnesium powder. Unreinforced AZ91 samples were prepared using the

same blending and compaction procedures, excluding the addition of CNTs, to serve as reference materials.

Powder metallurgy was selected as the fabrication route because it offers improved control over reinforcement distribution and minimises segregation compared to conventional casting techniques (Gupta & Nai, 2011).

***Sintering Process***

The green compacts were sintered in a controlled inert atmosphere to prevent oxidation and degradation of the magnesium matrix. Sintering was conducted at an elevated temperature below the melting point of AZ91 alloy and held for a predetermined duration to promote diffusion bonding and densification. The heating and cooling rates were carefully controlled to minimise thermal stresses and microstructural defects.

Following sintering, the samples were allowed to cool naturally to room temperature under the same inert atmosphere. This controlled cooling process helped to stabilise the microstructure and minimise unwanted phase transformations prior to thermal analysis.

***Differential Scanning Calorimetry (DSC) Analysis***

Differential Scanning Calorimetry (DSC) was employed to investigate the thermal properties and phase transformation behaviour of the AZ91 alloy and AZ91–CNT nanocomposites. DSC measurements were performed using a calibrated DSC instrument under a continuous flow of high-purity argon gas to minimise oxidation during heating.

Small specimens with a mass of approximately 10–15 mg was sectioned from the sintered samples and placed in alumina crucibles. Each sample was heated from room temperature to 700 °C at a constant heating rate. An empty alumina crucible was used as the reference. The DSC thermograms were recorded as a function of temperature, and endothermic and exothermic peaks were analysed to identify phase transformations, including β-$Mg_{17}Al_{12}$ precipitation, dissolution, and melting, as well as the melting of the α-Mg matrix (Zhou & Xu, 1997; Singh & Srivastava, 2015).

***Data Analysis and Repeatability***

To ensure the reliability and repeatability of the DSC results, each experiment was conducted at least twice under identical conditions. The reported peak temperatures and enthalpy values represent the average of repeated measurements. Any minor deviations observed between runs were within acceptable experimental limits and did not affect the overall interpretation of the thermal behaviour.

The DSC data were analysed using the instrument's dedicated software, and baseline correction was applied prior to peak integration. Phase transformation assignments were made based on peak characteristics and comparison with previously reported DSC studies on AZ-series magnesium alloys.

## Results And Discussion

### *Thermal Behaviour of Unreinforced AZ91 Alloy*

The DSC curve of unreinforced AZ91 alloy exhibited several distinct thermal events, consistent with previous studies on magnesium alloys (Zhou & Xu, 1997). An exothermic peak observed at lower temperatures was attributed to the precipitation of the β-$Mg_{17}Al_{12}$ phase from the supersaturated α-Mg matrix. This precipitation reaction is commonly associated with the redistribution of aluminium atoms during heating (Kim et al., 2009).

At intermediate temperatures, an endothermic peak corresponding to the dissolution of the β-phase was observed. This transformation indicates the destabilisation of the β-$Mg_{17}Al_{12}$ phase and its gradual dissolution into the α-Mg matrix. A strong endothermic peak at higher temperatures was associated with the melting of the β-phase, followed by the melting of the α-Mg matrix at temperatures close to the liquidus of AZ91 alloy (Zhou & Xu, 1997).

### *Effect of CNT Reinforcement on Phase Transformations*

The DSC thermograms of AZ91–CNT nanocomposites showed similar thermal events; however, noticeable shifts in transformation temperatures were observed compared to the unreinforced alloy. The onset temperature of β-phase dissolution was delayed in the CNT-reinforced samples, suggesting enhanced thermal stability of the β-$Mg_{17}Al_{12}$ phase. This behaviour can be attributed to the presence of CNTs at grain boundaries and matrix interfaces, which may act as diffusion barriers and restrict atomic mobility (Rashad et al., 2014).

Furthermore, changes in enthalpy values associated with β-phase transformations were observed in the AZ91–CNT nanocomposites. The reduced enthalpy suggests that CNT addition modifies the thermodynamic driving force for phase transformations, possibly due to altered interfacial energy and heterogeneous nucleation behaviour (Hassan & Gupta, 2006). Figure 1 shows the DSC thermograms of unreinforced AZ91 alloy and AZ91–CNT nanocomposites obtained during heating under identical experimental conditions.

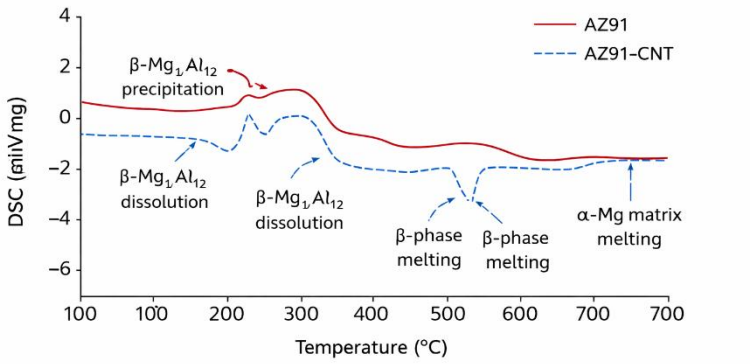



**Figure 1: DSC thermograms of AZ91 and AZ91–CNT**

As illustrated in Figure 1, the AZ91–CNT nanocomposite exhibits a noticeable rightward shift of the β-$Mg_{17}Al_{12}$ dissolution peak compared to the unreinforced AZ91 alloy, indicating enhanced thermal stability due to CNT reinforcement.

**Table 1: DSC Peak Temperatures and Enthalpy Changes of AZ91 and AZ91–CNT Nanocomposites**

| Sample | Thermal Event | Peak Temperature (°C) | Enthalpy Change (J/g) | Interpretation |
|---|---|---|---|---|
| AZ91 | Exothermic peak | 170–190 | +3.8 | β-$Mg_{17}Al_{12}$ precipitation |
| AZ91 | Endothermic peak | 380–410 | −5.2 | β-$Mg_{17}Al_{12}$ dissolution |
| AZ91 | Endothermic peak | 430–450 | −8.6 | β-phase melting |
| AZ91 | Endothermic peak | 595–610 | −12.4 | α-Mg matrix melting |
| AZ91–CNT | Exothermic peak | 180–200 | +3.1 | Delayed β-phase precipitation |
| AZ91–CNT | Endothermic peak | 400–425 | −4.3 | Delayed β-phase dissolution |
| AZ91–CNT | Endothermic peak | 445–465 | −7.5 | Modified β-phase melting |
| AZ91–CNT | Endothermic peak | 600–615 | −11.8 | α-Mg matrix melting |

***Implications for Thermal Stability and Applications***

The delayed β-phase dissolution and modified thermal transition behaviour observed in AZ91–CNT nanocomposites are particularly significant for automotive applications, where components are exposed to intermediate temperature ranges during service. Enhanced phase stability contributes to improved dimensional stability, creep resistance, and long-term performance (Luo, 2002; Pollock, 2010).

The results indicate that CNT reinforcement can effectively tailor the thermal response of AZ91 alloy, making AZ91–CNT nanocomposites promising candidates for lightweight components operating under thermal loading conditions.

**Conclusions**

This study has systematically investigated the thermal properties and phase transformation behaviour of AZ91 magnesium alloy reinforced with carbon nanotubes using Differential Scanning Calorimetry. The results clearly demonstrate that the incorporation of CNTs significantly influences the intrinsic thermal response and phase stability of the AZ91 alloy. Distinct endothermic and exothermic events associated with the precipitation, dissolution, and melting of the β-$Mg_{17}Al_{12}$ phase, as well as the melting of the α-Mg matrix, were successfully identified for both unreinforced and CNT-reinforced samples.

A noticeable shift in transformation temperatures was observed in the AZ91–CNT nanocomposites, particularly in the delayed onset of β-phase dissolution. This behaviour indicates enhanced thermal stability, which can be attributed to the presence of CNTs acting as diffusion barriers and modifying interfacial characteristics within the magnesium matrix. Additionally, variations in enthalpy values suggest that CNT reinforcement alters the thermodynamic driving forces governing phase transformations.

The modified thermal transition behaviour observed in the intermediate temperature range is especially relevant for automotive and other temperature-sensitive applications, where thermal reliability and dimensional stability are critical. The findings of this study provide a reliable thermal baseline for evaluating the high-temperature performance of AZ91–CNT magnesium nanocomposites and contribute to a deeper understanding of CNT–matrix interactions from a thermal perspective.

Overall, this work highlights the potential of carbon nanotube reinforcement as an effective strategy for tailoring the thermal properties and phase transformation behaviour of AZ91 magnesium alloy. The insights gained from this study are expected to support the future design, optimisation, and predictive modelling of magnesium-based nanocomposites for advanced lightweight engineering applications.

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# THE EFFECTIVENESS OF THE SPAGHETTI TOWER MARSHMALLOW CHALLENGE ON STUDENTS' SELF-CONFIDENCE AND SOFT SKILLS AT HENRY GURNEY SCHOOL

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***Abstract:*** *Experiential learning activities are becoming more widely recognized as an effective way to build students' self-confidence and soft skills especially in rehabilitation-based education. The Spaghetti Tower Marshmallow Challenge (STMC) is often used for this purpose, but quantitative evidence of its effectiveness is still limited, particularly among students in rehabilitation institutions such as Henry Gurney School. To address this gap, this study explores how STMC contributes to the development of students' intrapersonal skills specifically self-confidence, as well as their interpersonal skills. A total of 40 students completed pre and post intervention surveys using two validated instruments, namely the General Self-Efficacy Scale (GSE) and the Group Social Skills Inventory (GSSI). These instruments measured self-confidence, teamwork, communication, and problem-solving skills. The comparison of scores before and after the activity showed a clear and significant improvement across all skill domains. The findings provide quantitative support that experiential learning activities such as STMC can enhance students' personal and social development. This supports the incorporation of similar activities should be incorporated into rehabilitation education programs to strengthen students' reintegration into society. Overall, this study contributes empirical evidence on the usefulness of experiential learning in alternative education settings.*

***Keywords:*** *Communication, Experiential Learning, Rehabilitation Education, Self-Confidence, Soft Skills*

## Introduction

Rehabilitation education plays an important role in shaping the behavior, values, and skills of individuals involved in the juvenile justice system. Its main purpose is to help them return to society and function in a positive and responsible manner (Ministry of Education Malaysia, 2019). In Malaysia, Henry Gurney Schools are specialized institutions that provide academic education together with rehabilitation focused training for adolescents placed under welfare orders. In this setting, education is not limited to academic achievement. It also focuses on the development of soft skills such as self-confidence, communication, cooperation, and problem solving. These skills are essential for supporting students' social reintegration and personal growth (Mohd Nor et al., 2020).

However, conventional teacher centered approaches are often less effective in meeting the emotional and social needs of students in rehabilitation settings (Hussin & Tamuri, 2019). Many students in these institutions come from difficult life backgrounds. They often have low self-confidence and limited interpersonal skills. Therefore, they require teaching approaches that are more interactive and motivating. Learning activities based on real life experiences are also important to help rebuild their psychosocial strengths and support positive change (Hayat, & Shokrpour, 2021).

In this context, experiential learning has gained wide recognition as a more holistic approach with strong potential to support students' interpersonal development. The experiential learning model introduced by Kolb (1984) emphasizes learning as a continuous cycle involving concrete experience, reflection, conceptual understanding and active experimentation. This approach is particularly suitable for rehabilitation education. It encourages active student participation and allows learning to occur through real experiences. Students are given opportunities to make mistakes in a controlled setting. Through this process, they develop understanding, resilience, and self-confidence within a safe and supportive environment (Choi & Yang, 2021; Zainal & Siraj, 2022).

One experiential learning activity that has gained increasing attention across education and training contexts is the Spaghetti Tower Marshmallow Challenge (STMC), widely introduced by Tom Wujec (2010). It's a group task where teams must build the tallest, most stable structure they can by using limited materials such as spaghetti, adhesive tape, string and one marshmallow that must go on top within a fixed time frame (Wujec, 2010). At its core, this activity works like a simulation. It requires students to communicate effectively, practice flexible leadership, think outside the box and solve problems together while the clock is ticking (Kamarudin et al., 2021). In theory, this process engages multiple dimensions of soft skills that are critical for life success.

Although STMC is commonly used in corporate training and general education, very few quantitative studies have examined its effects on rehabilitation students, especially in terms of self-confidence and interpersonal skills (Lee & Subramaniam, 2021). Most existing studies rely on qualitative methods or descriptive observations. Others focus mainly on cognitive learning outcomes. As a result, there is limited quantitative evidence on how STMC influences students' emotional and social development in rehabilitation settings (Mohd Noor et al., 2022). This lack of empirical evidence makes it difficult to justify the systematic use of STMC in rehabilitation education programmes that aim to be evidence based.

Therefore, this study was conducted to address this gap by examining the effectiveness of the Spaghetti Tower Marshmallow Challenge in improving self-confidence as a core of interpersonal skills, particularly communication, cooperation and problem solving among students at Henry Gurney School. Using a quantitative pre and post-test design, this study aims to provide concrete data on the pedagogical value of experiential learning activities in an alternative education context. The findings are expected to contribute empirical evidence on experiential learning in rehabilitation education. They may also serve as a practical reference for educators, counsellors and policymakers in planning and implementing more systematic, evidence based and student-centred pedagogical interventions.

## Literature Review

### *Rehabilitation Education and the Needs of At-Risk Students*

Rehabilitation education aims to support the development of adolescent involved in the juvenile justice system. It uses an educational approach that focuses on changing behaviour, social adjustment and building personal skills. In this context, education functions not only as a means of delivering academic knowledge, but also as a form of social intervention that supports students' reintegration into society (Barnert et al., 2016). Students in rehabilitation institutions often experience disrupted learning histories. They often struggle with low self-confidence and poor social skills. As a result, they need a teaching approach that is more supportive and focused on their overall development.

Studies show that successful social reintegration among at risk adolescents depends greatly on the development of soft skills such as self-confidence, communication, cooperation and problem-solving abilities (OECD, 2018). Without these abilities, students risk remaining isolated and will likely struggle to adapt to their communities after they complete their rehabilitation. Therefore, rehabilitation education needs to focus on teaching strategies that do more than just cover academic material. They must also actively and systematically build a student's personal and social skills.

### *Experiential Learning Theory*

Experiential learning is a teaching approach that focuses on active learning. Students learn by taking part in meaningful real-life experiences. Kolb (1984) explained that learning happens in four stages: concrete experience, reflective observation, abstract conceptualization and active experimentation. This cycle helps students build understanding and skills from their own experiences, rather than passively receiving information.

In education, experiential learning has been shown to enhance student engagement, self-directed learning, and the development of social and emotional skills (Kolb, 2015). A systematic review by Morris (2020) found that this approach contributes significantly to the development of soft skills especially when students participate in collaborative activities that require interaction and reflection. These characteristics make experiential learning highly suitable for rehabilitation education. This field places a strong emphasis on personal development and learning through real-life experience.

### *Experiential Learning through Collaborative Activities*

Collaborative activities are a form of experiential learning that emphasizes social interaction, idea sharing, and group problem solving. Through these activities, students not only build knowledge but also develop social skills such as effective communication, leadership, and teamwork (Johnson & Johnson, 2019). These activities give students a space to experience real situations that require negotiation, shared decision-making, and collective responsibility.

For at risk students, collaborative experiential learning provides a safe environment to try, make mistakes, and learn from experience. This approach supports the development of self-confidence and interpersonal skills through meaningful direct experiences and reflection with

peers (Beard & Wilson, 2013). Therefore, collaborative experiential activities are considered an effective approach to support the learning needs of students in rehabilitation institutions.

### *The Spaghetti Tower Marshmallow Challenge as an Experiential Learning Activity*

The Spaghetti Tower Marshmallow Challenge (STMC) is an experiential learning activity. It involves students in a collaborative task where they must build a structure using limited materials and a strict time limit. This activity requires participants to plan, communicate, and work together to achieve a common goal. In this way, it directly reflects the core principles of Experiential Learning (Wujec, 2017).

By taking part in the STMC, students get directly involved in a challenging, hands-on experience. This is followed by discussions and reflections on the strategies they used and the results they achieved. This process allows students to build a real-world understanding of the importance of communication, teamwork, and problem-solving. Although STMC is often used in training and educational settings, there is still a lack of quantitative research on how well it works in rehabilitation education. Specifically, there are few studies that measure its impact on the psychosocial well-being of students.

### *Self-Confidence and Interpersonal Skills in Rehabilitation Education*

Self-confidence, which is tied to the idea of self-efficacy, means a person's belief that they can handle tasks and meet challenges effectively (Bandura, 1997). In education, when students have strong self-efficacy, they tend to participate more actively, bounce back better from setbacks, and can engage more positively with the people around them (Schunk & DiBenedetto, 2020).

Interpersonal skills such as communication, teamwork and problem-solving are also a component of a student's social and emotional development. A meta-analysis by Durlak et al. (2011) shows that educational programs focusing on social and emotional learning have a significant positive impact on students' social skills and overall well-being. Therefore, experiential learning activities like the STMC could be an effective way to build self-confidence and interpersonal skills together for students in rehabilitation education.

Thus, self-confidence and interpersonal skills are important constructs in rehabilitation education that should be fostered through active, experience-based learning approaches.

### *Research Gap*

Although experiential learning has been recognized as an effective approach for developing soft skills (Kolb, 1984; Tan et al., 2022; Zainal & Siraj, 2022), quantitative evidence on its impact in rehabilitation education remains very limited. Most existing studies focus on formal education or corporate training, while research involving adolescents in rehabilitation institutions are still rarely reported (Ungar et al., 2014; Hussin & Tamuri, 2019).

In the Malaysian context, studies on rehabilitation students have focused more on counselling, discipline, and psychosocial support rather than on evaluating collaborative, experiential

pedagogical approaches. Recent literature also indicates that data driven evaluations of learning activities such as STMC among rehabilitation students have not been widely conducted (Yusri et al., 2024).

Therefore, this study was conducted to address the research gap by examining the effects of STMC on self-confidence and interpersonal skills among students at Henry Gurney School. The findings aim to support evidence-based teaching and provide guidance for teachers and policymakers in designing suitable learning interventions for rehabilitation education in Malaysia.

## Research Methodology

This study uses a quantitative approach. It has a one-group pretest-posttest design, which is a type of pre-experimental design. This was used to assess the effect of the Spaghetti Tower Marshmallow Challenge (STMC) intervention on students' levels of self-confidence and interpersonal skills. This design allows for a direct assessment of change without involving a control group. This helps minimize disruption to the institution's routine and reduces administrative challenges, particularly in the context of rehabilitation education.

The study was conducted at Henry Gurney School, a rehabilitation education institution in Malaysia. It provides academic education and character development for adolescents under welfare supervision. In this context, learning focuses not only on academic achievement but also on the development of soft skills to prepare students for social reintegration. The STMC intervention was carried out in a controlled and safe environment. Teachers and researchers were present to monitor the activity.

The study sample consisted of 40 students (N = 40) enrolled in the institution’s education program. Participants were selected using purposive sampling. They were chosen based on criteria such as official student status, age between 15 and 17 years and the ability to understand instructions and complete written questionnaires. All participants took part voluntarily with official consent from the institution.

Two sets of instruments were used to measure the study's variables. The level of self-confidence was measured using the General Self-Efficacy Scale (GSES) developed by Schwarzer and Jerusalem (1995). This scale assesses an individual's belief in their own ability to face challenges and carry out tasks. This instrument has been widely used in education and psychology research.

Interpersonal skills were measured using a set of items adapted from the social skills constructs in the Social Skills Inventory (SSI) developed by Riggio (1989). This inventory assesses dimensions of social and emotional skills, such as social expressiveness, social control, and social sensitivity. For this study, the items were adjusted to fit the context of rehabilitation education and teamwork, with a focus on three main aspects: communication, cooperation and problem-solving. All items were rated using a five-point Likert scale to ensure consistency in measurement.

The study procedure was conducted in two main phases. The first phase involved a pretest to assess students' self-confidence and interpersonal skills. The second phase included the implementation of the STMC intervention in groups, followed by a posttest using the same instruments. During the intervention, students were divided into four groups to build marshmallow towers using limited materials within a set time. The activity was designed to foster communication, cooperation, planning, and collaborative problem solving. A reflection session was also conducted after the activity to help participants evaluate their experiences and group interactions.

Data was analyzed using IBM SPSS Statistics version 28. Descriptive analysis was conducted to obtain the mean and standard deviation for each study variable. Instrument reliability was tested using Cronbach's Alpha. Paired sample t tests were used to examine significant differences between pretest and posttest scores. In addition, effect sizes (Cohen's d) were calculated to determine the magnitude of change. The significance level was set at $p < 0.05$.

All research ethics were strictly followed throughout this study. Official permission was obtained from the institution's administration before the study began. Student participation was completely voluntary. The confidentiality of respondents' data was fully guaranteed. A briefing session was also conducted to ensure the psychological well-being of the participants. All data is used solely for academic and research purposes.

## Findings

This study involved 40 male students between the ages of 15 and 17 from Henry Gurney School. As shows in Table 1, the reliability of the study's instruments as tested using Cronbach's Alpha coefficient. The results show that all constructs achieved a good level of reliability, with alpha values above 0.80.

**Table 1: Reliability Of The Study Instruments**

| Variable | Number of Items | Cronbach's Alpha (α) |
|---|---|---|
| Self Confidence (GSES) | 10 | 0.89 |
| Communication | 5 | 0.84 |
| Cooperation | 5 | 0.82 |
| Problem Solving | 5 | 0.81 |

A paired-sample t-test was conducted to evaluate the difference in scores before and after the STMC intervention. Table 2 below shows the results of the analysis. It indicates a statistically significant improvement in all measured constructs ($p < 0.001$).

The students' self-confidence scores increased significantly after the STMC intervention. Their self-confidence mean score rose from 2.45 to 3.28, with a large effect size ($d = 1.39$). Meanwhile, all three aspects of interpersonal skills also showed significant improvement: communication ($d = 1.25$), cooperation ($d = 1.45$) and problem-solving ($d = 1.34$).

**Table 2: Comparison of Pretest and Posttest Scores for STMC Intervention (N = 40)**

| Variable | Mean (Pra) | Mean (Post) | t | p | Cohen's d |
|---|---|---|---|---|---|
| Self Confidence (GSES) | 2.45 | 3.28 | 8.76 | < .001 | 1.39 |
| Communication | 2.81 | 3.65 | 7.92 | < .001 | 1.25 |
| Cooperation | 2.78 | 3.72 | 9.14 | < .001 | 1.45 |
| Problem Solving | 2.62 | 3.54 | 8.45 | < .001 | 1.34 |

Note: All tests were significant at $p < .001$.

The findings show that the STMC intervention effectively improved self confidence and interpersonal skills among Henry Gurney students. Significant gains with large effect sizes highlight STMC's potential as a practical, active and structured experiential learning approach.

## Discussion

The findings of this study show that the Spaghetti Tower Marshmallow Challenge (STMC) had a significant positive effect. It improved both the self-confidence and interpersonal skills of students at Henry Gurney School. The clear improvement in the soft skills indicate that practical and structured experiential learning can support students' psychosocial development in rehabilitation education settings. These findings are consistent with previous studies that highlight the effectiveness of experiential learning in promoting self-development and prosocial behaviour among adolescents (Chan et al., 2021).

The biggest improvement was seen in cooperation. This aligns with the core features of STMC feature that requires groups to plan together, assign roles and communicate constantly to reach their goal under a tight deadline.

From the perspective of rehabilitation education, social skills such as communication, cooperation and problem-solving are essential in supporting adolescents' adjustment and social reintegration. This aligns with contemporary rehabilitation approaches that focus on building social competence and a positive identity (Lesnick et al., 2023). The findings of this study support the use of the STMC as a practical, experiential learning intervention in local rehabilitation education. However, further studies with a stronger design and involving multiple institutions are recommended to strengthen the empirical evidence of its effectiveness.

## Conclusion

This study shows that the Spaghetti Tower Marshmallow Challenge is effective. It successfully increased the self-confidence and interpersonal skills of students at Henry Gurney School. The key finding is that hands-on learning through structured group activities is an effective approach in rehabilitation education. It helps students rebuild self-belief and learn how to communicate, cooperate, and solve problems together. For educators, this suggests that activities such as the challenge are valuable practical tools. They provide a meaningful way to develop the life skills these students need. Although this study involved a single group with a limited duration, the results are clearly positive. Further research with different groups and over a longer period is recommended. Nevertheless, these findings provide a strong evidence-based

reason to incorporate more active and collaborative learning approaches in programmes that support at-risk youth.

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# FROM PARTICIPATION TO PERFORMANCE: HOW RESIDENT CENTRED PROGRAMS SHAPE SAFETY, SATISFACTION, AND OCCUPANCY

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***Abstract:*** *Resident-centred community stewardship programmes in multi-unit housing are increasingly deployed to generate social value while supporting operational reliability and market performance. This conceptual paper develops a theory-of-change model for Program Pemerkasaan Komuniti (PPK), linking inputs such as resident participation, micro-project delivery, routine upkeep, and small CPTED-informed improvements to building-level outcomes through four mechanisms: situational guardianship, collective efficacy, maintenance cadence, and positive signaling. The model specifies intermediate outcomes, including reduced perceived disorder, increased perceived safety, improved service responsiveness, and stronger place attachment, and turns these ideas into measurable indicators commonly used by owners and public agencies (e.g., incidents per 100 units, repair cost per unit, satisfaction scores, renewal rates, vacancy days, and occupancy stability). The paper advances a set of propositions to guide empirical testing using matched site or staggered rollout designs, panel surveys, and administrative records, with moderation by baseline disorder, neighbourhood risk, operational capacity, tenure mix, resident churn, and social cohesion. Practical implications are outlined for contract terms, incentive design, and public benchmarking, alongside an evaluation agenda that supports transparent asset-level ESG reporting and evidence-based stewardship in stratified housing.*

***Keywords:*** *Resident-Centred Programmes; Property Management; Perceived Safety; Tenant Satisfaction; Occupancy Stability*

## Introduction

Across public and private multi-unit housing, property managers are increasingly using resident-centred programs to pursue social value alongside their day-to-day operational goals. Evidence from recent studies links stronger resident engagement with a better service experience and more positive perceptions of the place, suggesting that participation and visible care in shared spaces can enhance perceived safety and satisfaction (Basit et al., 2023). At the same time, much of this literature reports associations rather than an integrated, theory-led account that traces how specific practices travel through mechanisms to produce building-level outcomes such as lower vandalism, reduced repair cost per unit, higher tenant satisfaction, and steadier occupancy. A conceptual bridge is therefore needed to connect practical stewardship activities with measurable indicators that matter to asset owners and public bodies.

The model developed here draws on several established strands that are widely used in the literature. Crime Prevention Through Environmental Design (CPTED) emphasizes the

importance of activating common areas, enhancing sightlines, and maintaining routine guardianship to reduce opportunities for damage and improve perceived safety. Place management research reveals that visible care and co-produced improvements serve as credible signals of quality (Wilson & Kelling, 1982). Social and governance work (Cohen & Felson, 1979; Jeffery, 1971; Fisher, 1974) on stakeholder alignment and shared agency explains why participation can build collective efficacy, the capacity of residents and management to set expectations and solve problems together, thereby strengthening safety perceptions and evaluations of place (Sampson, Raudenbush, & Earls, 1997; Sampson & Raudenbush, 1999). Service quality studies in built environment settings demonstrate that faster responses and reliable resolution of issues lead to higher satisfaction, which serves as a central outcome that influences global judgments of management performance (Parasuraman et al., 1988).

A complementary perspective is offered by real estate operations and strategy. Research on capabilities and structured routines suggests that a clear performance architecture, including who is responsible, how performance is measured, and how it is rewarded, supports resilience and consistent delivery, creating conditions under which resident energy can be converted into timely action and tangible results (Autio, Pulkka, & Junnila, 2023). On the market side, rental housing analyses indicate that perceived management quality and amenity value influence renewals and vacancy dynamics, linking human-centred improvements to occupancy stability and, by extension, to cash flow risk (Li et al., 2024). Taken together, these strands motivate a conceptual model that specifies mechanisms such as situational guardianship, maintenance cadence, collective efficacy, and positive signalling, along with boundary conditions such as baseline disorder, operational capacity, tenure mix, and neighbourhood risk.

The contribution of this article is to organise these insights into a coherent theory of change for resident-centred stewardship in housing. The model translates routine operational data, including incidents per 100 units, repair costs per unit, participation inputs, perceived safety, satisfaction, and occupancy stability, into a compact set of social value indicators that owners, lenders, and public agencies already understand. By articulating mechanisms, boundary conditions, and testable propositions, the introduction sets up an empirical agenda that can be implemented with panel surveys and administrative records, enabling rigorous evaluation and transparent reporting that align with the journal's indexed (Autio et al., 2023; Basit et al., 2023; Parasuraman et al., 1988; Sampson et al., 1997; Li et al., 2024; Wilson & Kelling, 1982).

## Conceptual Definitions

In the context of public and private multi-unit housing, the Program Pemerkasaan Komuniti (PKK) implements structured property management interventions that are co-designed with residents. The program’s core components encompass resident committees, microgrants allocated for small projects, and systematic cleaning and landscaping schedules. Additionally, modifications informed by Crime Prevention Through Environmental Design (CPTED), such as enhanced lighting and improved sightlines, facilitate the effective utilisation, maintenance, and oversight of shared spaces. Recent studies indicate that visible care and participatory placemaking enhance perceptions of safety and quality. Moreover, sustained resident engagement is correlated with improved evaluations of both service quality and overall living conditions, as noted by Basit et al. (2023) and Wilson and Kelling (1982).

At the building level, social value manifests as tangible, measurable enhancements that hold significance for residents and the surrounding community. These improvements include aspects such as perceived safety, inclusion, participation, and overall well-being. Such factors can be translated into indicator sets already monitored by asset owners and public agencies, including reduced costs associated with vandalism, increased participation levels, improved occupancy stability, and higher satisfaction rates. Research in place governance emphasises that shared agency and stakeholder alignment are essential for converting participation into enhanced evaluations of place. Furthermore, studies on service quality in built environments demonstrate a correlation between prompt, reliable responses and higher satisfaction levels, both of which are crucial for asset performance (Parasuraman et al., 1988; Sampson et al., 1997).

A complementary strand effectively connects human-centered improvements to market outcomes. Evidence derived from rental housing suggests that perceived management quality and amenity value have a considerable influence on tenant renewal behaviors, vacancy durations, and overall absorption rates. This indicates that safer and better-managed environments can stabilise occupancy and cash flow at the asset level (Li et al., 2024). Collectively, these findings establish a conceptual model in which resident activation, regular maintenance, collective efficacy, and positive signaling function as core mechanisms linking daily stewardship to favorable building-level outcomes. Therefore, this introduction positions Program Pemerkasaan Komuniti as a pragmatic approach to achieving measurable social value, thereby setting the foundation for subsequent empirical testing utilising transparent indicators that are recognised by owners, lenders, and public agencies (Basit et al., 2023; Parasuraman et al., 1988; Sampson et al., 1997; Li et al., 2024; Wilson & Kelling, 1982). (Bhattacherjee, 2001; Vargo & Lusch, 2008).

## Conceptual Model and Mechanisms

The model describes a sequence in which Program Pemerkasaan Komuniti (PPK) inputs trigger four mechanisms that produce intermediate outcomes, which in turn, lead to asset-level outcomes. First, situational guardianship arises when shared spaces are actively used, the presence of residents and staff is visible, and informal surveillance becomes a routine practice. These practices reduce opportunities for vandalism and antisocial behavior, aligning with Crime Prevention Through Environmental Design (CPTED) insights, which associate activated spaces and clearer sightlines with higher perceived safety and lower disorder (Wilson & Kelling, 1982). Second, collective efficacy reflects participation that fosters trust, shared expectations, and a willingness to intervene, helping residents and management solve problems together and strengthening prosocial norms within housing blocks. Recent place governance work indicates that aligned stakeholders and shared agency are associated with more positive evaluations of place quality and safer perceptions (Sampson et al., 1997). Third, maintenance cadence refers to faster, shared routines for reporting and fixing issues. Shorter ticket ages and reliable closure rates suppress visible cues of neglect, interrupt the accumulation of minor defects, and lower repair spending, which is consistent with service quality evidence in built environment settings where response speed is a strong predictor of satisfaction (Parasuraman et al., 1988). Fourth, positive signalling is generated by co-produced artefacts, such as gardens, murals, and noticeboards, which publicly signal care and competence, reinforcing expectations

of safety and service quality through credible, visible cues in shared spaces (Wilson & Kelling, 1982).

These mechanisms yield intermediate outcomes that can be measured with short, validated scales and operational records. Expected changes include lower perceived disorder, higher perceived safety, better service responsiveness, and stronger place attachment. As these improvements accumulate, asset-level outcomes follow. Sites should experience fewer vandalism incidents and lower repair costs per unit, higher tenant satisfaction with management services, and more stable occupancy, patterns that align with evidence linking management quality and amenity value to renewal behaviour and vacancy dynamics in rental housing markets (Basit et al., 2023; Parasuraman et al., 1988; Li et al., 2024). In this way, the model converts everyday stewardship into a transparent route from inputs to outcomes that owners, lenders, and public bodies can audit and compare across time and estates.

**Theory Driven Expectations**

In a conceptual article, theory-driven expectations are clear, testable statements that specify how key constructs are expected to relate, without making claims about specific results in advance. The expectations below translate the logic of resident-centred community empowerment programmes into observable building-level patterns by identifying (i) the mechanisms that should operate and (ii) the contextual conditions likely to strengthen or weaken effects.

E1 Situational guardianship. Greater resident activation of shared areas through PPK is associated with fewer vandalism incidents per 100 units.

The expectation state that resident activation of shared areas through Program Pemerkasaan Komuniti should reduce opportunities for damage by increasing natural surveillance and visible guardianship, resulting in lower incident rates per 100 units. This is consistent with place management accounts of safety signalling through activated space use and visible care for shared environments (Wilson & Kelling, 1982).

E2 Maintenance cadence. Faster shared maintenance cycles mediate the association between PPK and lower vandalism repair cost per unit.

A second expectation holds that faster shared maintenance cycles mediate the link between stewardship inputs and lower vandalism repair cost per unit, because shorter ticket times and shared routines remove cues of neglect and interrupt disorder accumulation. This pathway aligns with operational quality work in built environment services where speed of response and closure rates predict global judgments of service performance (Parasuraman et al., 1988).

E3 Collective efficacy. Participation driven by PPK increases perceived safety through stronger collective efficacy (Sampson et al., 1997; Putnam, 2000).

A third expectation asserts that participation driven by Program Pemerkasaan Komuniti increases perceived safety through stronger collective efficacy. When residents share expectations and feel able to solve problems together, informal rule enforcement becomes

easier, and safety evaluations improve, a pattern reflected in recent place and governance research that links shared agency with evaluations of place quality (Sampson et al., 1997).

E4 Satisfaction pathway. Improvements in perceived safety result in increased tenant satisfaction with management services.

A fourth expectation states that gains in perceived safety enhance tenant satisfaction with management services, as safety serves as a foundational service outcome that influences overall evaluations of responsiveness and quality in housing settings (Parasuraman et al., 1988).

E5 Occupancy response. Improvements in tenant satisfaction mediate the positive association between PPK and occupancy rates.

A fifth expectation predicts that higher satisfaction stabilises occupancy by supporting renewals and reducing churn, which is consistent with evidence that perceived management quality and amenity value influence rental market behaviour and vacancy dynamics in multi-unit housing markets (Li et al., 2024).

E6 Signalling. Visible PPK artefacts strengthen the link from safety to satisfaction by signalling care and competence.

A sixth expectation suggests that visible stewardship artifacts, such as gardens, murals, and noticeboards, amplify the translation of safety gains into satisfaction by signalling managerial care and competence, thereby strengthening the link between perceived safety and overall service evaluations through salient and credible cues in shared spaces (Wilson & Kelling, 1982).

E7 Spillover. Effects attenuate when disorder spills over from adjacent blocks unless stewardship is coordinated across sites.

A seventh expectation anticipates that effects will attenuate when disorder pressures spill over from adjacent blocks unless stewardship efforts are coordinated across sites, highlighting the moderating role of neighbourhood risk and management capacity in sustaining program effects across the asset and portfolio context discussed in real estate strategy work (Autio et al., 2023). Together, these propositions transform the conceptual model into a set of study-ready statements that specify what to measure, the expected direction of effects, and the boundary conditions to consider in future empirical research. For transparent reporting to owners, lenders, and public bodies, the study variables can be mapped directly to social value indicators such as incidents per one hundred units, repair cost per unit, participation hours, resident led projects, satisfaction scores, perceived safety, and occupancy stability, ensuring a consistent assessment language for the social dimension of environmental, social and governance (ESG) at the building level (Basit et al., 2023).

**Boundary Conditions and Moderators**

Boundary conditions and moderators specify the contexts in which Program Pemerkasaan Komuniti is likely to be more or less effective, as well as the factors that alter the size or

direction of its effects. Two external conditions that anchor this discussion are baseline disorder and neighbourhood risk. Where disorder is moderate, visible gains from resident activation, routine upkeep, and light CPTED adjustments are easier to realise because cues of neglect can be reversed quickly; incident rates and perceived safety typically improve as natural surveillance and visible guardianship increase (Wilson & Kelling, 1982). In contrast, extremely high external crime pressure can overwhelm site-level efforts, compressing effect sizes unless actions are coordinated beyond the property boundary. In empirical models, these conditions operate as moderators: the association between stewardship intensity and safety or satisfaction is expected to be stronger at moderate disorder and weaker under extreme external risk (Autio et al., 2023).

Management capacity constitutes a second family of moderators. Staffing ratios, budget flexibility, vendor responsiveness, and supervision cadence determine the implementation fidelity and speed, converting resident energy into timely and credible action. Faster work order closure, first-time fix rates, and reliable vendor service levels sustain a maintenance cadence that suppresses disorder cues and reduces follow-on costs, reinforcing the pathway from stewardship inputs to lower vandalism repair cost per unit (Parasuraman et al., 1988). In practice, capacity can be summarised as an index and interacted with stewardship intensity in regression or panel models; positive interactions would indicate that higher capacity magnifies the benefits of resident-centred programming (Autio et al., 2023). For reporting, these operational metrics can be mapped to social value indicators, allowing owners and public bodies to see the link between rapid service response and measurable safety and cost avoidance outcomes (Parasuraman et al., 1988; Basit et al., 2023).

Tenure structure and mobility dynamics add a third layer. High churn dilutes the benefits of participation because social ties become fragile, and collective routines are harder to sustain. Conversely, mixed tenure can strengthen stewardship when governance roles and cost-sharing are clearly defined; however, ambiguity can lead to delays, conflict, and uneven implementation. These conditions can be operationalized through measures such as turnover rate, renewal rate, share of owner-occupiers, and the presence of written charters and service level agreements across tenure groups. Models should investigate whether churn weakens participation in the safety pathway and whether governance clarity enhances the translation from safety to satisfaction through the signalling of managerial competence and shared responsibility (Autio et al., 2023; Wilson & Kelling, 1982).

Initial social cohesion functions as both a boundary condition and a mechanism primer. Where trust is low, small early wins and structured listening sessions are often necessary to unlock participation and collective efficacy. As stakeholders converge on shared expectations, informal rule enforcement becomes easier, perceived safety rises, and downstream satisfaction improves (Sampson et al., 1997). Measurement can combine brief collective efficacy and trust scales with participation counts and meeting turnout; analysis can test whether collective efficacy statistically mediates the effect of stewardship intensity on perceived safety. Finally, asset outcomes are filtered through market responses: satisfied residents are more likely to renew, refer others, and reduce vacancy durations, which stabilizes occupancy and cash flow (Li et al., 2024).

Taken together, these boundary conditions and moderators clarify when and where community empowerment programs are most likely to succeed, as well as why effect sizes differ across sites and how results should inform action (Autio et al., 2023). First, external risk shapes feasibility at the site level: when area risk is moderate, activated spaces, clearer sightlines, and routine presence can deliver rapid, visible gains; however, when external risk is very high, the same inputs may be overwhelmed unless on-site work is paired with cross-block coordination (Wilson & Kelling, 1982). Second, operational capacity converts resident energy into timely results; specifically, stronger staffing, flexible budgets, responsive vendors, and reliable supervision shorten ticket ages and raise first-time fixes, thereby reinforcing the maintenance cadence pathway, whereas thin capacity slows closure and weakens effects (Autio et al., 2023; Parasuraman et al., 1988). Third, tenure and governance structure condition participation; for example, high churn erodes ties and routines, while mixed tenure can either enable or hinder progress depending on whether decision rights and cost sharing are explicit (Autio et al., 2023; Sampson et al., 1997). Fourth, social cohesion primes collective efficacy; accordingly, settings with low trust often require listening sessions and early small wins before the main mechanisms take hold (Sampson et al., 1997). Consequently, variation across estates becomes informative rather than distracting: for instance, a site with moderate risk and strong capacity should show faster declines in incidents per one hundred units and repair cost per unit, followed by gains in perceived safety, satisfaction, and occupancy stability, whereas a site facing high external pressure or rapid turnover may exhibit smaller early gains that grow only after coordination or stabilisation steps. Thus, heterogeneous impacts become a map for tailoring interventions and a credible guide for scale-up (Autio et al., 2023).

**From Operations to Social Value Indicators**

Turning day-to-day operations into social value begins with aligning property-level key performance indicators (KPIs) on the same scale and then renaming them to align with indicators that decision-makers already use. For safety and cost avoidance, the core measures are the vandalism incident rate per one hundred units and the repair cost per unit. Calculate the incident rate as the total number of relevant incidents in a month or quarter divided by the number of dwellings, then multiply by one hundred. This lets different estates be compared fairly. Estimate cost avoidance as the difference between a pre-program or matched control baseline and the post-program repair cost per unit, multiplied by total units for the chosen period. This makes the financial effect traceable in budgets and work order ledgers (Basit et al., 2023). Because fewer incidents often occur in conjunction with faster ticket closure, report response time distributions can be used to demonstrate that lower costs result from real reductions in damage rather than from deferring maintenance (Parasuraman et al., 1988).

For civic participation, two inputs are dependable and easy to audit: resident participation hours and the count of resident-led projects that meet an agreed standard. Track these with sign-in sheets or digital check-ins and validate with a simple completion checklist for activities such as planting days, corridor clean-ups, or noticeboard upkeep. Turn them into a civic participation indicator by expressing hours per one hundred units and, if useful, by weighting projects by complexity or ongoing upkeep needs. The resulting index signals community capacity and co-production, which are known pathways to sustained improvements in service experience (Basit et al., 2023).

For well-being and service quality, pair perceived safety with tenant satisfaction using short, validated scales. Perceived safety can be measured using three to five Likert items that ask about feelings of safety in corridors, lifts, and open spaces after dark. Tenant satisfaction should cover overall management, responsiveness, and quality of resolution. Report average scores and the share of respondents meeting a target threshold. When possible, display changes over time alongside response metrics to clarify the causal story: better guardianship and quicker fixes are associated with higher perceived safety, and higher perceived safety is linked to higher service satisfaction in housing settings (Parasuraman et al., 1988). Where data allow, report results by block or tenure to target follow-up actions (Sampson et al., 1997).

For liveability, the clearest operational signal with an asset link is occupancy stability. Build a quarterly indicator using renewal rate, vacancy days per unit, and month-to-month variance in occupied units. Higher renewal rates and fewer vacancy days indicate conditions that residents find liveable and worth staying in, which aligns with evidence that perceived management quality and amenity value shape renewal behaviour and market absorption (Li et al., 2024). Showing occupancy stability alongside perceived safety and satisfaction helps decision makers see how human-centred improvements translate into more resilient cash flow. To make the indicators ESG ready, place them in one measurable dashboard: safety and cost avoidance (incidents per one hundred units, repair cost per unit, avoided cost), civic participation (participation hours per one hundred units, number of completed resident led projects), well being and quality (perceived safety and satisfaction scores), and liveability (renewal rate, vacancy day intensity, occupancy variance). Using common denominators such as per one hundred units, clear baselines, and documented data sources allows consistent comparison across assets and over time and lets Program Pemerkasaan Komuniti outcomes be reported in the same language used by owners, investors, and public agencies (Basit et al., 2023; Li et al., 2024).

## Research Agenda

A rigorous research agenda can combine panel surveys with administrative records using staggered or matched rollouts, and then test identifying assumptions using event-study diagnostics. Under staggered adoption, different buildings begin Program Pemerkasaan Komuniti (PPK) at different times. This allows for comparisons between treated and untreated sites within the same period, while controlling for site and time effects. An event-study plot can then trace outcome movements before and after adoption to verify flat pre-trends and to visualise dynamic effects on incidents per 100 units, repair cost per unit, perceived safety, satisfaction, and occupancy outcomes (Li et al., 2024).

When adoption timing is not naturally staggered, a matched rollout can pair treated and control buildings using baseline disorder, operational capacity, tenure mix, and neighbourhood risk. This can be followed by difference-in-differences estimation and an event-style plot to assess parallel pre-trends prior to the programme. Measurement should blend brief validated scales and hard operational counts. Perceived safety can be captured with three to five items covering corridors, lifts, and open spaces after dark. Satisfaction can be assessed through overall management, responsiveness, and the quality of resolution. Participation intensity can be logged using attendance records, volunteer hours, and completed resident projects. Incident

and cost outcomes should be drawn from coded work orders and ledgers to ensure that financial effects are measurable (Parasuraman et al., 1988).

Analytically, the model calls for testing mediation and moderation, consistent with the theory-driven expectations. Mediation analyses can examine whether faster maintenance cycles and stronger collective efficacy explain part of the association between PPK and lower vandalism cost or higher perceived safety, using building–month panels and lag structures to reduce simultaneity concerns. Moderation analyses can interact treatment intensity with baseline disorder, neighbourhood risk, capacity indices, churn, and governance clarity to identify where effects are strongest (Autio et al., 2023; Sampson et al., 1997). Robustness checks should include alternative specifications for rates and costs, placebo tests using false start dates, and sensitivity tests that re-estimate results after trimming sites exposed to extreme external shocks.

Comparative work across Malaysia and other ASEAN cities can then test whether institutional conditions such as tenancy law, strata governance arrangements, and public housing management moderate programme effects and help explain cross-site heterogeneity in renewal behaviour, vacancy dynamics, and satisfaction responses to stewardship signals (Li et al., 2024; Wilson & Kelling, 1982). Reporting should map each variable to a consistent social value dashboard, allowing owners, lenders, and public bodies to interpret human-centered improvements alongside cash-flow and risk metrics (Basit et al., 2023).

**Implications For Practice and Policy**

Embedding the Program Pemerkasaan Komuniti into practice requires contract clauses that clearly outline inputs, outputs, and a simple indicator dashboard, and then tie incentive arrangements to key performance indicators that can be audited. Clear performance architecture enhances implementation fidelity and pace because teams and vendors are aware of exactly what is being measured and rewarded, a point consistent with evidence that managerial capacity and structured routines support more resilient performance in real estate operations (Autio et al., 2023). The indicator set should track incident rates per 100 units, repair costs per unit, participation hours, resident-led projects, perceived safety, satisfaction, renewals, and vacancy days, as these variables connect day-to-day service routines to perceived quality and market responses. In housing services, satisfaction operates as a central outcome that organises perceptions of quality and responsiveness, and it often mediates the influence of operational improvements on wider judgments about the provider, suggesting that incentives anchored in measurable service and satisfaction targets can move both experience and reputation in the right direction (Parasuraman et al., 1988). Property management research in strata settings also links better digital reporting and transparent procedures to higher resident satisfaction, strengthening the case for indicator-based incentives that reward responsiveness and closure quality alongside participation and stewardship efforts (Basit et al., 2023).

Owners and lenders can view the safety and satisfaction gains associated with Program Pemerkasaan Komuniti as de-risking factors, as these gains are linked to lower vacancy rates and more stable occupancy. Rental market research indicates that perceived management quality and amenity value influence renewal behaviour and absorption, suggesting that sustained improvements in safety and service experience can stabilize cash flow through higher renewals and fewer vacancy days (Li et al., 2024). In practice, loan or performance covenants

can reference a small set of verifiable indicators such as incident rates, repair cost per unit, and satisfaction thresholds, allowing owners and lenders to monitor operational risk alongside financial metrics. Visible stewardship artefacts and activated spaces also contribute by signalling managerial care and place quality, which supports positive narratives among residents and local stakeholders and can reduce the reputational component of risk for both owners and financiers (Wilson & Kelling, 1982).

Public housing authorities can accelerate uptake and comparability by issuing short playbooks, small micro-grant schemes, and shared metrics that allow estates to report in a common format. Place governance studies emphasise that stakeholder alignment and clearly communicated roles make joint action easier, and shared templates help translate local participation into recognisable indicators of place quality and satisfaction (Sampson et al., 1997). At the program level, authorities can standardise data definitions for incidents, repair costs, participation hours, perceived safety, and satisfaction, then publish benchmarking summaries across estates. A common reporting spine increases accountability, enables fair comparison, and makes it easierto coordinate area-wide efforts when spillovers from adjacent blocks threaten to dilute site-level gains, all while reinforcing the strategic links between operational capacity, resident experience, and asset performance that owners and lenders closely monitor (Autio et al., 2023; Li et al., 2024; Wilson & Kelling, 1982).

## Conclusion

The conclusion brings the argument together by showing how a resident-centred Program Pemerkasaan Komuniti can create social value at the level of a single building. The model explains the route from everyday practices to meaningful outcomes through four clear ideas: activated spaces that increase natural surveillance, a faster maintenance rhythm, stronger collective efficacy, and visible signals of care. These mechanisms help lower incidents and repair costs, improve perceived safety and tenant satisfaction, and stabilize occupancy. By transforming routine operational data into a concise set of social value indicators that owners, lenders, and public bodies already understand, the model provides a common language for monitoring the social dimension of ESG in housing (Basit et al., 2023; Parasuraman et al., 1988).

The conclusion also clarifies where the model is most likely to succeed. Effects should be stronger where disorder is moderate, capacity and budgets allow for timely action, roles in mixed tenure settings are clear, and there is sufficient social cohesion to support shared problem-solving. Effects may be weaker when external crime pressure is very high or when resident turnover is rapid, unless action is coordinated at the area level. Treating these as boundary conditions and moderators turns variation across sites from a puzzle into an expected pattern that can be planned for, measured, and reported with transparency (Autio et al., 2023; Sampson et al., 1997).

Ultimately, the conclusion suggests a practical research path. Staggered or matched rollouts, combined with event study checks, can test pre-trends and show how outcomes move over time. Mediation tests can demonstrate how faster maintenance and stronger collective efficacy have effects that extend to safety and cost, while moderation tests can identify where programs are effective and where additional coordination is needed. Comparative work across Malaysia

and other ASEAN cities can reveal how tenancy law, strata governance, and public housing practices shape outcomes, thereby improving both external validity and policy relevance. In short, the paper presents a concise theory of change, a shared indicator spine for reporting, and a test plan that decision-makers can trust and researchers can implement using standard data and clear methods (Li et al., 2024; Wilson & Kelling, 1982).

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# INTEGRATING BIG DATA AND ARTIFICIAL INTELLIGENCE (AI) INTO SHARIAH-ESG (ENVIRONMENTAL, SOCIAL AND GOVERNANCE) INVESTMENT: ALIGNING INVESTMENT STRATEGY WITH SHARIAH COMPLIANCE

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***Abstract:*** *With the fast-paced development of digital financial services, Islamic fintech platforms are gaining recognition for offering Shariah compliant investment options with personalized investment strategies and risk preferences. The integration of Big Data and Artificial Intelligence (AI) into Shariah-ESG (Environmental, Social and Governance) investment portfolios presents both opportunities and challenges to the global asset management industry. While conventional asset management companies have increasingly applied AI for portfolio optimization and risk management, the Islamic asset management industry must comply with Shariah compliant requirements and ethical limitations. Shariah-ESG investment is the Shariah-compliant investment which is based on the prohibition of riba (interest), maisir (gambling) and gharar (uncertainty) with ESG elements that take into account and evaluate the long-term impact of business practices on society, the environment and the business itself. This type of investment applies the negative screening process when dealing with industries such as tobacco, alcohol, weapons as well as other non-halal products. Thus, integrating ESG elements into Shariah compliant investment is consistent with the fundamental Shariah principles that promote equality, social justice and financial inclusion. This study analyses the legal framework regulating the application of Big Data and AI in Shariah-ESG investment portfolios which involves examination of relevant legislation, guidelines, fund prospectus, product highlight sheet, fund annual reports and, user interface and app walkthroughs experience. The findings show that AI enhances portfolio screening, ESG scoring and investment decision while Shariah governance framework plays a significant role to ensure compliance and investor confidence. As Shariah-ESG investment continues to grow, driven by increasing awareness of global challenges and evolving regulatory landscapes, the role of Big Data and AI will become even more critical. The study contributes to the emerging discourse on Islamic FinTech, offering strategic insights for regulators, asset management companies and digital platform developers in the development of Shariah compliant investment solutions in support of the broader objective of financial inclusion and sustainability within the Islamic finance ecosystem.*

***Keywords:*** *Big Data, Artificial Intelligence, Shariah compliant, ESG, investment*

## Introduction

Environmental, Social and Governance (ESG) components are central factors within the context of sustainability. There are numerous classifications of ESG based on categories such as climate change, environment, ethical, governance, social impact, responsible and sustainable investments, including the use of different acronyms (World Bank, 2018). ESG investing and

Shariah compliant investing generally share common objectives in that they promote social values. The ESG initiatives include a range of issues related to company activities in environmental, social relations and corporate governance aspects to promote sustainable business practices. Shariah compliant investing, which is based on the prohibition of *riba*, *maisir* and *gharar*, also applies a negative screening process when dealing with industries such as tobacco, alcohol, weapons as well as other non-halal products (Miskam & Abdullah, 2021).

With the fast-paced development of digital financial services, Islamic FinTech platforms are gaining recognition for offering Shariah-compliant investment options with personalised investment strategies and risk preferences for diverse backgrounds of investors. The integration of Big Data and Artificial Intelligence (AI) into Shariah-ESG (Environmental, Social and Governance) investment portfolios presents both opportunities and challenges to the global asset management industry. While conventional asset management companies have increasingly applied AI for portfolio optimization and risk management, the Islamic asset management industry must comply with Shariah compliant requirements and ethical limitations.

Based on this background, the paper aims to analyse the legal framework regulating the application of Big Data and AI in Shariah-ESG investment portfolios. This paper is structured as follows: Section 2 provides a review of the literature focusing on big data, artificial intelligence and Shariah ESG investments. Section 3 explains the methodology applied in this study. Section 4 explains the results and findings of the study and section 5 provides a detailed discussion based on the findings. The final section concludes the discussion by providing recommendations and insights for future research.

## Literature Review

### *Big Data and Artificial Intelligence*

Big data refers to vast volumes of information consisting of extensive knowledge and data pools with millions of entries, records, relationships and parameters (Challa, 2022). According to the European Commission (2018), big data comprises ‘large amounts of different types of data produced with high velocity from a high number of various types of sources” and is often explained through the three Vs model: Volume which highlights the immense scale of data generated from financial transactions, stock markets, social media and news; Velocity which emphasizes the speed at which data is produced and requires real-time or near real-time processing; and Variety which captures the diversity of types of data including structured, semi structured and unstructured formats such as numbers, texts, images and videos (Pillai, 2023). Big data analytics involves the technical process of examining massive datasets to identify patterns, correlations, market trends, and consumer preferences, thereby enabling businesses to make more informed decisions (Ahmadi, 2024). It encompasses a range of technologies, models, and procedures designed to uncover insights, causal relationships, and predictive outcomes, similar to practices in data science and data mining (Giudici, 2018).

Artificial Intelligence (AI) refers to systems and processes that replicate or enhance human and collective intelligence, particularly in decision-making and problem-solving (Challa, 2022). AI enables computer systems to perform tasks traditionally requiring human cognition, such as speech recognition, decision-making, and pattern identification. In the era of digital

transformation, the financial industry has undergone significant changes, largely driven by the integration of big data and AI into financial operations (Ahmadi, 2024). Artificial Intelligence (AI) has become a powerful and fast-expanding force, transforming how companies create new markets, boost productivity, and strengthen customer engagement. The sector has experienced notable growth, sparking heightened interest among businesses worldwide. At the same time, regulatory frameworks are evolving, with new local and international measures shaping the landscape (Lee et. al, 2025).

Financial technology (FinTech) encompasses smart systems within the financial sector that facilitate innovation and modern financial practices (Challa, 2022). Big data and AI are at the forefront of this digital revolution, reshaping the finance industry (Goldstein, 2021). Within Islamic FinTech, these technologies have been adopted to enhance efficiency and transparency (Killic, 2023). AI improves operational performance by automating processes and reducing manual intervention. Predictive analytics powered by AI allow financial institutions to anticipate investor behavior, optimize decision-making, and streamline transactions, thereby reducing costs and time while maintaining Shariah compliance. Furthermore, AI strengthens risk management and fraud detection capabilities in Islamic financial services (Hendarti et al., 2024).

AI-driven tools such as Shariah-compliant robo-advisors and automated credit risk assessment systems can enhance efficiency without compromising Islamic ethical principles (Mohd Najib et al., 2025). Robo-advisory services, in particular, have emerged as a significant innovation, offering algorithm-based investment management with minimal human involvement. These platforms appeal to digitally literate investors seeking cost-effective, transparent, and automated investment solutions (Hidayat-ur-Rehman et al., 2025).

The convergence of big data and AI in finance is driven by the exponential growth of financial information from transactions, market feeds, and social media, which provides vast opportunities for actionable insights. Advances in computational power and declining data storage costs have made large-scale data processing more feasible. However, the rise of AI in finance also introduces challenges, including ethical concerns, the need for transparency in algorithmic decisions, managing bias, safeguarding data privacy, and mitigating risks associated with algorithmic trading. Addressing these challenges requires robust ethical frameworks and regulatory measures to ensure AI is deployed responsibly and equitably, benefiting all stakeholders (Najem et al., 2025).

### *Shariah ESG Investment*

Environmental, Social and Governance (ESG) represents a framework for evaluating a company's impact on environmental sustainability, social responsibility, and effective governance practices (Lee et. Al., 2025). ESG is commonly used interchangeably with the term 'sustainable finance', which is defined as "process of taking ESG considerations into account when making investment decisions in the financial sector, leading to more long-term investments in sustainable economic activities and projects" (European Commission, 2021).

Shariah-ESG investment is the Shariah-compliant investment which is based on the prohibition of *riba* (interest), *maisir* (gambling) and *gharar* (uncertainty) with ESG elements that take into

account and evaluate the long-term impact of business practices on society, the environment and the business itself. This type of investment applies the negative screening process when dealing with industries such as tobacco, alcohol, weapons as well as other non-halal products. Thus, integrating ESG elements into Shariah compliant investment is consistent with the fundamental Shariah principles that promote equality, social justice and financial inclusion. ESG can be integrated to AI in three ways: leveraging AI to reduce ESG risks such as emission reduction, monitoring, and governance); using AI for positive impacts such as customer experience and addressing the concerns and risks of RAI, which overlap with ESG concerns and risks. Integrating AI into ESG frameworks is crucial for addressing these risks and concerns (Lee et. al, 2025).

Islamic finance's adherence to principles such as the prohibition of *riba, gharar, maysir* and investments in non-compliant industries necessitates AI systems that are designed with ethical and cultural sensitivities. AI is widely used to process and analyze financial market data, offering valuable insights into price movements and risk factors, thereby strengthening decision-making in Shariah-compliant investments (Shalboob, 2025). The integration of ESG factors with artificial intelligence in finance carries wide-ranging implications for both the industry and society. One significant area of impact is risk management, where generative AI can be utilised to model diverse ESG scenarios. This enables financial institutions to anticipate potential future developments, visualize different outcomes, and adapt their strategies proactively in response to evolving sustainability challenges (Lim, 2024).

## Methodology

This study analyses the legal framework regulating the application of Big Data and AI in Shariah-ESG investment portfolios which involves examination of relevant legislation, guidelines, fund prospectus, product highlight sheet, fund annual reports and, user interface and app walkthroughs experience.

## Results and Findings

For this study, three smart investment applications were selected: **BEST** by BIMB Investment Management Berhad, **Wahed** by Wahed Technology Sdn. Bhd., and **StashAway Malaysia Sdn. Bhd.** Each platform offers Shariah-compliant portfolios, ensuring that investments strictly adhere to Islamic finance principles, including the prohibition of *riba* (interest), *maisir* (gambling), and *gharar* (excessive uncertainty), as well as the exclusion of non-halal industries such as alcohol, tobacco, and weapons. Operating as mobile and web-based applications, these platforms exemplify the digital transformation of investment services in Malaysia while embedding Shariah governance into their operational frameworks. BEST integrates Big Data analytics to enhance portfolio screening, Wahed applies Modern Portfolio Theory (MPT) within Shariah-compliant parameters, and StashAway employs its proprietary ERAA® (Economic Regime-based Asset Allocation) model, all relying on data-driven strategies to

optimize investment outcomes. These platforms emphasize Shariah governance and transparency, featuring user-friendly interfaces and clear disclosures on fees, methodologies, and portfolio composition. Ultimately, they were chosen as case studies because they collectively represent the convergence of Shariah-compliant requirements, fintech innovation,

and ethical investment practices, making them exemplary models for analyzing how Islamic investment platforms in Malaysia advance inclusive and sustainable financial innovation.

***BEST***

BEST is a non-automated discretionary Robo-Intelligence unit trust online investing platform aims to provide an easy-to-use online investing platform for new and existing investors to perform investments transactions (purchase, sell and switch) on BIMB Investment's selected unit trust funds. BEST Robo-Intelligence platform allows investors to decide on which unit trust funds they wish to invest in, by how long and how much. BEST will then manage the investment portfolio according to the preference set. BEST and BIMB Investment uses Big Data technology in daily day-to-day data processing from managing online investment transactions and analytical data to make investment decisions.

***Wahed***

Wahed provides a fully automated investment process: Risk Assessment where investors answer questions to determine risk tolerance. Portfolio Allocation where investments are optimized using Modern Portfolio Theory (MPT). Continuous Monitoring where portfolios are rebalanced when market conditions shift. Full Transparency where all investment methodologies and fees are publicly disclosed. Wahed provides a range of portfolios with varying target returns, investing across multiple asset classes such as global equity, emerging markets equity, Malaysian equity, REITs, commodities and fixed income to enhance diversification benefits.

**StashAway**

StashAway holds the distinction of being the first robo-advisor in Malaysia to receive a Capital Markets Services License from the Securities Commission under the Digital Investment License framework. Its Shariah Global Portfolio offers a globally diversified investment strategy that fully adheres to Islamic finance principles. Managed through the proprietary Economic Regime-based Asset Allocation (ERAA®) model, the portfolio invests exclusively in Shariah-compliant exchange-traded funds (ETFs), covering asset classes such as equities, Islamic bonds (*sukuk*), and gold. This approach ensures both diversification and strict compliance with Shariah requirements, positioning StashAway as a leading example of innovation in Islamic digital investment solutions.

Table 1 summarises the features of the three Shariah-compliant investment platforms.

**Table 1: Features of Shariah-compliant Investment Platforms**

| Features | BEST | Wahed | StashAway |
|---|---|---|---|
| **Place of Origin** | BIMB Investment is a subsidiary of Bank Islam Malaysia Berhad (BIMB), which was established in Malaysia. | Wahed Inc. is a global company with its headquarters in New York, USA and its Malaysian operations are managed locally. | StashAway is a Singapore-based fintech company with a license to operate in Malaysia from the Securities |

| | | | |
|---|---|---|---|
| | | | Commission of Malaysia. |
| **Onboarding** | eKYC with NRIC & face recognition | Risk questionnaire and ID verification | Goal-based and risk profiling |
| **Portfolio Options** | Goal-based (Do It For Me / Yourself) | Regular & Thematic portfolios | Global Shariah-compliant portfolios |
| **User Interface** | Functional, goal-centric | Sleek, modern, educational | Clean, data-driven dashboard |
| **Fee Structure** | No sales charges; annual management fees | RM2.50 or 0.39%-0.79% (whichever higher) | Tiered fees based on assets |
| **Minimum Investment** | RM10 | RM100 | RM100 |
| **Shariah Compliance Oversight** | BIMB Securities Sdn Bhd: Shariah advisers registered with SC. | Shariah Review Bureau (SRB) | Masryef Advisory |
| **Investment Methodology** | Arabesque's AI investment research process uses alpha signals generated using its proprietary AI Engine and model portfolio construction via its in-house portfolio optimisation and risk modelling system. Its AI Engine uses a wide range of machine learning algorithms, such as Deep Learning models, to analyse and identify investment opportunities in the equity markets. | Modern Portfolio Theory (MPT) to determine optimal portfolios for clients. The investment strategy is based on allocating assets across multiple classes, ensuring diversification, capital growth, income generation, and risk mitigation. Each asset class is evaluated based on: capital growth potential, volatility, diversification benefits, inflation protection and cost-efficiency. | Economic Regime-based Asset Allocation, or ERAA®, is the intelligent investment framework that minimises risk and maximises returns which include the General Investing Portfolio, Thematic Portfolios, and Responsible Investing Portfolio. |
| **Apps Support** | Android & iOS | Android & iOS (no web for MY) | Android, iOS, and web platform |

(Source: Author)

## Discussion

### *Legal Framework*

BIMB Investment Berhad is an Islamic fund management company, licensed and registered with the Securities Commission of Malaysia and governed by the Capital Market Services Act 2007. It is a wholly-owned subsidiary of Bank Islam Malaysia Berhad under the supervision of Central Bank of Malaysia (CBM).

Wahed is a digital investment manager (DIM) licensed by the Securities Commission of Malaysia and governed by the Capital Market Services Act 2007. Wahed Technologies Sdn. Bhd. is a subsidiary of Wahed Inc., the first automated Shariah-compliant wealth advisor in the world. StashAway Malaysia Sdn Bhd is licensed by the Securities Commission Malaysia and governed by the Capital Market Services Act 2007. StashAway was the first robo advisor to obtain a full capital market services licence from the Monetary Authority of Singapore (MAS) in 2017.

***Shariah Governance***

The Securities Commission of Malaysia (SC) has established the Shari'ah Advisory Council of Securities Commission (SAC) to ensure that the Islamic capital market activities and instruments are Shari'ah compliant. The SAC was established in May 1996 to advise the SC on Shariah matters pertaining to the Islamic capital market. Members of the SAC are qualified individuals who can present Shariah opinions and have vast experience in the application of Shariah, particularly in the areas of Islamic economics and finance.

The SAC is the highest authority in the determination of Shariah matters arising from Islamic capital market transactions in Malaysia. The SAC derives its powers by virtue of the Securities Commission of Malaysia Act 1993. Section 31ZI empowers the SC to establish the SAC as the authority for the ascertainment of the application of Shariah principles for the purpose of ICM business or transactions. The functions of the SAC as set out in section 31ZJ are to ascertain the application of Shariah principles on any matter relating to Islamic capital market business or transaction; to issue ruling on any matter relating to Islamic capital market business or transaction; to advise the SC on any Shariah issue relating to Islamic capital market business or transaction; to provide advice to any person on any Shariah issue relating to Islamic capital market business or transaction; and such other functions as may be prescribed by the Minister of Finance.

Section 31ZK provides that a member of SAC will be appointed by the Yang di-Pertuan Agong, on the advice of the Minister of Finance after consultation with the SC and that member must be a person who are qualified in *fiqh muamalah*; Islamic jurisprudence; Islamic finance; or any other related discipline. The provision further requires that if a judge of the High Court, the Court of Appeal or the Federal Court, is to be appointed as a member of the SAC, such appointment shall not be made except after consultation by the SC with the Chief Justice; and in the case of a judge of the Shariah Appeal Court of a State or Federal Territory, after consultation by the SC with the Chief Shariah Judge of that State or Federal Territory, as the case may be. It is further provided that the member shall hold office on such terms and conditions as may be provided in their respective letters of appointment and shall be eligible for reappointment. The provision also provides that members of the SAC shall be paid such remuneration and allowances as may be determined by the SC.

In carrying out the functions of the SAC, section 31ZL allows the SC to establish a secretariat and such other committees as the Commission considers necessary to assist the SAC and to appoint an officer of the SC or any other person to be a member of the secretariat or such other committees. Any licensed person, stock exchange, derivatives exchange, clearing house,

central depository, listed corporation or any other person may seek the advice of the SAC or refer a matter for a ruling by the SAC relating to its Islamic capital market business or transaction in order to ascertain that it does not involve any element which is inconsistent with the Shariah by virtue of section 31ZM SCA.

Section 31ZN SCA deals with the effect of the ruling issued by the SAC upon reference made by the court or arbitrator on Shariah matters relating to ICM business or transaction. The provision states that the court or arbitrator in any proceedings before any court or arbitrator concerning a Shariah matter in relation to ICM business or transaction, shall take into consideration any ruling of the SAC or refer such matter to the SAC for its ruling. Section 31ZO further provides for the binding effect of Shariah ruling made by the SAC pursuant to section 31ZM or 31Z. The provision specifically states that the Shariah ruling made the SAC shall be binding on the licensed person, stock exchange, derivatives exchange, clearing house, central depository, listed corporation or any other person referred to in section 31ZM; and the court or arbitrator referred to in section 31ZN. To maintain consistency in the Shariah ruling in the industry, section 31ZP provides that in situation where a ruling given by a registered Shariah adviser to a person engaging in any Islamic capital market business or transaction is different from the ruling given by the SAC, the ruling of the SAC shall prevail.

By virtue of sections 377 and 378 of the Capital Markets and Services Act 2007 (CMSA), the SC has issued the Guidelines on Islamic Capital Market Products and Services. As far as Shariah governance of Islamic funds is concerned, several provisions are relevant. Paragraph 12.01 states that the constitution of an Islamic fund management company must state that the Islamic fund management company aims to achieve its commercial objectives in compliance with Shariah. Paragraph 13.01 requires that a fund management company undertaking an Islamic fund management business must appoint a Shariah adviser. The fund management company must take all reasonable steps to ensure that the Shariah adviser vacates its position immediately upon becoming aware that the Shariah adviser has been subjected to any disqualification or no longer satisfies the fit and proper criteria under Paragraph 13.02.

A Shariah adviser must, among others, provide Shariah expertise and advice on Shariah matters in relation to the Islamic capital market products or the Islamic capital market service including matters relating to documentation, structure, feature, investment instruments and ensure that all aspects of the products or activities are in accordance with Shariah requirements as set out in the relevant securities laws and guidelines issued by the SC; ensure that the applicable Shariah rulings, principles and concepts endorsed by the SAC are complied with; and apply ijtihad (intellectual reasoning) to ensure all aspects relating to the Islamic capital market products and the Islamic capital market service are in compliance with Shariah, in the absence of any rulings, principles and concepts endorsed by the SAC. In carrying out the roles and responsibilities above, a Shariah adviser must act with due care, skill and diligence. Where there is ambiguity or uncertainty relating to any Shariah matters, the Shariah adviser must consult the SC.

In addition, the Shariah adviser must review reports of the compliance officer or any investment transaction report to ensure that the Islamic fund management business and investment activities are Shariah-compliant; prepare a report stating its opinion whether the Islamic fund

management business has been managed or administered in accordance with Shariah. In relation to an Islamic fund management company, the Shariah adviser must ensure that the

operation and investment activities of the Islamic fund management company is in compliance with Shariah and prepare a report stating its opinion on compliance by the Islamic fund management company and provide the report to the investors on a periodic basis, where the fund is managed under a private mandate. A fund management company must ensure that its Islamic fund management business is limited to Shariah-compliant investments.

Paragraph 15.06 requires that any risk management policies and procedures undertaken by the fund management company in relation to the Islamic fund management business must be in compliance with Shariah and endorsed by the Shariah adviser. A fund management company must put in place appropriate systems and mechanisms within its internal audit requirements to monitor Shariah compliance in accordance with the Guidelines and relevant SC regulations including resolutions issued by the SAC.

***Application of ESG principles***

BIMB offers the following ESG funds in its portfolio:

- BIMB-ARABESQUE i Global Dividend Fund 1 (BiGDF1)
- BIMB-ARABESQUE Global Shariah Sustainable Equity Fund (BGSEF)
- BIMB-Arabesque Global Shariah-ESG AI Technology Fund (BGSEAIT)
- BIMB-Arabesque Asia Pacific Shariah-ESG Equity Fund (BAPAC)
- BIMB-Arabesque Malaysia Shariah-ESG Equity Fund (BMSEF)
- BIMB ESG Sukuk Fund (BSF)
- Makmur myWakaf Fund (MWF)

For the BIMB-Arabesque Global Shariah-ESG AI Technology Fund (BGSEAIT), the fund follows a rules-based investment process, targeting listed companies that comply with the principles of the United Nations Global Compact (UNGC) and are Shariah-compliant in accordance with the Shariah Advisory Council (SAC) and/or AAOIFI Shariah Standards. In addition, the fund may invest in Islamic collective investment schemes (CIS) whose underlying equities meet UNGC or ESG principles consistent with the fund's objectives. Investments are reviewed on a quarterly basis to ensure alignment with UNGC and ESG principles, as well as broader sustainability considerations. The fund is not actively managed, as it employs a quantitative approach driven entirely by artificial intelligence (AI) without human intervention. Portfolios are rebalanced monthly across Malaysian and foreign securities, while the investment universe is reassessed quarterly. To support this process, the fund manager engages Arabesque AI Limited, an investment advisory and research firm that provides tailored investment solutions using advanced AI research and technology.

The investment universe consists of Shariah-compliant equities and equity-related securities, with a focus on global technology sectors such as technology services, electronics, and healthcare technology. Companies are selected through a systematic process that integrates Arabesque S-Ray®, a proprietary tool assessing non-financial risk factors (including ESG issues and UNGC alignment), alongside financial and business activity screening.
The quarterly reassessment which applies several layers of screening is shown in Table 2:

**Table 2: Shariah compliant screening of BIMB-Arabesque Global Shariah-ESG AI Technology Fund (BGSEAIT)**

| SCREENING | REQUIREMENTS |
|---|---|
| Liquidity Screening | • Securities failing minimum liquidity criteria are excluded.<br>• Foreign securities must have a market capitalization of at least USD 500 million, a one-month average daily trading volume of USD 3 million or more, and a free float of at least 10%.<br>• Malaysian securities must meet a six-month average daily trading volume of RM400,000 or higher. |
| S-Ray® Screening | • GC Score: Evaluates companies against the four core UNGC principles; firms in breach are excluded.<br>• ESG Score: Assesses sector-specific, financially material ESG criteria; companies ranking at the bottom of their sector are removed. |
| Shariah Screening | • Business involvement filters: Excludes companies engaged in non-compliant activities such as conventional banking, insurance, real estate, alcohol, tobacco, pork products, gambling, adult entertainment, arms manufacturing, and trading/hedging of gold and silver.<br>• Financial filters: Excludes companies with non-permissible income exceeding 5% of total revenue, interest-bearing investments or debts exceeding 30% of market capitalization, or liquidity ratios above 67%. The Fund is prohibited from investing in preference shares. |

(Source: Fund Prospectus)

the screening process is AI-driven, any company failing liquidity, S-Ray®, or Shariah compliance checks is automatically removed during quarterly reassessments. This ensures that the fund's investments consistently align with UNGC and ESG principles, while maintaining Shariah compliance and supporting sustainability objectives.

Wahed Invest applies ESG principles in its investment strategies. The platform has launched a Shariah-compliant ESG-themed exchange-traded fund (ETF), which benchmarks to the Dow Jones Islamic Market International Titans 100 Index and employs ESG data science to assess risks related to environmental, social, and governance factors. Additionally, Wahed has a full-time Ethical Review Board that ensures that investments align with Islamic finance principles, indicating a commitment to responsible investing.

StashAway Shariah Global Portfolios that include shariah-compliant equities, Islamic bonds (sukuk), and gold, allowing investors to access globally diversified, shariah-compliant investments. StashAway's portfolios are designed to align with Islamic finance principles, ensuring that investments do not involve interest or excessive speculation. The Shariah Global Portfolio offered by StashAway is a globally diversified investment portfolio that complies with Islamic principles. The portfolio is managed using an intelligent investing framework, ERAA™, and only invests in Shariah-compliant ETFs across equities, Islamic bonds (sukuk), and gold. Each portfolio is reviewed and endorsed Shariah-compliant by Masryef Advisory, an independent Shariah advisor registered with the Securities Commission Malaysia.

The findings show that AI enhances portfolio screening and investment decision while Shariah governance framework play significant roles to ensure compliance and maintain investor confidence. While AI can enhance ESG, it also requires additional considerations within the ESG framework to address its own associated risks and concerns. As Shariah-ESG investment continues to grow, driven by increasing awareness of global challenges and evolving regulatory landscapes, the role of Big Data and AI will become even more critical.

## Conclusion

As sustainable investment demand continues to rise, it is essential to further explore and adopt AI technologies within ESG investing. Collaboration among investors, financial institutions, technology providers, and regulators is required to design innovative AI-driven solutions, strengthen transparency and accountability, and advance sustainable finance initiatives. Leveraging the capabilities of AI can open new pathways for financial success, foster positive societal and environmental change, and contribute to building a more resilient and equitable future. The study contributes to the emerging discourse on Islamic FinTech, offering strategic insights for regulators, asset management companies and digital platform developers in the development of Shariah compliant investment solutions in support of the broader objective of financial inclusion and sustainability within the Islamic finance ecosystem.

In a nutshell, AI holds transformative potential for ESG investing by improving portfolio management, enhancing performance, and driving sustainable outcomes. Through the integration of AI technologies and data-driven insights, progress toward a more sustainable and robust global financial system can be accelerated, delivering benefits to investors, businesses, and society at large.

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# TOWARDS A PEDAGOGICAL MODEL FOR TEACHING STANDARD MARINE COMMUNICATION PHRASES (SMCP): BRIDGING GENRE AND COMMUNICATIVE COMPETENCE IN MARITIME ENGLISH TRAINING

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***Abstract:*** *The International Maritime Organization (IMO) established the Standard Marine Communication Phrases (SMCP) to facilitate safe, clear communication at sea through standardized English phrases. Nevertheless, empirical studies continue to reveal a gap between the linguistic standard prescribed by the IMO and the actual communicative dynamics of shipboard interactions. Seafarers often work in stressful, multilingual environments. They frequently make SMCP easier to use by omitting, reordering, or simplifying its components. This gap suggests that contemporary teaching methods for Maritime English may prioritize memorization over proficiency in verbal and written communication. This paper employs Swales' (1990) genre theory and Bocanegra-Valle's (2010) move-step framework to propose a pedagogical model that integrates genre-based instruction with the enhancement of communicative competence. The model emphasizes the importance of understanding the rhetorical structure of both standard and specialized maritime communications. It also offers ideas for incorporating genre awareness and simulation-based training into Maritime English classes. The suggested approach aims to shift how people learn SMCP, moving from memorizing phrases to using them in meaningful, situation-based conversations. This will better align language learning with real-life professional practices at sea.*

***Keywords:*** *Maritime English; Standard Marine Communication Phrases; genre-based pedagogy; communicative competence; ESP; simulation-based learning*

## Introduction

Effective communication at sea is critical to maritime safety, operational efficiency, and environmental protection. In multilingual and multicultural shipboard environments, communication breakdowns have repeatedly been identified as a major contributor to maritime incidents and accidents (Boström, 2020; Ziarati et al., 2009). To address this issue, the International Maritime Organization (IMO) designated English as the working language of the maritime industry. It introduced the Standard Marine Communication Phrases (SMCP) as a standardized linguistic framework to ensure clarity, precision, and mutual intelligibility in shipboard and ship-to-shore communication (IMO, 2001).

The SMCP was created to minimize ambiguity by using fixed message markers, standardized phrases, and structured communication sequences, especially in safety-critical situations like distress, urgency, and navigational exchanges (Pritchard, 2003; Trenkner, Cole, & Pritchard,

(2007). Ideally, following SMCP should improve mutual understanding among seafarers of different linguistic backgrounds, thus promoting safer maritime operations. As a result, SMCP has become a key part of Maritime English training and is incorporated into international standards such as the STCW Convention and the IMO Model Course 3.17 on Maritime English (IMO, 2015). However, despite their widespread institutional use, research consistently shows a gap between the official linguistic standards of SMCP and actual communication practices in real maritime settings. VHF radio studies reveal that seafarers often simplify messages, leave out procedural steps, rephrase information, or modify standard phrases to meet operational needs, time pressures, and urgent circumstances (Bocanegra-Valle, 2010; Johnson, 1994; Boström, 2020). These variations are most noticeable during routine exchanges but also occur in critical situations where stress and cognitive demands are high.

Such findings imply that deviations from SMCP do not necessarily indicate linguistic deficiency or non-compliance. Instead, they often reflect adaptive communication strategies influenced by workplace conditions. Maritime discourse research indicates that seafarers tend to prioritize speed, clarity, and task achievement over strict adherence to official forms, especially in the dynamic, unpredictable maritime environment (Demydenko, 2012; Trenkner et al., 2007). This situation prompts essential questions about how SMCP is understood and taught in Maritime English education.

Current methods for teaching SMCP often focus on memorizing fixed phrases, using correct terminology, and following procedures (Pritchard, 2003). While these methods promote standardization, they may not adequately prepare learners to use SMCP effectively in real interactive situations. Specifically, a phrase-centered approach might neglect the importance of understanding communicative goals, interaction sequences, and employing strategic language under operational conditions. In the field of English for Specific Purposes (ESP), scholars are increasingly advocating teaching methods that highlight language as social action within specific contexts rather than as isolated language forms (Dudley-Evans & St John, 1998; Swales, 1990). Genre-based teaching, which emphasizes the link between communication purpose, discourse structure, and professional practice, offers a promising way to rethink SMCP instruction. From this view, VHF radio communication can be seen as a specialized genre characterized by conventionalized moves and steps designed to achieve particular operational objectives (Bocanegra-Valle, 2010).

Effective maritime communication demands more than just genre awareness. The idea of communicative competence emphasizes that learners must develop not only linguistic accuracy but also discourse, sociolinguistic, and strategic skills, especially in high-risk professional environments (Canale & Swain, 1980; DeFleur et al., 2005). In maritime settings, strategic competence—which includes handling breakdowns, clarifying messages, and prioritizing information—is vital to maintaining safety and efficient communication. This conceptual paper introduces a genre-integrated pedagogical model for teaching Standard Marine Communication Phrases, aiming to connect formal standardization with real-world communicative skills. Based on genre theory, communicative competence frameworks, and empirical research on maritime communication, the model seeks to improve Maritime English training by aligning it more closely with authentic shipboard and VHF radio interactions.

## Literature Review

### *Maritime English and the Role of SMCP*

Maritime English (ME) is widely recognised as a specialised variety of English for Specific Purposes (ESP), developed to meet the communicative demands of the global maritime industry. As an operational language used in navigation, cargo handling, engineering, and emergency response, ME is inherently goal-oriented and safety-driven (Dudley-Evans & St John, 1998; Trenkner, 2007). Given the multilingual composition of ship crews and shore-based personnel, effective communication in Maritime English is crucial to ensuring safe navigation and efficient maritime operations.

In response to persistent communication-related maritime incidents, the International Maritime Organization (IMO) introduced the Standard Marine Communication Phrases (SMCP) as a standardized linguistic framework to reduce ambiguity and enhance mutual intelligibility at sea (IMO, 2001). SMCP provides prescribed message markers, fixed phraseology, and structured message sequences for routine and special-purpose communication, particularly via VHF radio. These phrases are concise, unambiguous, and internationally comprehensible, supporting clear communication in high-risk situations such as distress alerts, navigational warnings, and ship-to-shore exchanges (Pritchard, 2003). SMCP instruction is further institutionalized through international training frameworks, including the Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Convention and the IMO Model Course 3.17 on Maritime English, which emphasize competence-based language training aligned with operational needs (IMO, 2015). As such, SMCP has become a central component of Maritime English curricula worldwide.

### *The Gap Between Prescribed Standards and Actual Maritime Communication*

Despite widespread adoption of SMCP, numerous empirical studies reveal a persistent gap between the idealized language outlined in international standards and the actual communication practices at sea. Research on VHF radio usage consistently finds that seafarers do not always follow SMCP guidelines strictly, especially during routine or urgent conversations (Johnson, 1994; Bocanegra-Valle, 2010). Recent research confirms that deviations from SMCP are systematic and context-dependent, not random. For instance, Boström (2020) measured ship-to-ship communication against SMCP standards and observed frequent omissions, simplifications, and reordering, especially during routine exchanges. Similar patterns appear in studies of live maritime discourse, where seafarers prioritize speed, clarity, and task completion over strict adherence to procedures (Demydenko, 2012; Trenkner et al., 2007). Importantly, these deviations should not be interpreted solely as communicative failure or linguistic incompetence. Instead, they reflect adaptive strategies employed by experienced practitioners operating under cognitive load, environmental noise, and operational stress. In this sense, real-world maritime communication often involves a negotiation between standardized forms and situational exigencies, suggesting that strict phrase-level compliance may not always be feasible or desirable (Bocanegra-Valle, 2010; Ziarati et al., 2009).

### *Limitations of Phrase-Based and Memorisation-Oriented Instruction*

Traditional methods for teaching SMCP have mostly depended on memorization, repetition, and drill exercises, focusing on accuracy and strict adherence to prescribed phraseology (Pritchard, 2003). Although this approach promotes standardization and helps learners become familiar with maritime terminology, it has been criticized for treating SMCP as isolated linguistic units rather than practical tools for real-world communication. Relying solely on phrase-based instruction might leave learners to manage interactional aspects like turn-taking, clarification, repair strategies, and prioritizing information in real-time conversations. Especially, learners who are primarily trained through memorization may find it challenging to adapt SMCP flexibly in unexpected situations or under stress conditions that are typical in maritime contexts (Demydenko, 2012).

Recent pedagogical research emphasizes the need for more communicative and learner-focused strategies in Maritime English training. Methods such as scenario-based learning, simulations, and gamification have proven to boost learner engagement and improve contextual understanding of SMCP (Rosedi, 2024). These strategies indicate that effective SMCP teaching should go beyond mere phrase memorization and focus on dynamic, real-world communication practice.

### *Genre-Based Pedagogy in ESP and Maritime Contexts*

Genre-based pedagogy provides a solid theoretical framework for overcoming the limitations of phrase-focused instruction. In ESP, genre is regarded as a socially recognized communicative event distinguished by shared goals, conventional structures, and disciplinary norms (Swales, 1990). This approach to instruction emphasizes not only linguistic forms but also the communicative function, audience, and context. In maritime communication, VHF radio exchanges are a highly regulated professional genre with identifiable moves and steps, especially in routine messages and special-purpose communication such as distress alerts and acknowledgements (Bocanegra-Valle, 2010). Genre analysis has effectively revealed how maritime communication is organized and how meaning is sequentially constructed to fulfill operational goals.

From a pedagogical perspective, genre awareness enables learners to recognise patterns of interaction, anticipate communicative expectations, and understand why confident linguistic choices are made in specific contexts. Research in ESP has shown that genre-based instruction can improve learners' ability to transfer language knowledge to authentic professional tasks, making it especially suitable for high-stakes occupational settings such as maritime communication (Dudley-Evans & St John, 1998; Swales, 2004).

### *Communicative Competence in High-Stakes Professional Communication*

While understanding genre helps learners grasp discourse structures, successful maritime communication also depends on communicative competence. Canale and Swain's (1980) framework identifies this competence as including grammatical, sociolinguistic, discourse, and strategic elements. In maritime settings, strategic competence is essential, as seafarers must manage misunderstandings, fix communication issues, and emphasize vital information within

operational limits. High-stakes professional communication, like VHF radio interactions during emergencies require quick linguistic decisions while ensuring clarity and adherence to procedures. The transactional model emphasizes the interactive, reciprocal nature of such exchanges, where meaning is constantly negotiated through feedback and role-taking (DeFleur et al., 2005). Together, these perspectives indicate that effective SMCP instruction should combine genre knowledge with both communicative and strategic skills, allowing learners to use standardized language correctly while adapting to real-world communication challenges.

The reviewed literature reveals a conflict between the push for standardization in SMCP and the practical communication needs of maritime professionals. While SMCP provides a crucial safety communication framework, studies show that seafarers frequently deviate from these standards in practice. Traditional teaching methods have focused mainly on memorization, often neglecting the importance of communicative flexibility and understanding different genres. This discrepancy underscores the necessity for a teaching approach that views SMCP as a practical, communicative genre, blending standardization with effective communication skills. Despite growing awareness of this issue, there is still a lack of teaching models that clearly connect genre analysis with SMCP training. To fill this gap, this paper introduces a genre-based pedagogical model designed to improve Maritime English education by aligning it more closely with real-world communication practices.

## Theoretical Underpinnings

This paper's pedagogical model draws on three interconnected theoretical perspectives: genre theory, communicative competence, and the transactional model of communication. Together, these frameworks provide a solid foundation for redefining SMCP instruction as both a standardized linguistic system and a flexible communicative practice embedded in maritime operations.

### *Genre Theory and Professional Communication*

Genre theory has been extensively used in English for Specific Purposes (ESP) research to analyze how language serves specific communicative goals within professional communities. Swales (1990) describes a genre as a category of communicative events acknowledged by members of a discourse community, distinguished by shared goals, structural norms, and audience expectations. These goals influence discourse organization and language choices. In professional settings, genres serve as cognitive and social tools that guide participants in creating and interpreting texts and interactions. Mastering a genre involves understanding not only linguistic features but also how discourse is organized to achieve particular professional objectives (Swales, 2004). From an ESP viewpoint, genre-based teaching helps learners recognize communication patterns and implement them effectively in real-world situations (Dudley-Evans & St John, 1998).

In the maritime domain, VHF radio communication is highly regulated and professional. Routine messages, distress alerts, and acknowledgements follow conventionalized sequences of moves and steps that serve distinct operational purposes. Genre analysis studies have demonstrated that these communicative events exhibit predictable rhetorical structures, particularly in safety-critical situations, where clarity and procedural order are paramount

(Bocanegra-Valle, 2010). Understanding these structures allows learners to see SMCP not as isolated phrases, but as components of an organised communicative system. Importantly, genre theory also accommodates variation and adaptation. While genres provide normative patterns, expert practitioners may strategically modify or compress these patterns in response to situational demands. This perspective is particularly relevant to maritime communication, where operational constraints and environmental pressures often necessitate flexible language use.

### *Communicative Competence in Maritime Contexts*

Communicative competence provides a second key theoretical foundation for the proposed model. Canale and Swain's (1980) framework conceptualizes communicative competence as comprising four interrelated components: grammatical competence, sociolinguistic competence, discourse competence, and strategic competence. In Maritime English, all four elements are essential, though their relative importance may vary by context. Grammatical competence supports accurate use of SMCP terminology and syntactic structures, while sociolinguistic competence enables appropriate language use across hierarchical and multicultural maritime environments. Discourse competence is particularly relevant to SMCP, as it involves organizing utterances coherently across extended interactions, such as routine VHF exchanges or emergency communication sequences. Strategic competence is especially salient in high-stakes maritime communication. Seafarers must often manage communication breakdowns, request clarification, prioritize critical information, and compensate for linguistic or technical limitations under time pressure. Research in maritime discourse suggests that experienced practitioners rely heavily on strategic competence to ensure intelligibility and task completion, even when deviations from standard phraseology occur (Demydenko, 2012; Boström, 2020). From a pedagogical perspective, communicative competence underscores the need to move beyond surface-level accuracy and train learners to use SMCP effectively in real operational conditions. This aligns with competence-based training principles embedded in international maritime education frameworks such as the STCW Convention and IMO Model Course 3.17 (IMO, 2015).

### *The Transactional Model of Communication*

The transactional communication provides an additional lens for understanding VHF radio interactions, viewing them as a dynamic, two-way exchange. Unlike linear models that conceptualize communication as a simple one-way transmission of information, the transactional model emphasises the simultaneous roles of participants as both senders and receivers, constantly providing feedback and negotiating roles (DeFleur et al., 2005; Foulger, 2004).

In maritime communication, this perspective is particularly relevant due to the interactive nature of VHF exchanges. Ship-to-ship and ship-to-shore communication involve turn-taking, acknowledgment, clarification, and confirmation, all of which are influenced by environmental noise, technological limitations, and situational urgency. Meaning is co-constructed through successive turns rather than transmitted in isolation. The transactional model also highlights the influence of contextual factors, such as the physical environment, social relationships, and institutional roles, on communication. In maritime settings, these include vessel hierarchy,

authority relationships, radio protocol, and operational stress, all of which influence how SMCP is applied in practice (Johnson, 1994; Trenkner et al., 2007).

By emphasizing interaction and feedback, the transactional model supports the idea that SMCP training should focus on preparing learners for dynamic communication, enabling them to interpret responses, adapt messages in real time, and manage communication flow to meet operational objectives.

### *Integrating the Theoretical Perspectives*

Overall, genre theory, communicative competence, and the transactional model of communication offer a strong theoretical basis for the proposed pedagogical approach. Genre theory describes the structured nature of SMCP and VHF communication, communicative competence highlights the skills necessary to use SMCP effectively, and the transactional model illustrates the dynamic interaction in maritime communication. Combining these viewpoints redefines SMCP as a genre-based communicative tool rather than just a fixed set of phrases. This integrated perspective promotes a teaching method that preserves SMCP's standardization while giving learners the flexibility and strategic skills needed to succeed in real-world maritime contexts.

## A Genre-Integrated Pedagogical Model for Teaching SMCP

Building on the theoretical foundations outlined in the previous section, this paper introduces a genre-integrated pedagogical model for teaching Standard Marine Communication Phrases (SMCP). This model aims to bridge the gap between the linguistic requirements of SMCP and the practical communication needs of maritime operations, especially VHF radio communication. Rather than treating SMCP as a fixed set of memorized phrases, the model sees it as a functional communicative genre that must be understood, practiced, and adapted to real professional contexts. It incorporates ideas from genre theory, communicative competence, and transactional communication, organized into five pedagogical stages. These stages are flexible rather than strictly sequential, allowing learners to revisit earlier stages as their communication awareness and proficiency develop.

### *Stage 1: Genre Awareness and Contextualization*

The first stage focuses on developing learners' awareness of SMCP as a situated communicative genre rather than isolated linguistic forms. At this stage, instruction emphasizes the communicative purposes of SMCP, the typical participants in maritime communication, and the operational contexts in which different types of messages occur. Learners are introduced to distinctions between routine and special-purpose messages (e.g., distress alerts,

distress acknowledgments, urgency messages), with attention to differences in risk level, message priority, and expected interactional structure (IMO, 2001; Bocanegra-Valle, 2010). By situating SMCP within real maritime scenarios, learners begin to understand why specific message formats exist and how they contribute to safety and efficiency.

This genre awareness aligns with ESP pedagogy, which emphasizes understanding language use in relation to professional practice (Dudley-Evans & St John, 1998). This foundational awareness prepares learners to move beyond surface-level phrase recall toward meaningful communicative engagement.

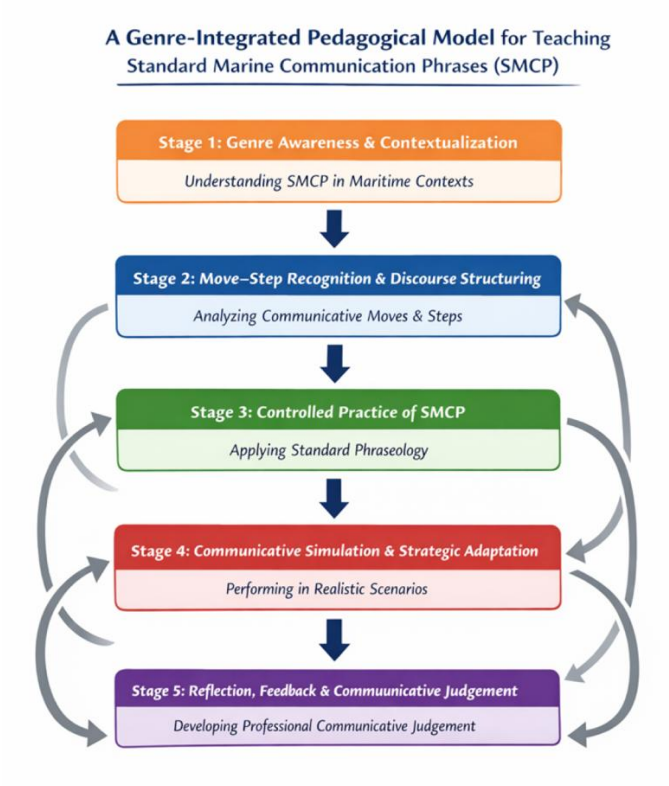



**Figure 1: A Genre-Integrated Pedagogical Model for Teaching Standard Marine Communication Phrases (SMCP)**

***Stage 2: Move–Step Recognition and Discourse Structuring***

The second stage focuses on helping learners identify and analyse the move–step structure of SMCP-based communication. Drawing on genre analysis frameworks, learners examine authentic or simulated VHF radio exchanges to identify how communication is organized sequentially to achieve specific purposes (Swales, 1990; Bocanegra-Valle, 2010).
At this stage, learners are guided to recognise:

- Initiation moves (e.g: establishing contact, identifying stations),
- Information exchange moves (e.g. stating position, nature of distress, or routine information),
- Closing moves (e.g. acknowledgements, termination of communication).

Through guided analysis, learners develop discourse competence, gaining insight into how meaning unfolds across turns rather than within isolated utterances (Canale & Swain, 1980). Importantly, learners are also exposed to empirical findings showing that some moves or steps may be omitted or compressed in real practice, encouraging critical reflection on the relationship between prescribed standards and actual use.

***Stage 3: Controlled Practice of SMCP in Structured Scenarios***

The third stage provides learners with opportunities for controlled practice, in which they apply SMCP to carefully designed, low-risk instructional tasks. These activities typically involve scripted role-plays, guided drills, and structured simulations that mirror standard maritime communication scenarios.
At this stage, pedagogical emphasis is placed on:

- Accuracy of SMCP phraseology,
- Correct sequencing of moves and steps,
- Clarity and intelligibility of message delivery

.
Controlled practice supports the development of grammatical and discourse competence, ensuring that learners become familiar with standard SMCP forms before encountering more complex communicative demands (Canale & Swain, 1980). This stage also aligns with the competence-based orientation of Maritime English training frameworks, such as the IMO Model Course 3.17, which emphasizes progressive skill development (IMO, 2015).

***Stage 4: Communicative Simulation and Strategic Adaptation***

In the fourth stage, learners engage in communicative simulations that more closely approximate real-world maritime conditions. These simulations introduce elements such as time pressure, background noise, incomplete information, and unexpected communicative challenges, reflecting the realities of VHF radio communication at sea (Johnson, 1994; Trenkner et al., 2007). During these activities, learners are encouraged to use SMCP flexibly while maintaining communicative effectiveness. Deviations from prescribed phraseology are not immediately treated as errors but are instead examined as strategic adaptations to ensure clarity, efficiency, or task completion. This approach acknowledges research showing that experienced seafarers often adapt SMCP in practice to cope with operational constraints (Boström, 2020; Demydenko, 2012).

This stage is crucial for developing strategic competence, as learners learn to manage communication breakdowns, request clarification, and prioritise critical information under pressure (Canale & Swain, 1980). It also reflects the transactional nature of maritime communication, where meaning is negotiated interactively through feedback and adjustment (DeFleur et al., 2005).

***Stage 5: Reflection, Feedback, and Communicative Judgement***

The final stage emphasizes reflective learning and the development of professional communicative judgment. Learners are guided to reflect on their performance in simulations, considering questions such as:

- Which SMCP elements were essential for clarity?
- When and why were adaptations made?
- How did communicative choices affect interaction outcomes?

At this stage, instructor and peer feedback focus on communicative effectiveness rather than rigid compliance. This reflective process helps learners internalize both the normative expectations of SMCP and the pragmatic considerations of real-world maritime communication. By engaging in reflection, learners consolidate their understanding of SMCP as a living communicative system, reinforcing the integration of genre knowledge and communicative competence. Such reflective practice aligns with contemporary ESP pedagogy, which values learner autonomy and critical awareness in professional language use (Dudley-Evans & St John, 1998).

***Summary of the Pedagogical Model***

The proposed genre-integrated pedagogical model provides a structured yet flexible framework for teaching SMCP in Maritime English training. By progressing from genre awareness to strategic communicative practice, the model supports the development of both standardization and adaptability. In doing so, it addresses longstanding concerns regarding the gap between SMCP as prescribed by international standards and SMCP as enacted in real maritime communication.

## Classroom Implementation and Pedagogical Implications

The proposed genre-integrated pedagogical model has direct implications for the design and delivery of Maritime English and SMCP instruction in maritime academies, training centres, and professional development programmes.

***Implementing the Model in Maritime English Classrooms***

The five-stage model is designed to be adaptable across different instructional contexts, including pre-sea training, post-sea professional courses, and refresher programs for certified officers. Rather than replacing existing SMCP syllabi, the model can be integrated into current Maritime English curricula by shifting instructional emphasis from phrase memorization to communicative performance.

At the initial stages, instructors can introduce SMCP through scenario-based contextualization, using authentic or semi-authentic maritime situations to illustrate communicative purpose and risk level. For example, routine message exchanges and distress communications can be contrasted to highlight differences in priority, structure, and interactional expectations (IMO, 2001; Bocanegra-Valle, 2010). Such activities help learners understand why specific phraseology and message sequencing are required, rather than merely what phrases to use. Subsequent stages can be implemented through guided discourse analysis, in which learners analyze transcripts or recordings of VHF radio communication to identify communicative moves and steps. This approach aligns with genre-based pedagogy, which has been shown to support learners' ability to transfer classroom learning to professional practice (Swales, 2004; Dudley-Evans & St John, 1998).

### *Simulation-Based Learning and Communicative Practice*

A key implication of the model is the greater use of simulation-based learning in SMCP instruction. Communicative simulations enable learners to practice SMCP under conditions that approximate real maritime operations, including time pressure, environmental noise, and incomplete information. Research in maritime training indicates that such experiential learning environments enhance learner engagement and communicative readiness (Trenkner et al., 2007; Demydenko, 2012).

During simulations, instructors are encouraged to assess communicative effectiveness, intelligibility, and task completion rather than focusing solely on strict phrase-level accuracy. This does not undermine the importance of standardization; rather, it reflects the reality that effective maritime communication involves strategic adaptation within regulated frameworks (Boström, 2020). Technological tools such as VHF simulators, computer-based training platforms, and gamified learning environments may further support this stage of the model. Recent studies indicate that technology-enhanced learning can improve learner motivation and contextual understanding in SMCP instruction (Rosedi, 2024).

### *Assessment and Feedback Practices*

The proposed model also has implications for assessment practices in Maritime English training. Traditional assessments have often focused on discrete-item tests of terminology or scripted oral examinations. While these assessments help evaluate foundational knowledge, they may not fully capture learners' ability to communicate effectively in real-world contexts.

In line with competence-based training principles, assessment under the proposed model should incorporate performance-based tasks, such as simulated VHF exchanges, role-plays, and oral scenario-based evaluations. Feedback should address both compliance with SMCP standards and strategic communicative choices, encouraging learners to reflect on the effectiveness of their language use (Canale & Swain, 1980; DeFleur et al., 2005). Reflective activities, such as post-simulation debriefings and guided self-assessment, play an essential role in developing learners' professional communicative judgment. These practices align with contemporary ESP pedagogy, which emphasizes learner awareness and autonomy in professional language use (Dudley-Evans & St John, 1998).

### *Implications for Instructor Training and Curriculum Design*

Implementing a genre-integrated approach to SMCP instruction also requires attention to instructor preparedness. Maritime English instructors need not only familiarity with SMCP phraseology but also an understanding of genre theory, communicative competence, and the interactional dynamics of maritime communication. Professional development programs may include training in discourse analysis and communicative pedagogy. At the curriculum level, the model supports alignment with international frameworks such as the STCW Convention and IMO Model Course 3.17, which emphasize competence-based outcomes and operational relevance (IMO, 2015). By integrating genre awareness and communicative competence into SMCP instruction, curricula can better reflect the communicative demands of modern maritime operations.

## Conclusion

This paper advocates a rethink of Standard Marine Communication Phrases (SMCP) instruction in Maritime English training, shifting from a mainly phrase-focused, memorization-based approach to a genre-inclusive, communicative teaching approach. Drawing on genre theory, communicative competence frameworks, and the transactional communication model, it proposes a pedagogical model that better aligns SMCP instruction with the communicative demands of maritime operations.

The literature review reveals an ongoing discrepancy between the standardized language set by the International Maritime Organization and the real-world communication practices observed via VHF radio. Studies show that seafarers often modify, simplify, or reorganize SMCP elements to meet operational needs, manage cognitive load, and address urgency. Instead of viewing these adaptations as failures, this paper considers them strategic uses of language within a highly regulated professional genre.

To address this gap, the proposed five-stage pedagogical model includes genre awareness, move–step recognition, controlled practice, communicative simulations, and reflective judgment. By viewing SMCP as a functional genre rather than a fixed code, the model upholds standardization goals while equipping learners with the communicative and strategic skills needed for maritime interactions. It emphasizes interaction, feedback, and contextual adaptation, reflecting the transactional nature of VHF radio communication.

Practically, this model provides maritime English instructors, curriculum developers, and training institutions with practical guidance on improving SMCP teaching within competence frameworks like the STCW Convention and IMO Model Course 3.17. By emphasizing simulation, performance-based assessment, and reflection, it supports the development of professional judgment vital to high-stakes maritime environments. As a conceptual paper, it does not offer empirical validation but presents a theoretically grounded framework to guide future research and instruction. Future studies could evaluate the model's effectiveness across different training settings, learner profiles, and operational contexts, and explore integration with emerging technologies such as digital simulators and adaptive learning tools.

In summary, by integrating genre analysis with communicative competence, this paper advances discourse in Maritime English and ESP on how to teach standardized professional language in pedagogically effective, operationally relevant ways. It aims to support better SMCP instruction and contribute to safer, more efficient maritime communication.

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# KAJIAN TINDAKAN: MEMPERKASA PEMIKIRAN KRITIS DAN PEMBELAJARAN KENDIRI MURID TINGKATAN SATU MELALUI AI

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***Abstract:*** *Kajian tindakan ini dijalankan bagi menilai keberkesanan integrasi kecerdasan buatan (AI), khususnya ChatGPT dalam memperkasa pemikiran kritis, pembelajaran kendiri serta pencapaian murid dalam mata pelajaran Sains. Intervensi dilaksanakan melalui tiga kitaran dalam tempoh lapan minggu menggunakan pendekatan mixed-method. Ujian pra dan pasca menunjukkan peningkatan signifikan dalam skor murid, min pra ujian (M = 44.37) meningkat kepada min pasca ujian (M = 58.24), t(37) = - 11.529, p < .001. Dapatan kualitatif pula menunjukkan perkembangan ketara dalam kemahiran prompting, keupayaan menyoal, semakan silang, serta keupayaan menilai ketepatan respons AI. Murid menunjukkan perubahan daripada penerima maklumat pasif kepada pengguna AI yang lebih kritis dan reflektif. Walaupun wujud cabaran seperti keraguan maklumat dan risiko kebergantungan terhadap AI, dengan bimbingan guru, latihan prompting dan semakan berdasarkan silibus berjaya memastikan penggunaan AI berlaku secara selamat dan beretika. Kajian ini menyimpulkan bahawa penggunaan AI secara terancang berpotensi besar menyokong kemahiran berfikir aras tinggi dan pembelajaran kendiri dalam Pendidikan Sains menengah rendah.*

***Keywords:*** *Kecerdasan Buatan, ChatGPT, Pemikiran Kritis, Pembelajaran Kendiri, Pendidikan Sains*

## Pengenalan

Pendidikan Sains di Malaysia memainkan peranan penting dalam menyokong agenda STEM negara yang menekankan pembangunan murid kreatif, kritis dan berkeupayaan menyelesaikan masalah (Abdullah et al., 2024). Namun begitu, budaya PdP yang masih berorientasikan peperiksaan menghadkan ruang pembelajaran yang lebih bermakna dan menyebabkan murid cenderung bergantung pada guru sekolah mahupun tenaga pengajar dari pusat-pusat tuisyen untuk memahami konsep Sains (Muda et al., 2024; Kenayathulla, 2023). Situasi ini turut diperhatikan oleh pengkaji, di mana murid Tingkatan 1 mampu menguasai konsep asas tetapi kurang mahir menjawab soalan aplikasi, analisis dan soalan berstruktur yang telah diubahsuai.

Perkembangan teknologi kecerdasan buatan kini membuka potensi baharu dalam PdP melalui penyampaian maklum balas segera, latihan adaptif dan peluang pembelajaran yang lebih bersifat kendiri (Xu & Ouyang, 2022). AI seperti ChatGPT berupaya memberi penjelasan terperinci, menjana contoh-contoh relevan dan mudah difahami, membantu murid membina soalan, serta menggalakkan interaksi bermakna yang lebih aktif (Gokcearslan et al., 2024; Cheung et al., 2024). Walaupun AI menunjukkan anjakan dalam corak pendidikan yang memberangsangkan, alat kecerdasan buatan itu tidak bebas daripada risiko seperti keraguan

input, bias dan kekeliruan maklumat yang memerlukan semakan silang (*cross-checking*) dan bimbingan guru yang sewajarnya (Akgun & Greenhow, 2022; Chinta et al., 2024).

Melihat potensi dan cabaran ini, kajian tindakan ini dijalankan bagi (1) mengenalpasti kesan penggunaan kecerdasan buatan (AI) terhadap pencapaian murid dalam mata murid Sains; dan (2) meneroka pengaruh penggunaan alat AI terhadap keupayaan murid untuk berfikir secara kritis dan belajar secara berdikari bagi mata pelajaran Sains dalam kalangan murid Tingkatan 1.

## Sorotan Literatur

### *Pemikiran Kritis dan Pembelajaran Kendiri*

Pemikiran kritis merupakan kemahiran teras Pendidikan Sains yang melibatkan kemampuan menilai bukti, membina inferens dan membuat pertimbangan berasaskan logik (Kalukar et al., 2024; Schroeder, 2024). Namun banyak kajian menunjukkan pelajar Malaysia masih berada pada tahap rendah hingga sederhana dalam aspek analisis dan penilaian (Fadhlullah & Ahmad, 2017). Hal ini berkait rapat dengan pendekatan PdP berpusatkan guru yang menekankan penerimaan maklumat pasif (Sharma, 2024).

Pembelajaran kendiri pula melibatkan kemampuan murid mengawal matlamat, strategi dan penilaian pembelajaran mereka (Foxworthy & McCarter, 2025). Kajian Lepper, Greene dan Nisbett (1973) menunjukkan bahawa autonomi pelajar meningkat apabila motivasi intrinsik dipupuk, bukan melalui ganjaran ekstrinsik. Alwadaeen dan Piller (2022) menegaskan bahawa pembelajaran kendiri boleh dipupuk seawal sekolah rendah melalui aktiviti inkuiri dan penerokaan digital. Kedua-dua elemen ini saling menyokong dan diperlukan dalam amalan pembelajaran Sains.

### *Penggunaan AI dalam Pendidikan*

Integrasi kecerdasan buatan (AI) dalam pendidikan Sains semakin mendapat perhatian global kerana potensinya dalam menyokong pemahaman konseptual, pemikiran kritis dan pembelajaran kendiri. Dalam konteks pembelajaran Sains menengah rendah, AI menawarkan keupayaan menyesuaikan penyampaian kandungan, memberikan maklum balas segera serta mewujudkan pengalaman pembelajaran yang bersifat interaktif dan autentik (Mayasari et al., 2024; Nawaz, 2024). Hal ini relevan dalam sistem pendidikan Malaysia yang sedang berhadapan dengan cabaran kelas besar, kekangan masa dan kepelbagaian tahap keupayaan murid (Norazman et al., 2021).

Kajian Mayasari et al. (2024) menunjukkan bahawa Oleh yang demikian, penggunaan tutor pintar AI dan kurikulum tersuai meningkatkan literasi saintifik dan kemahiran penaakulan murid melalui interaksi berulang atau berkonsep drilling (Mayasari et al., 2024). AI membolehkan murid menguji kefahaman secara kendiri melalui penghasilan jawapan mereka sendiri, semakan kendiri dan perbandingan dengan penjelasan alternatif yang dijana oleh AI. Mekanisme ini menepati prinsip kognitivisme yang menekankan proses pemahaman berlaku melalui organisasi maklumat dan pengurangan beban kognitif (Anjali, 2024).

Di samping itu, satu kajian oleh Nawaz (2024) menegaskan bahawa simulasi maya berasaskan AI menggalakkan murid untuk membuat keputusan saintifik yang memerlukan aplikasi konsep, analisis risiko dan perbandingan pembolehubah. Keupayaan murid menukar pembolehubah secara langsung dalam makmal maya membantu mereka memahami hubungan sebab-akibat (*cause-effect*) yang merupakan asas pemikiran saintifik aras tinggi dalam Pendidikan Sains. Tambahan pula, interaksi bersama AI mewujudkan ruang dialog kognitif yang tidak selalu boleh berlaku dalam kelas tradisional (Gokcearslan et al., 2024). Murid dapat mencabar AI, mempertikaikan jawapan dan meminta penjelasan tambahan. Proses ini membangunkan aktiviti mental seperti verifikasi, analisis, sintesis dan refleksi, lalu memupuk pemikiran kritis yang lebih berkembang (Cheung et al., 2024).

Namun begitu, integrasi AI turut mempunyai cabaran signifikan. Risiko kebergantungan, keraguan maklumat dan kecelaruan input daripada AI disebabkan keluasan informasi yang disimpan oleh AI merupakan dapatan yang konsisten dalam pelbagai kajian antarabangsa mahupun tempatan (Akgun & Greenhow, 2022; Giray et al., 2025). Hal ini menuntut murid untuk dilatih menggunakan AI secara reflektif, bukannya menerima maklumat secara pasif. Dalam kajian tindakan ini, kemahiran prompting yang diperkenalkan pada Kitaran 1 berfungsi untuk memastikan murid mengawal konteks pembelajaran, mengurangkan kesilapan maklumat dan meningkatkan kejelasan respons AI.

Keseluruhannya, literatur menunjukkan bahawa AI mampu menyokong pemikiran aras tinggi dan pembelajaran kendiri apabila digunakan secara berstruktur, diselia dan berpandukan teori pembelajaran yang kukuh. Dapatan ini memberikan rasional kukuh kepada intervensi kajian tindakan ini, terutamanya dalam konteks Sains Tingkatan 1 yang menuntut pembinaan konsep asas dan kemahiran inkuiri.

### *Teori Pembelajaran dalam Mengintegrasi AI*

Penggunaan AI dalam pengajaran dan pembelajaran tidak boleh dipisahkan daripada asas teori pembelajaran yang menyokong keberkesanannya. Empat rangka teori utama yang digunakan dalam kajian ini ialah behaviorisme, kognitivisme, konstruktivisme dan sosio-konstruktivisme. Dari sudut behaviorisme, AI berfungsi sebagai agen peneguhan melalui maklum balas segera dan automatik (Gibson et al., 2023). Respons AI yang menyokong jawapan betul atau membetulkan kesilapan serta-merta telah membantu membentuk tingkah laku pembelajaran positif yang lebih konsisten. Dalam konteks kajian ini, penggunaan ChatGPT untuk menyemak soalan murid memperlihatkan maklum balas segera daripada AI membantu murid mengukuhkan kefahaman.

Teori kognitivisme menekankan peranan AI dalam mengorganisasi maklumat, mengurangkan beban kognitif dan menyediakan struktur pembelajaran yang sistematik (Anjali, 2024). Penjelasan AI yang terperinci tetapi teratur membantu murid Tingkatan 1 memahami konsep abstrak seperti atom, sel atau fenomena ekosistem. Namun begitu, AI turut boleh mewujudkan ‘ilusi kefahaman’ sekiranya murid tidak dilatih menilai maklumat, sekaligus menjadi murid penerima input yang pasif (Agbo et al., 2025). Di samping itu, teori sosio-konstruktivisme oleh Vygotsky menekankan pembelajaran melalui interaksi sosial dan *scaffolding*. AI boleh berfungsi sebagai *scaffold* digital yang mengisi jurang kefahaman murid dan bertindak dalam Zon Perkembangan Proksimal (ZPD) mereka (Zhou & Schofield, 2024). Akan tetapi, interaksi

manusia masih lagi diperlukan dan kritikal. Sharples (2023) menegaskan bahawa AI tidak boleh menggantikan peranan interaksi atau komunikasi antara rakan sebaya mahupun guru.

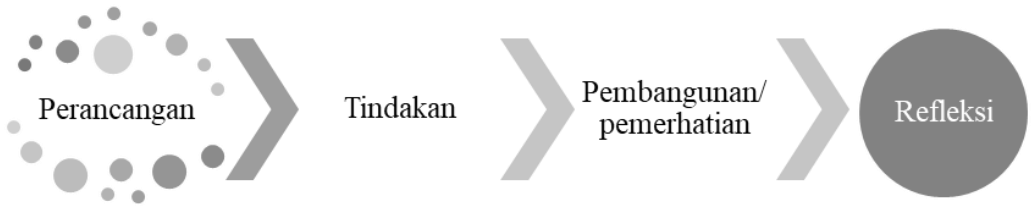
Kesimpulannya, teori pembelajaran memberikan asas kukuh yang menyokong keberkesanan AI dalam kajian ini. Kecerdasan buatan bukan sekadar alat teknologi tetapi alat pedagogi yang sejajar dengan proses kognitif, tingkah laku dan sosial murid.

## Metodologi

Kajian ini menggunakan pendekatan kajian tindakan dalam konteks PdPc Sains menengah rendah bagi membolehkan pengkaji mengenalpasti isu sebenar bilik darjah, merancang intervensi, melaksanakan intervensi dalam situasi autentik dan menilai keberkesanannya melalui refleksi berterusan. Pendekatan ini bersifat fleksibel serta praktikal, justeru mod campuran *(mixed-methods)* digunakan bagi memperoleh gambaran menyeluruh tentang impak penggunaan AI. Kaedah kuantitatif menilai perubahan pencapaian murid melalui ujian pra dan pasca. Manakala kaedah kualitatif meneroka perubahan tingkah laku pembelajaran, maklum balas murid dan refleksi guru. Gabungan ini menyokong penambahbaikan amalan PdPc secara sistematik dan reflektif.

38 murid Tingkatan 1 program DLP terlibat dalam kajian tindakan ini dan mereka terdiri daripada pelbagai kaum, serta menunjukkan minat tinggi terhadap Sains tetapi bergantung kepada guru dan tuisyen. Kumpulan ini dipilih kerana kesediaan menggunakan teknologi serta keperluan meningkatkan prestasi Sains, pembelajaran berdikari dan pemikiran kritis melalui intervensi berasaskan AI.

Prosedur kajian ini menggunakan model kajian tindakan yang diadaptasi daripada Mertler (2024) menggariskan empat langkah utama: (1) perancangan, (2) tindakan, (3) pembangunan dan pemerhatian, dan (4) refleksi terhadap hasil pelaksanaan.




**Rajah 1. Mertler (2012) Clinical Model of Action Research**

Fasa kajian ini merangkumi lima langkah utama.

1. *Pemerhatian dan Refleksi Awal*: Penyelidik mengenal pasti masalah melalui pre-test dan pemerhatian, seperti kebergantungan murid kepada guru dan kelemahan dalam pembelajaran kendiri serta pemikiran kritis.
2. *Perancangan Tindakan*: Modul intervensi berasaskan AI (ChatGPT, Google Gemini) dibangunkan dengan fokus kepada kemahiran bertanya, meneroka konsep secara bebas dan menyemak kefahaman secara kritis.

3. *Pelaksanaan*: Intervensi dijalankan secara berperingkat dalam kelas selama lapan minggu dengan bimbingan dan pemantauan guru.

4. *Pemerhatian dan Pengumpulan Data*: Tingkah laku, penglibatan murid serta kualiti soalan dan jawapan diperhatikan dan direkodkan.
5. *Refleksi dan Penambahbaikan*: Maklum balas murid dan refleksi guru dianalisis untuk menambah baik intervensi sebelum kitaran seterusnya.

**Jadual 1 Penstrukturan Fasa Kajian Tindakan**

| ***Langkah Kajian*** | ***Fasa Mertler*** ***(2012, 2020, 2024)*** | ***Huraian Ringkas*** |
|---|---|---|
| *Pemerhatian dan Refleksi Awal* | *Planning* (Perancangan) | Kenalpasti masalah: murid kurang berdikari, pemikiran kritis lemah. (*inst: pre-post test*) |
| *Perancangan Tindakan* | | Rancang intervensi: penggunaan AI (ChatGPT, etc.) fokus kepada soalan, penerokaan dan kefahaman kendiri. |
| *Pelaksanaan* | *Acting* (Pelaksanaan) | Pelaksanaan intervensi AI (3 kitaran) dalam kelas dengan pemantauan pengkaji. |
| *Pemerhatian & Pengumpulan Data* | *Developing / Observing* (Pemerhatian) | Perhatikan penglibatan murid, kualiti soalan dan respons. (instrumen: Borang Pemerhatian) |
| *Refleksi & Penambahbaikan* | *Reflecting* (Refleksi) | Analisis maklumbalas dan refleksi terhadap intervensi untuk penambahbaikan. (instrumen: Borang Maklum balas murid dan catatan refleksi pengkaji) |

## Dapatan Kajian

### *Analisis Ujian Pra dan Pasca*

Untuk menilai perubahan tahap penguasaan murid terhadap konsep Sains, ujian pra diberikan sebelum intervensi dilaksanakan, diikuti dengan ujian pasca setelah ketiga-tiga kitaran intervensi selesai.

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | PRETEST | 44.37 | 38 | 15.901 | 2.579 |
| | POSTTEST | 58.24 | 38 | 17.114 | 2.776 |

**Paired Samples Correlations**

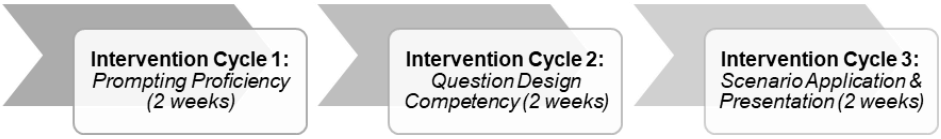
| | | | | Significance | |
|---|---|---|---|---|---|
| | | N | Correlation | One-Sided p | Two-Sided p |
| Pair 1 | PRETEST & POSTTEST | 38 | .902 | <.001 | <.001 |

**Rajah 2. Data Deskriptif Ujian Pra dan Pasca Murid**

Analisis ujian-t berpasangan menunjukkan peningkatan ketara dalam prestasi murid. Skor min pra ujian ialah 44.37 (*SD* = 15.90) dan meningkat kepada 58.24 (*SD* = 17.11) dalam ujian pasca, dengan peningkatan purata sebanyak 13.87 mata. Korelasi antara pra dan pasca ujian adalah sangat kuat (r = .902, p< .001), menandakan konsistensi peningkatan prestasi murid. Ujian-t mengesahkan perbezaan ini signifikan; t(37) = -11.529, p<.001), membuktikan bahawa intervensi berasaskan AI memberi kesan positif yang jelas terhadap pencapaian Sains murid Tingkatan 1.

### *Analisis Kitaran Intervensi*

Bagi memastikan pelaksanaan intervensi dapat memberi impak maksimum terhadap pembelajaran murid, pengkaji telah merancang dan membahagikan pelaksanaan intervensi kepada tiga kitaran.

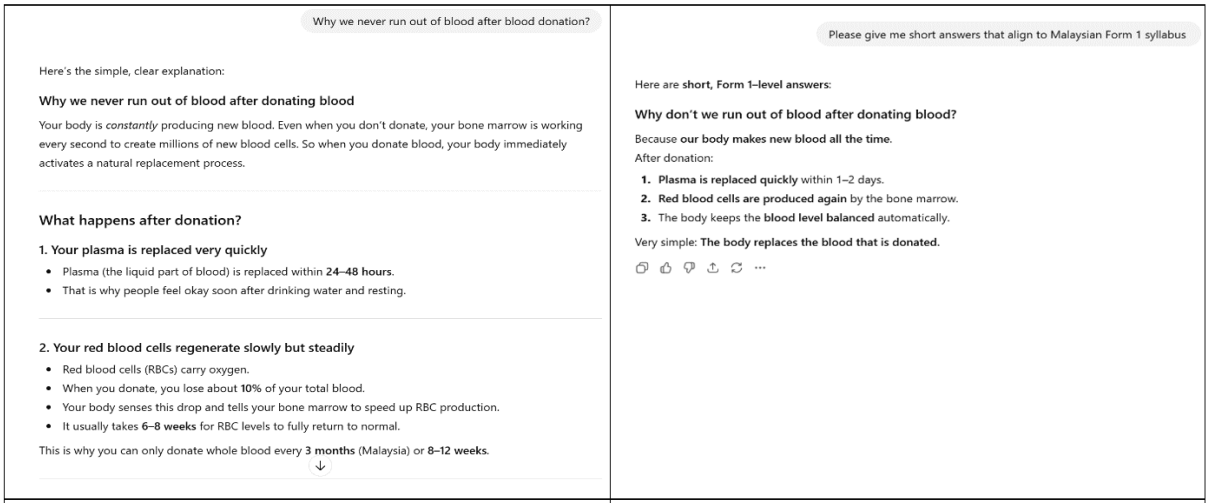



**Rajah 3. Kitaran Intervensi Penggunaan AI**

Tiga kitaran intervensi yang telah dirancang bermula dengan asas prompting AI, diikuti penggunaan AI untuk pembinaan soalan serta refleksi dan diakhiri dengan tugasan aplikasi serta pembentangan kumpulan. Setiap kitaran dilaksanakan selama dua minggu (sesi satu jam seminggu), dengan satu minggu sela sebelum kitaran seterusnya bagi memberi ruang kepada latihan kendiri. Secara keseluruhan, intervensi berlangsung selama lapan minggu, meliputi tiga kitaran dan dua tempoh sela.

#### *Kitaran Intervensi 1: Penggunaan AI untuk Prompting*

Pada awal intervensi, murid belum mahir membina *prompt* yang berkesan dan cenderung mengemukakan soalan umum tanpa konteks menyebabkan AI memberi jawapan panjang dan di luar tahap Tingkatan 1. Oleh yang demikian, murid sukar memahami penjelasan dan hanya menyalin jawapan tanpa menilai kesahihan dan kesesuaiannya.




| Jawapan *prompting* generik. | Jawapan *prompting* khusus. |
|---|---|

**Rajah 3 Pengajaran Perbezaan Prompting AI Generik & Khusus**

Situasi seperti rajah 3 mendorong pengkaji memperkenalkan kaedah *prompting* yang sistematik agar respons daripada AI lebih relevan dengan tahap pembelajaran mereka.

**Jadual 2 Ringkasan Pemerhatian Progres Asas Prompting AI**

| SEBELUM PENGENALAN ASAS PROMPTING AI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **ELEMEN PEMERHATIAN** | **INDIKATOR** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** | **K7** | **K8** | **K9** |
| ***Penglibatan murid*** | Murid aktif menggunakan AI; Berinteraksi dalam kumpulan/individu | / | / | / | / | / | / | / | / | / |
| ***Kemahiran prompting*** | Menyatakan kehendak dengan jelas; Memfokuskan skop berdasarkan silibus | / | / | | | | / | / | | / |
| ***Kefahaman kandungan*** | Menjelaskan semula jawapan AI; Mengaitkan dengan silibus sains tingkatan 1 | / | / | | | | | | | / |
| **SELEPAS PENGENALAN ASAS PROMPTING AI** | | | | | | | | | | |
| ***Penglibatan murid*** | Murid aktif menggunakan AI; Berinteraksi dalam kumpulan / individu | / | / | / | / | / | / | / | / | / |
| ***Kemahiran prompting*** | Menyatakan kehendak dengan jelas; Memfokuskan skop berdasarkan silibus | / | / | / | / | / | / | / | / | / |
| ***Kefahaman kandungan*** | Menjelaskan semula jawapan AI; Mengaitkan dengan silibus sains tingkatan 1 | / | / | | / | | / | / | | / |

Jadual 2 menunjukkan peningkatan sebelum dan selepas pengenalan asas *prompting* AI. Pada awalnya, hanya beberapa kumpulan sahaja yang aktif dan kebanyakan murid mengemukakan soalan umum, menghasilkan respons AI yang panjang dan di luar silibus Tingkatan 1. Kekurangan kemahiran *prompting* turut menjejaskan kefahaman kerana murid gagal mengaitkan jawapan AI dengan silibus. Selepas latihan asas *prompting*, hampir semua kumpulan menunjukkan penglibatan lebih konsisten, soalan lebih berfokus dan kefahaman yang lebih baik. Pengkaji merumuskan bahawa kemahiran menghasilkan *prompt* ialah asas utama untuk memanfaatkan AI secara berkesan.

### *Kitaran Intervensi 2: Pembinaan dan Penyoalan Menggunakan AI*

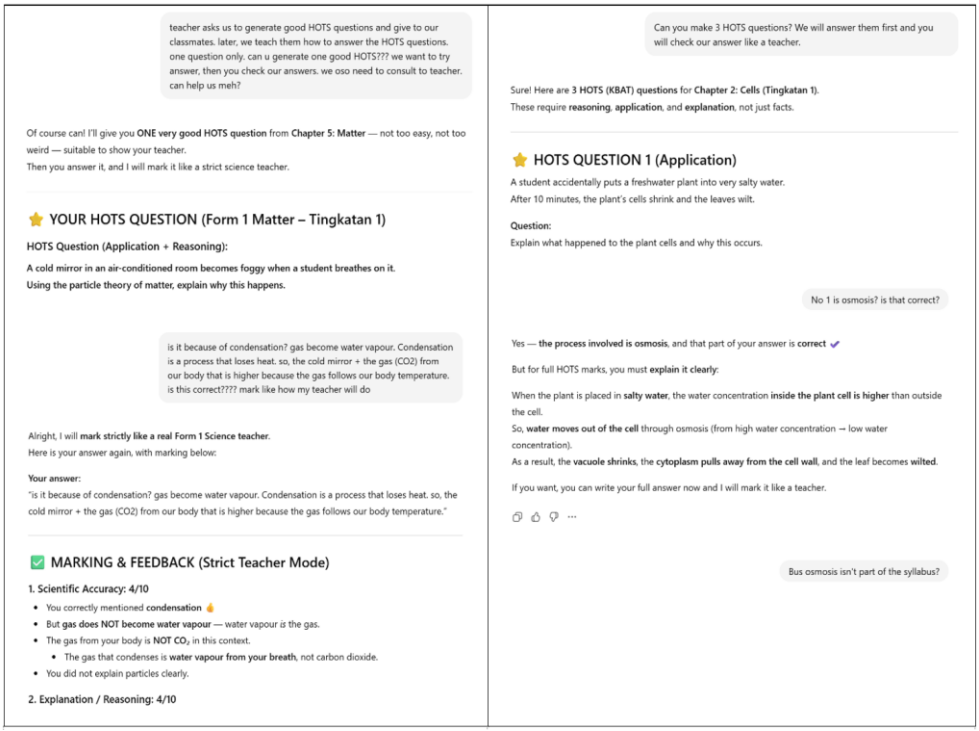
Dalam kitaran kedua, intervensi memberi fokus kepada pembinaan soalan dan penilaian jawapan bagi menggalakkan pembelajaran aktif dan pemikiran kritis. Murid bekerja dalam 9 kumpulan kecil untuk membina satu item KBAT. Namun, pada peringkat awal, mereka masih belum mampu menghasilkan soalan yang bermakna atau menghubungkan kefahaman dengan pertanyaan yang dibina.

**Jadual 3 Ringkasan Pemerhatian Progres Pembinaan dan Penyoalan Menggunakan AI**

| PERINGKAT AWAL (PEMBINAAN ITEM KBAT) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **ELEMEN PEMERHATIAN** | **INDIKATOR** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** | **K7** | **K8** | **K9** |
| ***Pembinaan soalan*** | Menjana soalan berkaitan topik; Soalan sesuai aras | / | / | | | / | / | / | / | |
| ***Pemikiran kritis*** | Menyoal lanjut; Menilai ketepatan jawapan AI | | / | | | | | | | / |
| ***Kolaborasi*** | Bekerjasama; Membahagi tugas | / | | / | / | / | / | / | / | / |

| PERINGKAT AKHIR (PEMBINAAN ITEM KBAT) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Pembinaan soalan*** | Menjana soalan berkaitan topik; Soalan sesuai aras | / | / | / | / | / | / | / | / | / |
| ***Pemikiran kritis*** | Menyoal lanjut; Menilai ketepatan jawapan AI | / | / | / | | | / | / | | / |
| ***Kolaborasi*** | Bekerjasama; Membahagi tugas | / | / | / | / | / | / | / | / | / |

Jadual 3 menunjukkan peningkatan konsisten dalam kemahiran pembinaan soalan, pemikiran kritis dan kolaborasi sepanjang aktiviti pembinaan item KBAT menggunakan AI. Pada peringkat awal, hanya beberapa murid mampu menghasilkan soalan relevan, menyoal lanjut atau menyemak ketepatan jawapan AI. Manakala kolaborasi masih bergantung pada murid yang dominan. Selepas latihan dan bimbingan, lebih banyak kumpulan berjaya membina soalan KBAT yang tepat, dan murid menunjukkan pemikiran kritis yang lebih kukuh dengan meneliti serta menilai jawapan AI secara aktif.




**Rajah 4 Perbandingan Interaksi Kumpulan (K5 & K2) dengan AI**

Rajah 4 menunjukkan perbezaan ketara dalam interaksi murid dengan AI. Kumpulan 5 berinteraksi secara pasif dan bergantung pada AI untuk membetulkan jawapan, manakala

Kumpulan 2 menunjukkan pemikiran kritis dengan menyoal lanjut, menilai maklumat dan membetulkan AI apabila perlu. Perbandingan ini membuktikan bahawa latihan prompting meningkatkan keaktifan analitikal murid. Maklum balas automatik AI juga membantu mereka mengenalpasti kelemahan sendiri dan memperkukuh pembelajaran mendalam.

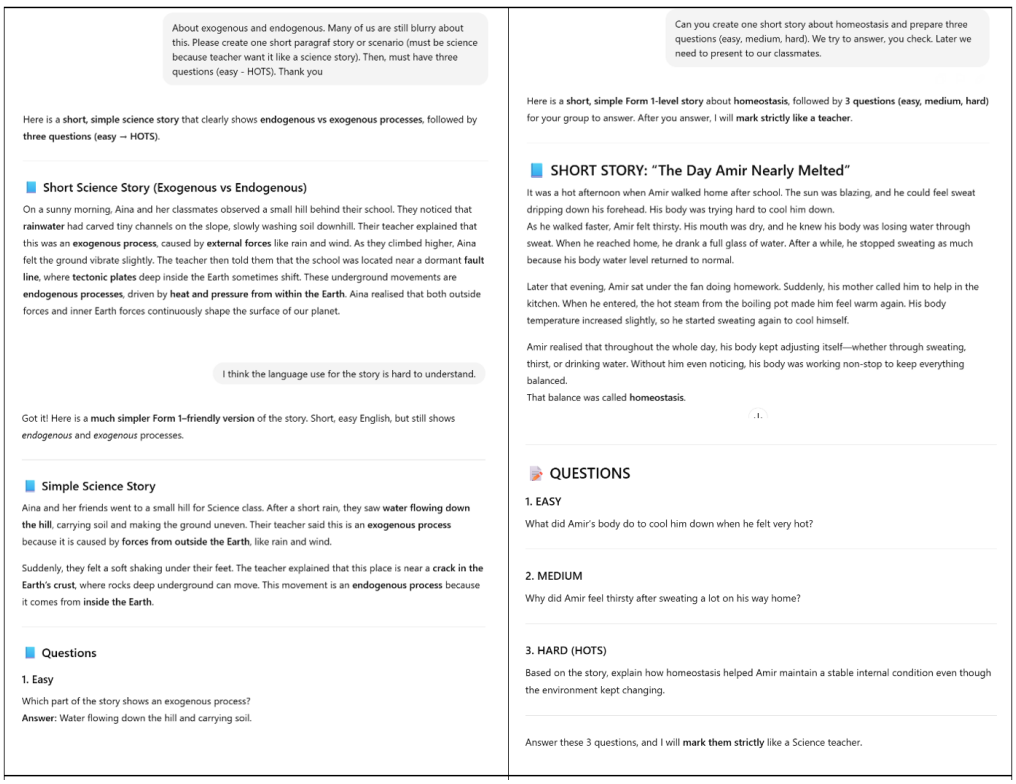
### *Kitaran Intervensi 3: Pembinaan Senario, Soalan & Pembentangan*

Dalam kitaran akhir, murid membina senario aplikasi menggunakan AI dengan menghasilkan cerita berasaskan masalah, menjana tiga soalan berkaitan dan menyediakan jawapan, semuanya secara berkumpulan.

**Jadual 5 Ringkasan Pemerhatian Progres Pembinaan Senario, Soalan & Pembentangan**

| PERINGKAT AWAL (PEMBINAAN SENARIO, SOALAN & PEMBENTANGAN) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **ELEMEN PEMERHATIAN** | **INDIKATOR** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** | **K7** | **K8** | **K9** |
| ***Persembahan (Kitaran 3)*** | Senario relevan; Soalan berkaitan; Jawapan tepat | | / | | | | | | | / |
| ***Kesukaran / halangan*** | Arahan jelas; Tahap kesukaran soalan; Kandungan tepat | / | / | | | | | | | / |
| ***Tindakan guru*** | Menunjuk cara; Memberi contoh *prompt*; Membetulkan kesilapan | / | / | / | / | / | / | / | / | / |
| **PERINGKAT AKHIR (PEMBINAAN SENARIO, SOALAN & PEMBENTANGAN)** | | | | | | | | | | |
| ***Persembahan (Kitaran 3)*** | Senario relevan; Soalan berkaitan; Jawapan tepat | / | / | / | / | / | / | / | / | / |
| ***Kesukaran / halangan*** | Arahan jelas; Tahap kesukaran soalan; Kandungan tepat | / | / | / | | / | / | / | | / |
| ***Tindakan guru*** | Menunjuk cara; Memberi contoh *prompt*; Membetulkan kesilapan | / | / | / | / | / | / | / | / | / |

Jadual menunjukkan peningkatan jelas bagi semua sembilan kumpulan. Pada awalnya, hanya dua kumpulan dapat menghasilkan senario, soalan dan jawapan yang relevan. Selepas bimbingan guru, semua kumpulan berjaya membina senario lebih berstruktur dan soalan lebih mencabar, dengan pembentangan kelas turut mengukuhkan komunikasi serta pemikiran kritis murid.




**Rajah 5 Perbandingan Interaksi Kumpulan (K9 & K3) dengan AI**

Rajah 5 menunjukkan dua strategi berbeza semasa murid membina senario dan soalan menggunakan AI. Kumpulan 9 menilai dan mengubah suai cerita AI agar sesuai dengan tahap Tingkatan 1, mencerminkan kemahiran metakognitif yang baik tetapi tidak menumpukan pada penyediaan jawapan. Sebaliknya, Kumpulan 3 menerima cerita AI tanpa banyak pengubahsuaian, namun, menumpukan usaha pada menjawab soalan dengan bantuan AI sebagai semakan konsep. Perbandingan ini menunjukkan murid menggunakan AI secara berbeza. Ada yang lebih kritis terhadap kandungan, ada yang lebih fokus pada penerapan konsep. Kedua-duanya mencerminkan penglibatan aktif.

Pengkaji seterusnya mewajibkan semakan awal bersama guru bagi memastikan senario, soalan dan jawapan selaras dengan silibus Tingkatan 1.

### *Penerokaan Persepsi Interaksi Murid dengan AI*

Data kualitatif diperoleh melalui pemerhatian bilik darjah, interaksi murid dengan ChatGPT dan maklum balas Padlet. Analisis tematik mengenal pasti empat tema utama iaitu (1) AI sebagai sokongan pembelajaran, (2) cabaran penggunaan AI, (3) perkembangan pemikiran kritis/metakognitif dan (4) peningkatan motivasi murid.

1. *Tema 1: AI sebagai alat sokongan*
   Murid menyatakan AI membantu mereka memahami Sains dengan lebih jelas dan teratur, termasuk penjelasan konsep asas dan istilah DLP. AI berfungsi sebagai "tutor

digital" yang memudahkan ulang kaji.

"*ChatGPT guidance… makes it clearer*" (K9)

2. *Tema 2: Cabaran AI & kebolehpercayaan*
   Murid menghadapi kesukaran menghasilkan prompt tepat, menyebabkan jawapan tidak selaras silibus. Mereka juga menyedari ketidaktepatan respons dan kelemahan AI dalam imej/jadual.

   "*ChatGPT gave us questions not in our syllabus*" (K2)

3. *Tema 3: Pemikiran kritis & metakognitif*
   Murid menjadi lebih analitikal, tidak menerima jawapan AI bulat-bulat dan mula menilai ketepatan maklumat. Keyakinan meningkat apabila mereka dapat mengenal pasti kesilapan AI.

   "*It makes me think twice*" (K1)

4. *Tema 4: Motivasi & penglibatan*
   Intervensi AI menjadikan PdP lebih menyeronokkan, interaktif dan kolaboratif, terutamanya melalui tugasan pembinaan soalan, senario dan pembentangan.

   "*The scenario and presentation are fun*" (K7)

Penggunaan AI dalam pembelajaran Sains Tingkatan 1 terbukti meningkatkan penguasaan kandungan, KBAT dan pembelajaran kendiri murid. Latihan *prompting*, pembinaan soalan dan pembentangan senario menjadikan PdP lebih aktif dan bermakna. Peningkatan skor ujian pasca mengesahkan keberkesanan intervensi, manakala dapatan kualitatif menunjukkan peningkatan pemahaman konsep, kemahiran menyoal dan keupayaan menilai maklumat. Walaupun terdapat cabaran seperti ketepatan respons AI, bimbingan guru membantu murid mengatasinya. Intervensi ini turut meningkatkan motivasi dan penglibatan murid.

## Perbincangan

Perbincangan memberi fokus kepada kesan intervensi AI terhadap pencapaian, pemikiran kritis, pembelajaran kendiri, kolaborasi, cabaran pelaksanaan dan refleksi pengkaji. Intervensi AI meningkatkan pencapaian murid secara signifikan, dibuktikan oleh peningkatan skor min pra 44.37 kepada pasca 58.24, dengan perbezaan signifikan ($t(37) = -11.529$, $p < .001$). Selari dengan behaviorisme, AI berfungsi sebagai peneguhan segera melalui maklum balas adaptif (Mohammed et al. 2024), manakala dari perspektif kognitivisme, penjelasan terstruktur AI membantu mengurus beban kognitif dan memperkukuh pemahaman (Anjali 2024). Secara keseluruhan, dapatan ini selari dengan kajian lepas yang menunjukkan tutor pintar AI berupaya meningkatkan prestasi murid.

Dapatan kualitatif menunjukkan peningkatan jelas dalam kemahiran menyoal, menilai maklumat dan membina soalan KBAT selepas latihan prompting dan bimbingan guru. Perubahan ini mencerminkan pembelajaran aktif dan konstruktivis, di mana murid membina pengetahuan melalui interaksi dengan AI dan tugasan berasaskan senario (Alim & Butsiarah 2025; Mayasari et al. 2024). Sosiokonstruktivisme turut terserlah melalui kerjasama kumpulan dan scaffolding digital AI (Sharples 2023; Anjali 2024). Dampak lain termasuk peningkatan pembelajaran kendiri apabila murid menggunakan AI untuk ulangkaji dan semakan kendiri, disokong dengan latihan menentang ilusi pembelajaran (Yousif 2025; Agbo et al. 2025).

## Cabaran, Penyelesaian & Cadangan Penambahbaikan

Cabaran utama meliputi kelemahan prompting, ketidaktepatan maklumat, risiko kebergantungan AI serta isu masa dan infrastruktur. Masalah prompting dan ketepatan kandungan diatasi melalui latihan berstruktur, penggunaan frasa silibus Tingkatan 1, dan semakan silang buku teks. Risiko kebergantungan dikurangkan melalui pemantauan rapi, aktiviti menjawab tanpa AI dan pembentangan kumpulan (Bennett & Abusalem 2024; Sharples 2023). Kekangan teknikal diselesaikan melalui penggunaan pusat sumber, peranti pinjaman dan peningkatan kompetensi digital guru.

Intervensi AI mengubah peranan guru kepada fasilitator yang memberi bimbingan strategi dan pemantauan pemikiran kritis. Refleksi kitaran membantu mengenal pasti aspek yang perlu diperbaiki seperti penekanan pada prompting dan verifikasi fakta. Literasi digital pengkaji turut meningkat, membolehkan integrasi AI secara lebih etika dan berkesan, seiring keperluan pembelajaran terbeza dalam kelas berbilang gaya belajar.

Penambahbaikan meliputi latihan prompting berterusan (Bamgbose 2025), pembangunan bank soalan AI yang selaras silibus, pengukuhan literasi verifikasi maklumat, serta memastikan keseimbangan interaksi manusia–AI melalui aktiviti kolaboratif dan pembentangan.

## Kesimpulan

Kajian ini membuktikan bahawa integrasi AI seperti ChatGPT dapat meningkatkan pencapaian, pemahaman konsep, pemikiran kritis dan pembelajaran kendiri murid dalam subjek Sains. AI berfungsi sebagai alat sokongan yang responsif dan kolaboratif, sekali gus memperkaya PdPc dan meningkatkan motivasi murid. Walaupun wujud cabaran seperti ketepatan maklumat, kelemahan *prompting* dan risiko kebergantungan terhadap AI, pendekatan berstruktur dan bimbingan guru berjaya mengatasinya. Secara keseluruhannya, keberkesanan intervensi ini menegaskan bahawa AI memerlukan kerangka pedagogi kukuh, literasi maklumat dan pemantauan guru untuk melahirkan murid yang lebih kritis, berdikari dan bersedia menghadapi cabaran masa depan. Kajian ini turut menyediakan asas untuk pembangunan modul PdPc Sains berasaskan AI bagi kegunaan lebih meluas di peringkat menengah rendah.

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# E-REHLAH: INSPIRASI *RIHLAH* IBNU BATTUTA DALAM MEMBANGUNKAN APLIKASI LAWATAN SAMBIL BELAJAR MESRA MUSLIM ABAD KE-21

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***Abstrak:*** *Penulisan ini mengkaji pembangunan dan kedudukan aplikasi mudah alih e-Rehlah dalam ekosistem lawatan sambil belajar. Pembangunan aplikasi ini bermula dengan analisis mendalam tentang konsep sejarah rihlah, sepertimana yang dipopularkan oleh pengembara Muslim terkemuka Ibnu Battuta dan mengaitkannya dengan prinsip-prinsip lawatan sambil belajar kontemporari. Idea ini terhasil kerana aktiviti lawatan sambil belajar bagi pelajar di pusat-pusat pengajian sama ada sekolah mahupun pusat pengajian tinggi. Laporan ini kemudiannya mengupas secara terperinci latar belakang, skop dan ciri-ciri teknikal yang perlu ada pada aplikasi e-Rehlah yang dibangunkan bagi memudahkan aktiviti pelancongan dan pengembaraan terutamanya dalam kalangan pelajar pusat pengajian tinggi yang ingin menjalankan aktiviti lawatan sambil pelajar. Penilaian kritikal terhadap prototaip aplikasi ini adalah melalui kajian saintifik dengan menggunakan Model ADDIE (Analysis, Design, Development, Implementation, Evaluation). Model ini telah dikenal pasti sebagai pendekatan reka bentuk yang sistematik dalam membangunkan perisian inovatif. Penelitian mendapati bahawa, walaupun reka bentuk kandungan dan antara muka pengguna aplikasi ini amat memuaskan, aspek interaktifnya memerlukan penambahbaikan yang bersesuaian. Kesimpulannya, e-Rehlah bukan sekadar sebuah aplikasi navigasi tetapi ia adalah manifestasi moden bagi pengembaraan berorientasikan spiritual dan intelektual, yang berpotensi menjadi pemangkin utama dalam memartabatkan industri pelancongan halal di Malaysia sekiranya pembangunan berterusannya disasarkan kepada pematuhan piawaian industri dan pengalaman pengguna yang lancar. Oleh yang demikian, pemakaian aplikasi e-Rehlah yang akan dibangunkan tidak hanya bagi tujuan lawatan sambil belajar tetapi juga boleh digunakan dalam skop industri pelancongan yang lebih luas.*

***Kata Kunci:*** *E-Rehlah, Ibnu Batutta, Rihlah, Lawatan Sambil Belajar*

## Pengenalan

Perspektif tradisi keilmuan Islam, pengembaraan bukan sekadar aktiviti fizikal semata tetapi merupakan sebahagian proses intelektual, spiritual dan budaya. Islam mempunyai tokoh pengembaran yang hebat iaiatu Ibnu Battuta yang menjadi simbol ketekunan intelektual dan keberaniuan dalam menelusuri dunia yang luas dalam mencari ilmu. Hasil keberanian beliaulah maka catatan perjalanan dinaratifkan menerusi *rihlah* yang memperlihatkan keupayaan beliau dalam mendokumentasikan sebuah pengalaman bukan hanya sari sudut geografi, tetapi juga melihat sistem sosial, budaya, ekonomi dan institusi keagamaan yang ada di seluruh dunia (Dunn, 2012). Istilah *rihlah* merupakan perkataan yang berasal daripada bahasa Arab yang membawa maksud perjalanan.

Merujuk kepada definisi yang diberikan oleh Arief Subhan (2020), istilah *rihlah* atau perjalanan mempunyai tradisi yang panjang dalam sejarah manusia. Definisi tersebut menjadi indikasi dan perkaitan dengan konsep kemanusiaan kerana perjalanan merupakan salah satu ciri utama dalam aspek kebudayaan manusia. Menurut beliau lagi, wujudnya konsep yang meyakini bahawa hakikat hidup merupakan sebuah perjalanan yang mempertemukan pelbagai aspek kehidupan. Oleh yang demikian, tradisi keilmuan Islam sejak awal lagi mengangkat aktiviti pengembaraan sebagai salah satu medium pencarian ilmu. Hal yang demikian juga dituntut oleh Islam sebagaimana sabda Rasulullah SAW yang berbunyi:

> عَنْ أَبِي الدَّرْدَاءِ رضي الله عنه قَالَ: سَمِعْتُ رَسُولَ اللَّهِ ﷺ يَقُولُ: "مَنْ سَلَكَ طَرِيقًا يَلْتَمِسُ فِيهِ عِلْمًا سَهَّلَ اللَّهُ لَهُ طَرِيقًا إِلَى الْجَنَّةِ"
>
> Maksudnya: "Sesiapa yang menempuh suatu jalan untuk mencari ilmu, maka Allah akan memudahkan baginya jalan ke syurga."
>
> (Riwayat Muslim, no. 2699)

Hadis di atas menunjukkan bahawa perjalanan fizikal atau pengembaraan yang dilakukan oleh setiap Muslim dalam usaha menuntut ilmu akan diberikan ganjaran yang sangat besar di sisi Allah SWT. Hal yang demikian adalah kerana, perbuatan bermusafir dikira sebagai sebahagian daripada jalan menuju keredaan Allah SWT. Bermusafir adalah satu pengorbanan yang harus dilakukan oleh setiap insan dalam mencari ilmu pengetahuan. Malah, perbuatan keluar mengembara untuk mencari ilmu adalah amalan yang sangat dimuliakan sehingga para malaikat mendoakan kebaikan penuntut ilmu tersebut. Apa lagi manusia yang bergelar pelajar. Aktiviti lawatan sambil belajar telah mula menjadi salah satu cara dalam aspek pengajaran dan pembelajaran (P&P) dalam beberapa tahun kebelakangan ini untuk mendapatkan hasil yang lebih berkesan. Malah terdapat juga beberapa program pertukaran pelajar yang melibatkan antara institusi dalam proses mencari ilmu. Selaras dengan perkembangan dan pertambahan populasi Muslim serta kesedaran terhadap keperluan gaya hidup Islamik ketika mengembara.

Namun begitu, masih terdapat jurang dari segi kemudahan, akses maklumat dan pengalaman yang menyeluruh untuk pelajar Muslim dalam usaha mnelusuri ilmu. Bermula dari sinilah, teknologi digital perlu memainkan peranan penting sebagai pemudah cara. Aplikasi e-Rehlah yang akan dibangunkan dan diperkenal sebagai solusi inovatif yang bukan sahaja memenuhi keperluan praktikal, tetapi juga memperkayakan pengalaman rohani dan budaya dalam setiap perjalanan para pelajar dalam menuntut ilmu. Sehubungan itu, aplikasi e-Rehlah dibangunkan dengan berinspirasikan semangat dan kisah pengembaraan tokoh pengembaraan ulung Islam,

Ibnu Battuta yang terkenal dengan catatan pengembaraannya ke lebih daripada 40 buah negara sepanjang abad ke-14.

Seperti mana Ibnu Battuta yang telah merekodkan pengalaman dan pemerhatian beliau tentang budaya, masyarakat serta kemudahan umat Islam di pelbagai wilayah, aktiviti sambil belajar mutakhir ini juga bertujuan sama. Malah, pembangunan aplikasi e-Rehlah juga bertujuan menjadi platform pintar untuk memudahkan pelajar dan pelancong Muslim abad ke-21 meneliti destinasi dengan lebih sistematik dan beretika. Pengembaraan menjadi sesuatu aktiviti yang bermanfaat dan mendidik bukan hanya untuk bersuka ria semata-mata. Pada masa yang sama dapat menjaga sahsiah dan syariah agama sewaktu menjalankan aktiviti lawatan dan melancong.

Melalui integrasi teknologi moden seperti peta digital, kecerdasan buatan *Artificial Intelligent* (AI) dan sistem cadangan mesra Muslim, e-Rehlah bukan sahaja berfungsi sebagai panduan aktiviti lawatan sambil belajar, tetapi juga sebagai simbol kesinambungan dengan warisan intelektual Islam yang menekankan perjalanan atau pengembaraan sebagai medium untuk proses P&P, pengalaman rohani, serta pembangunan insan (Hassan, 2019). Oleh yang demikian, e-Rehlah dapat menjadi satu inovasi yang mendukung aspirasi pengembaran ilmu bagi Islam secara global serta menyumbang kepada pembangunan industri pelancongan halal sejajar dengan keperluan kontemporari. Tidak lari dari objektif utama pembengunan aplikasi ini iaitu menjadikan aktiviti pembelajaran lebih menarik dan interaktif.

## Latar Belakang *Rihlah* Ibnu Battuta

Ibnu Battuta atau nama sebenar beliau Muhammad bin Batutah merupakan seorang ahli pengembara berbangsa Arab terbesar yang terakhir pada abad pertengahan (Mahlil & Furqan, 2022). Meneliti *rihlah* yang digagaskan oleh Ibnu Battuta (1304–1369) yang merupakan tokoh terkenal dalam dunia pengembaraan Islam yang menjelajah lebih 120,000 kilometer merentasi dunia Islam dan bukan Islam selama hampir 30 tahun. Catatan beliau dalam karya *Rihlah* bukan sahaja bersifat geografi, tetapi sarat dengan nilai ilmu, adab, budaya dan pengalaman rohani sepanjang pengembaraan beliau berlaku. Pengembaraan beliau merupakan contoh terbaik bagaimana perjalanan boleh dijadikan sebagai salah satu bentuk pencarian makna, hubungan ummah dan pembelajaran sepanjang hayat. Oleh yang demikian, sejarah pengembaraan ini menjadi inspirasi utama dalam pembangunan e-Rehlah sebagai salah satu aplikasi dalam platform digital yang mengangkat semula nilai-nilai tersebut. Pada masa yang sama mengangkat kembali kegemilangan tradisi keilmuan Islam yang semakin dibayangi dunia Barat.

Lawatan sambil belajar dalam kalangan pelajar Muslim kini semakin mendapat perhatian dan menjadi salah satu kaedah pembelajaran yang berkesan. Peningkatan populasi Muslim dan kuasa beli mereka telah mendorong wujudnya permintaan tinggi terhadap perkhidmatan serta kemudahan yang patuh syariah. Justeru, penganjuran lawatan sambil belajar perlu mengambil kira aspek ini agar pengalaman yang diperoleh pelajar lebih bermakna. Antara perkara yang sering menjadi kebimbangan peserta Muslim semasa mengikuti lawatan antaranya ialah khususnya apabila lawatan perlu dilakukan di negara bukan Islam, termasuklah akses terhad kepada makanan halal, kekurangan kemudahan solat, serta penyediaan perkhidmatan yang kurang menepati nilai dan gaya hidup Islam.

Sebagai tindak balas kepada cabaran-cabaran ini, teknologi mudah alih telah muncul sebagai salah satu jalan penyelesaian yang relevan dengan menyediakan alat-alat yang memudahkan perjalanan dan memenuhi keperluan patuh agama. Pelbagai aplikasi telah dibangunkan untuk tujuan ini, seperti Muslim Pro yang menawarkan waktu solat yang tepat dan pencari kiblat, Halal Trip yang menyediakan panduan untuk makanan halal dan masjid serta beberapa lagi aplikasi lain. Dalam konteks ini, usaha untuk membangunkan aplikasi e-Rehlah dilihat sebagai sebahagian daripada pergerakan global yang perlu, dengan matlamat untuk menyediakan panduan yang lebih terperinci dan holistik, terutamanya bagi kalangan pelajar muslim yang akan menjalankan mobiliti. Lawatan sambil belajar ini atau rihlah boleh dikatakan sebagai wadah ilmu secara silang budaya kerana kaedah ini membuka ruang interaksi dalam kalangan pelajar dengan masyarakat setempat yang dilawati.

## Sorotan kajian

### *Warisan Rihlah Ibnu Battuta sebagai Kerangka Teoritis*

Ibnu Battuta (1304–1368/1369) adalah salah satu tokoh pengembara Muslim paling terkenal dalam sejarah, dengan catatan perjalanan (*rihlah*) yang luas merangkumi Semenanjung Arab, India, Afrika, Asia Tenggara dan seterusnya. Kajian sejarah kontemporari menyoroti bagaimana rihlah beliau bukan hanya ekspedisi fizikal tetapi satu proses pembelajaran — sosial, budaya, agama dan intelektual — yang menghasilkan naratif penting dalam historiografi Islam. Ansar, Nuraeni & Ibrahim (2024) mendapati bahawa rihlah ilmiah Ibn Battuta memberikan kontribusi besar sebagai sumber sejarah Islam melalui pendekatan historiografi dan teks-teks yang ditinggalkan.

Dengan menjadikan aspek "*rihlah*" ini sebagai kerangka konseptual, aplikasi lawatan berasaskan sejarah seperti E-Rehlah boleh memasukkan elemen naratif, pembelajaran kontekstual, dan refleksi pengguna sama seperti penulisan catatan rihlah klasik.

### Pendidikan Pelancongan / Lawatan Sambil Belajar (*Educational Tourism*)

Proses pengajaran dan pembelajaran melalui kaedah lawatan (*study tour*) semakin diiktiraf sebagai alat pedagogi yang efektif, terutamanya apabila lawatan tersebut digabung dengan objektif pembelajaran eksplisit (misalnya tugasan lapangan, refleksi pasca-lawatan). Sorotan kajian lalu dalam aspek pendidikan menunjukkan bahawa *experiential learning* melalui pelancongan meningkatkan pemahaman budaya, penghargaan warisan dan pembelajaran antara disiplin. Dalam konteks pelancongan Muslim, elemen pendidikan rohani dan warisan Islam dapat dijalin dan diaktifkan secara langsung semasa lawatan, memperkaya pengalaman pelancong dan pelajar secara serentak.

Selain itu, kajian oleh Lina Munirah (2023) menunjukkan bahawa operator pelancongan Muslim di Malaysia melihat bahawa pakej pelancongan Islam (Muslim tourism) tidak hanya berkaitan dengan aspek ibadah tetapi juga "peringkat persiapan, perjalanan, dan aktiviti di destinasi" yang mempunyai karakteristik pedagogi tersendiri.
Oleh itu, aplikasi E-Rehlah boleh memberikan modul pembelajaran sebelum lawatan (pre-tour), aktiviti berpandu semasa lawatan dan refleksi selepas lawatan untuk menstrukturkan lawatan sebagai proses pembelajaran yang menyeluruh.
3. Digitalisasi dan Teknologi dalam Pelancongan Islam

Dengan kemajuan teknologi, digitalisasi pelancongan menjadi sangat relevan. Dalam kajian terkini, Azam, Muflih & Al Haq (2024) menggariskan bagaimana inovasi digital (seperti AR, peta interaktif, pangkalan data destinasi) dapat memperkayakan pengalaman pelancong Muslim.

Tambahan pula, teknologi realiti maya (VR) sedang digunakan dalam pelancongan senibina Islam; satu kajian di Malaysia mendapati Gen Y menunjukkan respons kognitif dan afektif positif apabila mengalami lawatan masjid secara VR. Integrasi AR/VR, peta geo-bertag, micro-learning dan elemen interaktif boleh diterapkan dalam E-Rehlah untuk menyediakan pengalaman lawatan yang bukan sekadar fizikal tetapi digital dan reflektif.

**Aplikasi Mesra Muslim (Halal) dan Keperluan Pelancong Muslim**

Literatur pelancongan halal menekankan pelbagai karakteristik kritikal aplikasi mesra Muslim: peta masjid, penunjuk waktu solat, restoran halal, akomodasi Muslim-friendly, dan panduan nilai budaya. Abdullah, Anuar, Zani & Akbar (2025) dalam satu ulasan integratif menyatakan bahawa pembangunan pelancongan halal menghadapi cabaran dari segi infrastruktur, kesedaran dan teknologi. Tambahan pula, kajian oleh Rosli, Jamaludin, Md Rosdy & Ahmad (2025) menekankan peranan pemandu pelancong Muslim dalam meningkatkan kepuasan pelancong Muslim, sebagai sebahagian daripada pengalaman holistik Muslim-friendly tourism. E-Rehlah harus mempertimbangkan modul pemanduan virtual atau digital, integrasi maklumat halal, sokongan komuniti, serta sistem navigasi beretika (nilai Islam) dalam antaramuka aplikasi.

**Cabaran & Strategi Pembangunan Pelancongan Islam Tempatan**

Kajian strategi pembangunan pelancongan halal di Malaysia dan Indonesia menunjukkan bahawa strategi ekonomi dan pelancongan Islam mesti disesuaikan dengan konteks tempatan. Suryanto, Susanti & Rosilawati (2025) menyatakan bahawa pendekatan pembangunan harus mengambil kira faktor geografi, budaya dan nilai Islam setempat. Selain itu, kajian Wulandari (2024) memberi tumpuan kepada strategi pembangunan industri halal pelancongan di Malaysia, menegaskan keperluan integrasi teknologi, penyertaan komuniti dan model perniagaan yang mampan. Oleh itu, dalam reka bentuk E-Rehlah, penting untuk menggabungkan konteks lokal (lokasi lawatan, warisan Islam setempat) dan model perniagaan pelancongan halal yang lestari dan inklusif.

**Etika, Keselamatan dan Pengalaman Pengguna dalam Aplikasi Pelancongan Islam**

Pengalaman pengguna (user experience) sangat penting dalam aplikasi pelancongan, terutama bagi pelancong Muslim yang mempunyai keperluan khusus. Kajian dalam konteks pemanduan lawatan mesra Muslim menunjukkan bahawa pemandu pelancong yang peka nilai Islam meningkatkan kepuasan (Rosli et al., 2025). Selain itu, inovasi AI juga mula diterokai dalam ekosistem pelancongan halal. Baru-baru ini, kajian oleh penulis di *Discover Sustainability* (2025) menyelidik peranan pembantu AI dalam menggalakkan pelancongan halal di destinasi bukan Muslim dan kajian tersebut menunjukkan potensi besar integrasi AI dalam aplikasi pelancongan mesra Muslim. Dalam konteks E-Rehlah, penggunaan AI (contoh: chatbot

pemandu, cadangan rute, fiqh perjalanan), sistem navigasi etika (nilai Islam) dan antara muka yang inklusif boleh memperkuat keterlibatan pelancong dan kepercayaan dalam kalangan pengguna aplikasi ini sekiranya dibangunkan.

## Analisis dan Perbincangan

### *Isu dan Keperluan Rihlah Masa Kini dalam Aspek Keilmuan*

Dalam sejarah tamadun Islam, pengembaraan (*rihlah*) telah memainkan peranan yang signifikan bukan sahaja sebagai aktiviti fizikal, malah sebagai wahana pembangunan intelektual, rohani, dan sosial. Tokoh ulung Islam, Ibnu Battuta (1304–1369M), merupakan simbol kegemilangan tradisi ini. Beliau merantau sejauh hampir 120,000 kilometer merentasi dunia Islam dari Maghribi hingga ke China, India dan Nusantara, lalu mendokumentasikan pengalaman tersebut dalam karya agungnya *rihlah* (Dunn, 2012). Catatan Ibnu Battuta tidak sekadar memberi maklumat geografi, tetapi juga menggambarkan keutuhan jaringan dunia Islam, peranan institusi agama, serta keperluan umat Islam dalam menghubungkan ibadah dengan kehidupan seharian. Hal ini memperlihatkan satu bentuk landskap intelektual Islam, di mana pengembaraan dianggap sebagai medan ilmu yang memupuk kefahaman tentang kepelbagaian budaya, hukum, dan amalan umat Islam di pelbagai wilayah.

Namun, jika dilihat dalam konteks abad ke-21, aspek pendidikan menghadapi realiti dan cabaran yang berbeza daripada globalisasi dan perkembangan dalam kepelbagaian industri moden. Antara yang terkesan ialah lapangan pendidikan yang cukup terancam dengan kaedah tradisional dan menimbulkan isu kritikal misalnya hilang minat belajar. Justeru inisiatif baharu diperlukan dalam mengangkat semula tradisi ilmu dalam aspek pembelajaran yang lebih menarik dan salah satunya adalah melalui kaedah lawatan sambil belajar. Namun begitu, pelajar Muslim sering berdepan masalah apabila aktiviti lawatan sambil belajar dilakukan antaranya dalam mencari makanan halal, ruang solat, serta maklumat berkaitan destinasi mesra Muslim yang sahih (Battour & Ismail, 2016). Tambahan pula, industri pelancongan global cenderung dikuasai oleh perspektif sekular dan komersial yang kurang menitikberatkan dimensi rohani dan keagamaan pelancong Muslim (Samori, Md Salleh, & Khalid, 2016). Ini menunjukkan wujudnya jurang antara keperluan praktikal dan pengalaman spiritual dalam pengembaraan Muslim kontemporari.

Dalam hal ini, inspirasi daripada lanskap intelektual Ibnu Battuta sangat relevan dijadikan sebagai model dalam membangunkan aplikasi e-Rehlah. Sudut pandang beliau yang melihat pengembaraan sebagai satu proses pembelajaran yang menghubungkan ilmu, agama, dan budaya dalam satu rangkaian pengalaman menjadi dasar utama dalam membangunkan aplikasi ini. Aplikasi moden seperti e-Rehlah boleh dianggap sebagai kesinambungan warisan tersebut dalam bentuk digital. Jika Ibnu Battuta mendokumentasi secara manual pengalaman rihlahnya, aplikasi e-Rehlah berpotensi menyediakan platform pintar berasaskan teknologi moden – seperti peta digital, kecerdasan buatan (AI), dan sistem cadangan mesra Muslim – untuk memastikan lawatan sambil belajar mendapat akses kepada maklumat halal, waktu solat, lokasi ibadah, serta panduan budaya setempat.

Makdisi (1981) menyatakan bahawa dunia Islam mempunyai satu sistem kohesi intelektual atau keselarian intelektual yang berpaksikan kepada pengiktirafan terhadap ilmu, autoriti ulama, dan mobiliti pelajar. Bahkan, Ibnu Batutta sendiri merupakan sebahagian daripada

sistem ini. Pembangunan aplikasi seumpama e-Rehlah bukan hanya memenuhi keperluan praktikal pelajar untuk lawatan sambil belajar, tetapi membawa dimensi intelektual dan rohani yang sejajar dengan *rihlah* ilmu Ibnu Batutta di samping mengangkat tradisi intelektual Islam dalam dunia digital.

Kesimpulannya, pembangunan aplikasi seumpama e-Rehlah bukan sahaja memenuhi keperluan praktikal lawatan sambil belajar, tetapi juga membawa dimensi intelektual dan rohani yang sejajar dengan gagasan Ibnu Battuta. Aplikasi ini dapat memperkukuh aspek pembelajaran dalam Islam sebagai satu bentuk ibadah. Malah, aplikasi ini secara tidak langsung mengangkat tradisi keilmuan dan keintelektualan umat Islam ke dalam dunia digital. Oleh itu, integrasi inspirasi sejarah dengan inovasi teknologi kontemporari adalah kunci dalam menangani cabaran dalam menggerakkan aspek pembelajaran menerusi lawatan sambil belajar, serta menjadikan pengembaraan pembelajaran ini bukan sekadar aktiviti fizikal, tetapi juga suatu perjalanan ilmu dan pembangunan diri yang selaras dengan tuntutan syariah. Justeru,e-Rehlah merupakan satu platform yang memenuhi keperluan yang holistik, mesra pengguna dan memenuhi gaya hidup pelajar dan masyarakat Muslim yang universal.

## *Rihlah*: Pengembaraan Mencari Ilmu dan Spiritual

Dalam konteks sejarah, perkataan *rihlah* merupakan perkataan daripada bahasa Arab yang bermaksud "perjalanan" atau "pelayaran", dan ia juga merujuk kepada genre sastera khusus yang popular pada zaman pertengahan Islam. *rihlah* bukanlah sekadar perjalanan rekreasi tetapi sebuah perjalanan yang terarah dan bermakna, dilakukan untuk mencari ilmu pengetahuan, mengumpul hadis atau menuntut ilmu agama. Tokoh paling terkenal yang mengidentifikasi dirinya dengan konsep ini ialah Ibnu Battuta, seorang musafir yang mengembara selama 29 tahun. Kisah-kisah pengembaraannya yang mengagumkan telah didokumentasikan dalam sebuah buku yang berjudul al-*rihlah*. Beliau dititahkan untuk menceritakan pengalamannya, termasuk merincikan tentang keadaan kota-kota, kejadian menarik berlaku dan naratif pertemuan beliau dengan pemerintah, ulama, serta orang-orang suci. Buku ini tidak hanya berfungsi sebagai naratif peribadi tetapi juga sebagai catatan sejarah dan budaya yang berharga.

Satu perbezaan kritikal antara *rihlah* bersejarah dan manifestasi moden adalah perbezaan dari sudut kronologi masa yang lampau kepada masa kini. *Rihlah* Ibnu Battuta adalah sebuah naratif yang dikarang selepas pengembaraan itu selesai dan *rihlah* tersebut berfungsi sebagai catatan deskriptif tentang apa yang telah beliau alami. Sebaliknya, aplikasi e-Rehlah adalah alat proaktif yang memudahkan perjalanan semasa ia berlaku bersesuaian dengan masa kini. Walaupun pengembaraan kontemporari mungkin lebih berorientasikan rekreasi, ia masih mengandungi elemen mencari pengetahuan dan aspek pengukuhan spiritual terutamanya dalam kalangan pelajar. Aplikasi e-Rehlah memodenkan dan menambahbaik tujuan asal *rihlah* dengan menyediakan alat-alat yang memudahkan matlamat ini antaranya, mencari masjid untuk tujuan ibadah, mencari makanan halal untuk kelangsungan hidup dan menggunakan peta interaktif untuk pengembaraan ilmu yang sistematik. Dengan cara ini, aplikasi e-Rehlah tidak hanya mewarisi sekadar nama *rihlah* semata, tetapi juga meneruskan falsafah asal *rihlah*, iaitu perjalanan yang bertujuan dan bermakna untuk mencari ilmu. Keistimewaan inilah yang membezakan antara e-Rehlah secara ketara daripada aplikasi pelancongan umum yang sedia ada.

Merujuk konteks *rihlah* ini telah memperluas horizon ilmu bagi para pelajar di IPT dalam mendalami ilmu pengetahuan. Hal ini juga membuka ruang baru bagi pelajar untuk menerokai dunia luar tanpa menjejaskan identiti keislaman walau di mana sahaja pengembaraan ilmu tersebut berlangsung. Dalam masa yang sama mengajar kita sebagai umat Islam bahawa agama merupakan elemen ketamadunan dan tidak menolak terhadap elemen-elemen lain tetapi sebaliknya membina hubungan baru dari aspek budaya dan sosial yang saling menguntungkan. Pengalaman Ibnu Batutta ini menjadi kerangka yang membuka ruang upaya untuk dilihat oleh masyarakat dunia bahawa dunia Islam klasik telah lama memiliki kerangka keterbukaan dan toleransi. Justeru, perkara ini amat penting untuk dijadikan sebagai teladan bagi dunia global hari ini (Yusoff, 2025).

**Elemen Utama dan Landskap Aplikasi dalam Pembangunan Aplikasi E-Rehlah bagi Tujuan Lawatan Sambil Belajar**

Aplikasi e-Rehlah dibangunkan sebagai alat bantu digital kepada pelajar IPT untuk merancang, mengalami dan merekodkan perjalanan secara bermakna terutamanya bagi golongan pelajar yang ingin menjalan aktiviti pengajaran dan pembelejaran di luar kelas misalnya lawatan sambil belajar. Konsep pembangunan aplikasi ini berpaksikan kepada 3 elemen utama iaitu maklumat lokasi yang mesra Muslim misalnya lokasi solat, restoran halal, masjid dan tempat sejarah Islam. Elemen yang kedua ialah panduan rohani dan adab musafir misalnya doa bermusafir, etika perjalanan dan nasihat ulama. Manakala elemen yang ketiga ialah jejak *rihlah* yang merujuk kepada laluan tematik berdasarkan lokasi iaitu peta mesra muslim, lokasi solat, masjid, arah kiblat berdasarkan lokasi GPS semasa.

Aplikasi e-Rehlah (yang prototaip akademiknya dikenali sebagai i-Rehlah) dibangunkan dengan inspirasi yang jelas daripada konsep pengembaraan Ibnu Battuta. Aplikasi ini direka khusus untuk pelajar IPT, dengan fokus awal yang lebih spesifik. Dari aspek teknikal, aplikasi ini dibangunkan untuk peranti mudah alih. Pembangunan ini mengikuti model Pendekatan Reka bentuk dan Pembangunan (DDR), bermula dari fasa analisis keperluan, diikuti reka bentuk dan pembangunan, serta penilaian kebolehgunaan.

Bagi memahami kedudukan e-Rehlah dalam pasaran, adalah penting untuk membandingkannya dengan aplikasi lawatan sambil belajar terkemuka yang lain. Aplikasi seperti Muslim Pro dan Halal Trip telah menetapkan piawaian dalam menyediakan ciri-ciri asas untuk pelancong Muslim, manakala Zabihah memfokuskan pada niche pencarian makanan halal.

Walaupun aplikasi-aplikasi ini menawarkan utiliti yang berguna, e-Rehlah membezakan dirinya melalui pendekatan yang lebih terarah dan strategik. Sementara Muslim Pro berfungsi sebagai utiliti kegunaan harian yang lebih umum untuk solat dan ibadah, e-Rehlah secara khusus diposisikan sebagai panduan pelancongan yang khusus, terutamanya untuk pelancong Arab di Selangor. Faktor pembeza utama ini diperkukuh lagi dengan dua ciri utamanya: sokongan bahasa Arab dan penekanan eksplisit pada pematuhan piawaian OIC yang menyeluruh.

Pesaing pasaran global mungkin mempunyai ciri-ciri asas yang sama, tetapi mereka tidak mengintegrasikan ciri-ciri ini ke dalam kerangka MFT yang lebih besar dan berfokus geografi. Dengan menumpukan perhatian pada pasaran yang kurang dilayani ini, e-Rehlah mengukir niche yang berpotensi untuk mendapatkan daya tarikan yang signifikan. Ini merupakan strategi yang lebih berpotensi untuk berjaya daripada cuba bersaing secara langsung dengan aplikasi global yang lebih besar yang menawarkan perkhidmatan yang lebih generik.

## Kesimpulan

Aplikasi e-Rehlah bukan sahaja satu solusi teknologi, tetapi juga satu usaha bagi mengangkat semula warisan kembara Islam dalam bentuk yang moden, interaktif dan relevan. Dengan menjadikan Ibnu Battuta sebagai inspirasi utama, e-Rehlah berpotensi menjadi pelopor kepada transformasi pelancongan Islamik digital, bukan sahaja di Malaysia tetapi di seluruh dunia pada masa yang sama memberi susut pandang berbeza bagi aspek pengajaran dan pembelajaran di Malaysia.

Pembangunan aplikasi e-Rehlah merupakan contoh cemerlang bagaimana warisan sejarah rihlah Ibnu Battuta dapat diperbaharui dan diadaptasi untuk memenuhi keperluan pelancong Muslim moden. Aplikasi ini tidak hanya mewarisi nama tetapi juga falsafah perjalanan yang bertujuan untuk mencari ilmu dan spiritualiti, yang kini dipermudahkan melalui teknologi. Analisis kebolehgunaan akademik yang dijalankan ke atas prototaipnya telah mengesahkan kekuatan reka bentuk kandungan dan visualnya. Walaupun reka bentuknya menarik secara estetika dan informasinya tepat, kajian ini juga mendedahkan keperluan mendesak untuk penambahbaikan dalam aspek interaktifnya bagi memastikan pengalaman pengguna yang lancar.

Secara keseluruhannya, e-Rehlah lebih daripada sekadar aplikasi mudah alih; ia adalah alat strategik yang direka untuk mempromosikan Pelancongan Islam di Selangor mengikut piawaian antarabangsa yang ketat yang ditetapkan oleh OIC. Pembangunannya yang berfokus pada niche pasaran dan kesesuaian budaya menjadikannya pesaing yang berpotensi kukuh dalam ruang pelancongan mesra Muslim.

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# KEBERKESANAN MODEL 4I-PBL (INSPIRE, INQUIRE, INNOVATE, IMPLEMENT) DALAM MENINGKATKAN PENGALAMAN PEMBELAJARAN STEM BAGI PELAJAR PINTAR DAN BERBAKAT

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***Abstrak:*** *Kajian ini bertujuan menilai keberkesanan Model 4I-PBL (Inspire, Inquire, Innovate, Implement) dalam meningkatkan pengalaman pembelajaran STEM dalam kalangan pelajar pintar dan berbakat. Model ini menggabungkan pendekatan pembelajaran berasaskan projek (Project-Based Learning, PBL), integrasi teknologi digital, serta kolaborasi dengan pakar industri sebagai pendekatan alternatif kepada pedagogi konvensional yang kurang menekankan aspek eksplorasi dan aplikasi dunia sebenar. Kajian ini melibatkan seramai 77 orang pelajar daripada aliran Digital Inovator di Kolej PERMATA@Pintar Negara, Universiti Kebangsaan Malaysia. Data kajian diperoleh melalui pendekatan kuantitatif dan kualitatif yang digabungkan bagi memberikan gambaran menyeluruh terhadap pelaksanaan model ini. Analisis data kuantitatif menggunakan statistik deskriptif menunjukkan tahap kepuasan dan motivasi pelajar berada pada paras tinggi, dengan min antara 4.1 hingga 4.5 dan sisihan piawai rendah, menunjukkan konsistensi dalam persepsi positif terhadap pelaksanaan model ini. Dapatan kualitatif pula memperkukuhkan bukti bahawa pelajar menunjukkan peningkatan dalam kemahiran teknikal, penyelesaian masalah secara kreatif, serta kebolehan mengaplikasikan konsep STEM dalam konteks sebenar. Kesimpulannya, Model 4I-PBL terbukti berkesan dalam membangunkan potensi pelajar pintar dan berbakat sebagai peneraju inovasi digital. Oleh itu, pengaplikasian model ini secara meluas disarankan sebagai strategi pendidikan yang relevan dan berimpak tinggi dalam membentuk modal insan STEM masa hadapan.*

***Kata Kunci:*** *Pendidikan pintar dan berbakat, pembelajaran berasaskan projek (PBL), Model 4I-PBL, inovasi digital, STEM.*

## Pengenalan

Dalam era Revolusi Industri 4.0 dan menuju ke arah masyarakat berasaskan pengetahuan, pembangunan modal insan berkemahiran tinggi dalam bidang Sains, Teknologi, Kejuruteraan

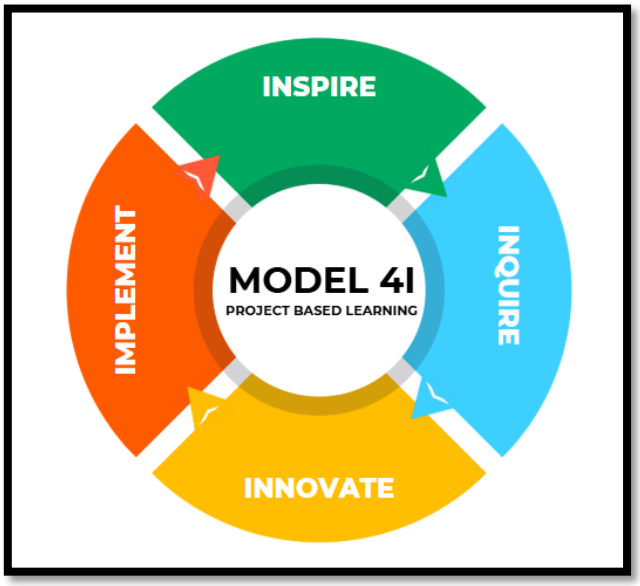
dan Matematik (STEM) menjadi keutamaan negara. Pelajar pintar dan berbakat merupakan aset penting dalam menghasilkan inovasi baharu yang mampu melonjakkan daya saing negara di peringkat global. Pelajar pintar dan berbakat ini memerlukan pendekatan pembelajaran yang mencabar, autentik dan kontekstual bagi memaksimumkan potensi mereka dalam bidang ini (Sundari, 2023). Namun, sistem pendidikan semasa masih bergelut dengan cabaran menyediakan pendekatan pengajaran yang dapat memenuhi keperluan unik golongan ini, khususnya dalam mengembangkan potensi intelek, kreativiti dan kemahiran penyelesaian masalah mereka. Kebanyakan kaedah pengajaran konvensional masih menumpukan kepada pengajaran langsung yang bersifat satu hala dan kurang memberi penekanan kepada eksplorasi kendiri, penyelesaian masalah secara kreatif, serta penerokaan aplikasi dunia sebenar.

Di Malaysia, keperluan untuk memperkukuh ekosistem pembelajaran STEM semakin mendesak apabila kajian menunjukkan penurunan minat dan penyertaan pelajar dalam bidang ini, termasuk dalam kalangan pelajar berkeupayaan tinggi (KPM, 2023). Walaupun pelbagai inisiatif telah diperkenalkan, seperti peluasan kurikulum STEM, pembelajaran berasaskan inkuiri serta penglibatan industri, keberkesanan pendekatan ini terhadap pelajar pintar dan berbakat masih belum mencapai tahap optimum. Hal ini disebabkan wujudnya jurang antara reka bentuk pengajaran dengan keperluan kognitif mereka yang lebih kompleks serta keperluan afektif seperti autonomi, cabaran intelektual dan peluang mencipta nilai baharu.

Dalam konteks pendidikan pelajar pintar dan berbakat, penyelidikan antarabangsa menunjukkan bahawa mereka memerlukan pengalaman pembelajaran yang lebih mendalam, bersifat transdisiplin dan mengintegrasikan elemen reka cipta serta inovasi (Renzulli, 2021). Oleh itu, pendekatan pembelajaran yang menyediakan pengalaman pembelajaran autentik, interaktif dan berfokus kepada penyelesaian masalah dunia sebenar menjadi semakin relevan dan kritikal.

Menyedari keperluan tersebut, model 4I-PBL (Inspire, Inquire, Innovate, Implement) dijadikan sebagai satu kerangka pedagogi yang holistik dan sistematik untuk meningkatkan pengalaman pembelajaran STEM. Model ini bukan sahaja menyokong perkembangan intelektual pelajar tetapi turut memupuk pemikiran reka bentuk, kreativiti, inovasi dan refleksi kendiri semua ciri utama yang diperlukan untuk mencapai kecemerlangan dalam ekosistem pembelajaran era digital. Integrasi model 4I-PBL juga berpotensi besar untuk menyelesaikan isu ketidakselarasan antara kaedah pengajaran semasa dengan keperluan pelajar pintar dan berbakat, seterusnya menyumbang kepada pembangunan modal insan berimpak tinggi yang mampu memacu transformasi negara dalam menghadapi cabaran abad ke-21.

Model 4I-PBL yang terdiri daripada empat fasa utama *Inspire, Inquire, Innovate* dan *Implement* dikembangkan sebagai variasi PBL yang lebih sistematik dan disesuaikan dengan keperluan pendidikan STEM untuk pelajar pintar dan berbakat. Model 4I-PBL (Inspire, Inquire, Innovate, Implement) adalah sebagai inovasi pedagogi yang menyepadukan elemen utama PBL bersama integrasi teknologi digital serta kolaborasi bersama pakar industri. Berbeza dengan model PBL konvensional, Model 4I-PBL dirangka secara sistematik untuk merangsang inspirasi pelajar, mendorong inkuiri mendalam, menggalakkan inovasi, dan membolehkan pelajar melaksanakan penyelesaian mereka dalam situasi autentik.




**Rajah 1: Model 4I -Project Based Learning**

Model ini bukan sahaja memberi peluang kepada pelajar untuk menghasilkan projek inovatif, malah memperkukuhkan integrasi teknologi digital dan hubungan dengan pakar industri melalui pembelajaran kontekstual. Kajian-kajian berkaitan Model 4I-PBL masih terhad, terutamanya dalam konteks pendidikan pelajar pintar dan berbakat di Malaysia. Kajian ini dilaksanakan untuk meneroka sejauh mana keberkesanan pelaksanaan Model 4I-PBL dalam meningkatkan kepuasan pembelajaran, motivasi, serta kemahiran teknikal dan inovatif pelajar berbakat di Kolej PERMATA@Pintar Negara, UKM.

## Kajian Literatur

Tinjauan literatur menunjukkan bahawa PBL dapat meningkatkan penglibatan pelajar, sikap afektif, dan kemahiran pemikiran aras tinggi dalam mata pelajaran STEM. Kajian kuantitatif dan meta analisis menunjukkan peningkatan pencapaian akademik dan kemahiran pemikiran kritis berbanding pedagogi tradisional apabila PBL dilaksanakan dengan elemen reka bentuk projek yang berkualiti. PBL juga sering dikaitkan dengan peningkatan kreativiti serta kebolehan aplikasi konsep ke dalam situasi dunia sebenar merupakan ciri penting dalam pendidikan STEM abad ke-21. PBL memberi peluang kepada pelajar melakukan kerja autentik (authentic tasks) yang memerlukan integrasi pengetahuan dari sains, matematik, teknologi dan kejuruteraan. Dalam konteks STEM, keberkesanan PBL bergantung kepada reka bentuk tugasan, sumber (penggunaan teknologi), dan sokongan guru atau mentor.

Model pembelajaran berasaskan projek berkesan kerana ia berpusatkan penyelesaian masalah melalui aktiviti projek yang memerlukan pelajar untuk menyiasat, menganalisis, dan mengaplikasikan konsep dalam konteks dunia sebenar (Andriyani et al., 2025). Integrasi pendekatan STEM ke dalam pembelajaran berasaskan projek membolehkan pelajar mengaitkan pelbagai disiplin ilmu untuk menghasilkan penyelesaian inovatif terhadap isu-isu kompleks (Lestari et al., 2023) (Wicaksono, 2020). Oleh itu, penggunaan model Project-Based Learning berintegrasi STEM seperti 4I-PBL dapat melengkapkan pelajar dengan kemahiran

abad ke-21 yang relevan dengan tuntutan industri dan pembangunan negara (Effendi & Yoto, 2024) (AlAli, 2024). Pelajar juga berpeluang untuk membangunkan kemahiran 4C (kolaborasi, komunikasi, pemikiran kritis, dan kreativiti) yang penting bagi menghadapi cabaran abad ke-

21 (Haritzah et al., 2024) (Andriyani et al., 2025). Pendekatan STEM ini bertujuan untuk membentuk pelajar menjadi pencetus, inovator, penyelesai masalah, pemikir yang logik dan individu yang yakin pada diri dan penting untuk menghadapi isu-isu global (Hakiki et al., 2022). Pengintegrasian STEM dengan pembelajaran berasaskan projek ini juga dapat mengembangkan kreativiti dan inovasi yang kritikal agar generasi masa depan dapat bersaing secara global bukan hanya sekadar teknik malah melalui intelektual (Sutrisno & Syukur, 2023) (Heryanti, 2020). Penggunaan model Project Based Learning yang diintegrasikan dengan pendekatan STEM telah terbukti meningkatkan pembangunan diri, motivasi dan ketekunan pelajar di samping memperbaiki kemahiran menyelesaikan masalah secara sistematik dan kontekstual (Andriyani et al., 2025).

Kaedah pengajaran konvensional yang berpusatkan guru dan berorientasikan peperiksaan telah membataskan peluang pelajar untuk meneroka ilmu secara lebih aktif, terlibat dalam pembelajaran autentik dan mengaplikasikan pengetahuan kepada situasi dunia sebenar. Kajian lepas menunjukkan bahawa pelajar berbakat memerlukan pendekatan pembelajaran yang lebih mencabar, fleksibel serta mengintegrasikan teknologi dan kerjasama dengan komuniti luar bilik darjah termasuk pakar industri.

Sehubungan itu, pendekatan Pembelajaran Berasaskan Projek (Project-Based Learning, PBL) telah dikenalpasti sebagai strategi pengajaran yang berkesan dalam memperkukuhkan pembelajaran bermakna, meningkatkan keterlibatan pelajar serta membina kemahiran abad ke-21. Model PBL telah dikenal pasti sebagai satu pendekatan efektif dalam membangunkan kemahiran abad ke-21 seperti pemikiran kritikal, kolaborasi dan kreativiti dalam kalangan pelajar (Mona & Rachmawati, 2023). Kajian Smith et al, (2022) turut menegaskan bahawa pendekatan PBL memperkukuh pemahaman konsep dan meningkatkan motivasi pelajar. (Smith et al., 2022) Walau bagaimanapun, dalam konteks pelajar pintar dan berbakat, keperluan pembelajaran mereka lebih kompleks dan memerlukan intervensi yang bukan sahaja menekankan kandungan tinggi tetapi juga keterlibatan dengan teknologi canggih dan kerjasama dunia sebenar (Ziadat & Sakarneh, 2021; Zimlich, 2017)

## Metodologi Kajian

### *Reka Bentuk Kajian*

Kajian ini dilaksanakan menggunakan reka bentuk kajian tindakan yang bertujuan memperbaiki amalan pengajaran dan pembelajaran dalam kalangan pelajar pintar dan berbakat dalam bidang STEM. Pendekatan kaedah campuran (mixed-method) digunakan bagi memperoleh gambaran holistik tentang keberkesanan Model 4I-PBL (Inspire, Inquire, Innovate, Implement) dalam meningkatkan pencapaian dan kemahiran pelajar. Pengumpulan data adalah menerusi soal selidik tertutup menggunakan skala Likert lima mata diberikan selepas intervensi bagi menilai tahap kepuasan, motivasi, dan persepsi pelajar terhadap Model 4I-PBL.

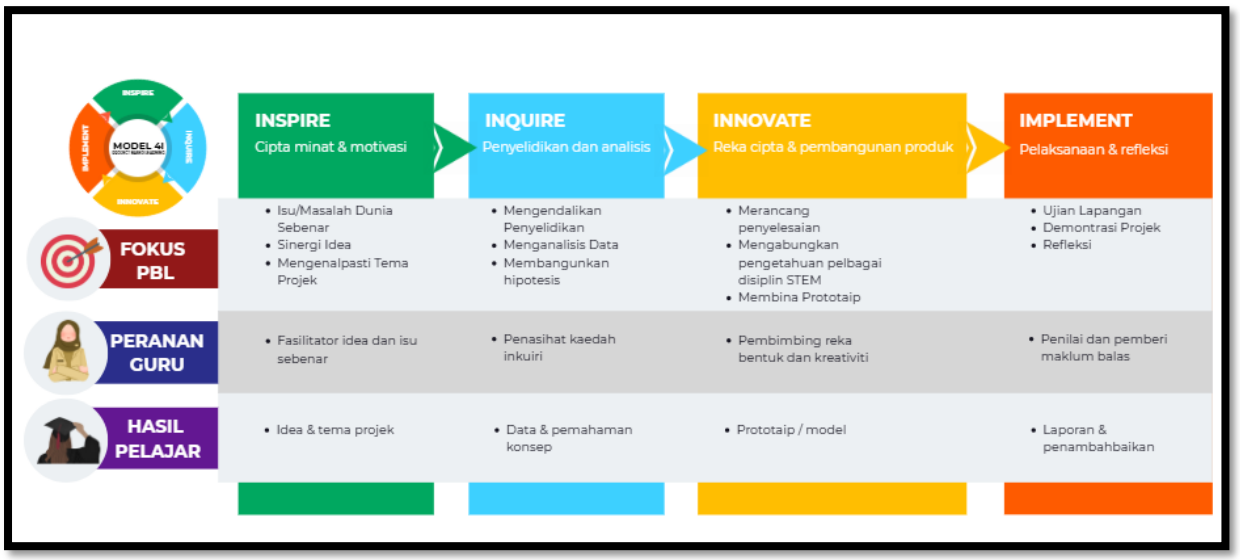
### *Lokasi Kajian dan Kumpulan Sasaran*

Kajian dijalankan di Kolej PERMATA@Pintar Negara, Universiti Kebangsaan Malaysia (UKM), iaitu sebuah institusi yang khusus menempatkan pelajar pintar dan berbakat. Seramai 77 orang pelajar daripada Program Digital Inovator terlibat sebagai peserta kajian. Pemilihan peserta dibuat melalui persampelan bertujuan (purposive sampling), berdasarkan keterlibatan mereka dalam modul pembelajaran STEM yang telah disesuaikan dengan struktur Model 4I-PBL serta kesediaan mereka mengikuti keseluruhan fasa intervensi.

### *Prosedur Pelaksanaan 4I- PBL*

Pelaksanaan Model 4I-PBL dijalankan secara berstruktur melalui empat fasa utama yang diintegrasikan dalam modul pembelajaran STEM.

Fasa pertama, *Inspire* memberi tumpuan kepada pendedahan awal pelajar terhadap masalah dunia sebenar dalam konteks STEM melalui penggunaan bahan multimedia, kajian kes, sesi perkongsian pakar dan demonstrasi amali. Pendekatan ini bertujuan merangsang rasa ingin tahu, meningkatkan keterlibatan kognitif dan menyediakan konteks autentik bagi mengekalkan minat pelajar pintar dan berbakat terhadap tugasan yang diberikan.




**Rajah 2: Prosedur Pelaksanaan 4I- PBL**

Fasa kedua, *Inquire* melibatkan aktiviti penyelidikan dan eksplorasi kendiri serta kolaboratif. Pelajar bekerja dalam kumpulan kecil untuk mengumpul maklumat, menyoal, meneroka konsep asas, dan menjalankan eksperimen berkaitan isu yang dikaji. Proses ini disokong melalui perbincangan ilmiah, analisis data, penggunaan sumber digital dan strategi pembelajaran berasaskan inkuiri yang bertujuan mengembangkan kemahiran penyiasatan saintifik dan pemikiran analitis.

Fasa ketiga, *Innovate* menekankan pembangunan idea dan penghasilan penyelesaian kreatif berdasarkan dapatan inkuiri sebelumnya. Dalam fasa ini, pelajar mereka bentuk prototaip, membangunkan produk digital atau menghasilkan model penyelesaian melalui proses reka bentuk interaktif. Aktiviti ini memupuk kreativiti, pemikiran kritikal dan kebolehan menyelesaikan masalah kompleks secara kolaboratif.

Fasa keempat, *Implement* merangkumi pembentangan dan penambahbaikan hasil kerja. Pelajar mengemukakan prototaip atau penyelesaian yang dibangunkan, menghuraikan justifikasi reka bentuk, serta membuat penyesuaian berdasarkan maklum balas rakan sebaya, guru dan pihak

industri. Hasil akhir didokumentasikan melalui pembentangan formal, portfolio digital atau demonstrasi amali, sekali gus mengukuhkan pengalaman reflektif pelajar terhadap keberkesanan penyelesaian yang dihasilkan.

Secara keseluruhannya, pelaksanaan keempat-empat fasa ini diwujudkan secara sistematik sepanjang intervensi bagi mewujudkan pengalaman pembelajaran yang autentik, berfokuskan pelajar dan sejajar dengan keperluan kognitif serta potensi pelajar pintar dan berbakat dalam bidang STEM.

### *Instrumen Kajian*

Kajian ini menggunakan instrument Soal Selidik Persepsi Pelajar yang menggunakan skala Likert lima mata bagi menilai Kepuasan Pelajar Terdapat Model 4I-PBL, Motivasi Pelajar dan Penyelesaian Masalah, Kreativiti dan Inovasi pelajar terhadap hasil pelaksanaan Model 4I-PBL ini. Data kualitatif turut dikumpulkan melalui soalan terbuka, refleksi pelajar, dan pemerhatian semasa aktiviti kumpulan.

### *Keputusan*

**Jadual 1: Instrumen Soal Selidik Persepsi Pelajar**

| Soalan | Min | Median | Sisihan Piawai |
|---|---|---|---|
| **Kepuasan Pelajar terhadap Model 4I-PBL** | | | |
| **Adakah anda menjalankan PBL dalam kelas pembelajaran anda?** | 4.51 | 5 | 0.76 |
| **Adakah anda sedar Model 4I dijalankan semasa PBL** | 4.05 | 4 | 0.67 |
| **Guru mengaplikasikan Model 4I dalam kelas PBL?** | 4.21 | 4 | 0.64 |
| **Saya faham bagaimana model 4I-PBL dilaksanakan dalam kelas STEM.** | 4.04 | 4 | 0.78 |
| **Pendekatan 4I-PBL menjadikan pembelajaran lebih menarik.** | 4.34 | 4 | 0.75 |
| **Saya lebih aktif terlibat dalam pembelajaran menggunakan model ini.** | 4.09 | 4 | 0.65 |
| **Model 4I-PBL membantu memahami konsep STEM?** | 4.26 | 4 | 0.65 |
| **Berpuas hati dengan cara Model 4I-PBL menggalakkan pembelajaran projek?** | 4.21 | 4 | 0.81 |

| | | | |
|---|---|---|---|
| **Model 4I-PBL memberi peluang berinteraksi dengan teknologi?** | 4.36 | 5 | 0.77 |
| **Motivasi Pelajar** | | | |
| **Model 4I-PBL meningkatkan minat meneroka konsep STEM?** | 4.1 | 4 | 0.84 |
| **Model 4I-PBL membuatkan anda bermotivasi mencari penyelesaian kreatif?** | 4.16 | 4 | 0.83 |
| **Lebih yakin dalam bidang STEM selepas Model 4I-PBL?** | 4.12 | 4 | 0.71 |
| **Penyelesaian Masalah, Kreativiti dan Inovasi** | | | |
| **Mengenal pasti masalah lebih jelas semasa PBL** | 4.18 | 4 | 0.6 |
| **Bebas mencuba kaedah berbeza dalam tugasan.** | 4.36 | 4 | 0.74 |
| **Digalakkan berfikir luar kotak.** | 4.49 | 5 | 0.63 |
| **Menghasilkan produk/penyelesaian baharu dari PBL** | 4.28 | 4 | 0.79 |
| **Faham aplikasi ilmu STEM kepada dunia sebenar.** | 4.22 | 4 | 0.82 |
| **Bangga idea diiktiraf guru/rakan** | 4.64 | 5 | 0.56 |
| **Meningkatkan kemahiran teknikal melalui Model 4I-PBL** | 4.3 | 4 | 0.69 |
| **Meningkatkan kreativiti dan inovasi** | 4.41 | 4 | 0.62 |
| **Model 4I-PBL membantu hasilkan penyelesaian inovatif projek STEM** | 4.31 | 4 | 0.58 |
| **Model 4I-PBL mengasah kerja berpasukan dalam pembelajaran STEM** | 4.2 | 4 | 0.79 |

## Perbincangan

### *Kepuasan Pelajar terhadap Model 4I-PBL*

Secara keseluruhan, konstruk kepuasan pelajar menunjukkan nilai min yang tinggi (4.04–4.51) dan median konsisten pada 4 hingga 5, menandakan tahap persetujuan yang kuat terhadap keberkesanan Model 4I-PBL. Dapatan utama item tertinggi adalah "Adakah anda menjalankan PBL dalam kelas pembelajaran anda?" (M=4.51, SP=0.76). Ini menunjukkan pelaksanaan PBL adalah sangat meluas dalam kelas. Pelajar merasakan Model 4I-PBL menjadikan pembelajaran lebih menarik (M=4.34, SP=0.75) dan membantu memahami konsep STEM (M=4.26, SP=0.65). Penggunaan teknologi turut disokong kuat (M=4.36; Median=5) konsisten dengan komponen *Innovate* dan *Implement* dalam Model 4I. Tahap kepuasan yang tinggi menunjukkan pelajar bukan sahaja sedar tentang penggunaan Model 4I-PBL, tetapi juga melihat keberkesanannya dalam menjadikan pembelajaran lebih interaktif, menarik dan berpusatkan pelajar.

### *Motivasi Pelajar*

Nilai min konstruk motivasi berada antara 4.10 hingga 4.16, dengan sisihan piawai sederhana (0.71–0.84). Dapatan utama adalah item pelajar melaporkan peningkatan minat meneroka STEM (M=4.10, SP=0.84). Mereka juga lebih bermotivasi untuk menghasilkan penyelesaian kreatif (M=4.16, SP=0.83). Keyakinan dalam bidang STEM turut bertambah (M=4.12, SP=0.71). Model 4I-PBL berjaya meningkatkan motivasi intrinsik pelajar dalam pembelajaran

STEM di mana pelajar lebih berminat, yakin dan terdorong untuk meneroka penyelesaian kreatif.

***Penyelesaian Masalah, Kreativiti dan Inovasi***

Konstruk ini mempamerkan skor yang sangat tinggi, antara 4.18 hingga 4.64, dengan median 4–5, dan sisihan piawai rendah-sederhana (0.56–0.82). Item dengan min tertinggi adalah "Bangga idea diiktiraf guru/rakan" (M=4.64, Median=5, SP=0.56) telah menunjukkan penghargaan sosial dan pengiktirafan idea sangat memotivasikan. "Digalakkan berfikir luar kotak" (M=4.49, Median=5, SP=0.63) pula menunjukkan keberkesanan komponen *Inspire* dan *Inquire.* Secara tidak langsung juga, kemahiran lain turut meningkat seperti kemahiran teknikal (M=4.30), kefahaman aplikasi dunia sebenar (M=4.22), inovasi (M=4.41), kerja berpasukan (M=4.20). Model 4I-PBL mempunyai impak besar terhadap pembangunan kemahiran abad ke-21 seperti kreativiti, inovasi, dan penyelesaian masalah. Ia membantu pelajar menghasilkan produk berasaskan projek dan memberi keyakinan menyelesaikan masalah sebenar.

Dapatan kajian ini menunjukkan bahawa Model 4I-PBL merupakan pendekatan pedagogi yang berkesan dalam meningkatkan pengalaman pembelajaran STEM dalam kalangan pelajar pintar dan berbakat. Hasil analisis kuantitatif menunjukkan tahap kepuasan dan motivasi pelajar yang tinggi, dengan skor min antara 4.1 hingga 4.5 dan sisihan piawai yang rendah, menandakan konsistensi dalam persepsi positif pelajar terhadap pelaksanaan model ini. Dapatan ini selari dengan kajian lepas yang menekankan nilai pembelajaran berasaskan projek (PBL) dan aplikasi dunia sebenar dalam pendidikan pelajar berbakat (Chiang & Lee, 2015)

Dapatan kualitatif turut menyokong hasil ini, di mana pelajar melaporkan peningkatan penglibatan, kemahiran teknikal yang lebih baik serta keyakinan yang lebih tinggi dalam menyelesaikan masalah secara kreatif. Ini seiring dengan dapatan Hmelo-Silver (2004) yang menegaskan bahawa PBL mampu menggalakkan pemikiran kritikal dan pemahaman mendalam adalah ciri penting dalam kalangan pelajar berkeupayaan tinggi. Pengintegrasian teknologi digital dan kerjasama dengan pakar industri juga membantu menghubungkan pembelajaran di bilik darjah dengan aplikasi sebenar dalam bidang STEM, sejajar dengan prinsip *authentic learning* seperti yang dikemukakan oleh Morris et al., (2019).

## Kesimpulan

Kajian ini menyimpulkan bahawa Model 4I-PBL (Inspire, Inquire, Innovate, Implement) berupaya menjadi pendekatan pedagogi yang berkesan dan relevan dalam meningkatkan pengalaman pembelajaran STEM, khususnya dalam kalangan pelajar pintar dan berbakat. Dapatan kajian menunjukkan prinsip pembelajaran berasaskan projek yang digabungkan dengan integrasi teknologi digital dan kerjasama industri dapat meningkatkan motivasi pelajar, memperkukuh kemahiran teknikal, serta merangsang kreativiti dan kebolehan menyelesaikan masalah secara inovatif.

Namun begitu, kajian ini turut mengenal pasti beberapa kekangan. Antaranya ialah kebolehgunaan terhad disebabkan konteks institusi kajian yang bersifat khusus, kemungkinan bias dalam pelaporan kendiri oleh pelajar, serta kekangan dalam penilaian objektif hasil projek.

Tambahan pula, pelaksanaan Model 4I mungkin berbeza bergantung kepada kompetensi guru dan kesediaan pelajar, yang boleh mempengaruhi keberkesanan keseluruhan model ini.

Dari segi implikasi, secara teorinya kajian ini menyokong integrasi model pembelajaran berasaskan projek dan teknologi dalam pendidikan pelajar pintar sebagai strategi pembelajaran abad ke-21. Secara praktikal, ia memberi justifikasi kukuh kepada penggubal dasar dan perancang kurikulum untuk mempertimbangkan pendekatan ini dalam pembangunan program pendidikan STEM berimpak tinggi bagi pelajar berbakat.

Sebagai rumusan, Model 4I-PBL bukan sahaja membina asas kognitif pelajar dalam STEM, malah membentuk jati diri mereka sebagai pemikir kritis dan inovator masa depan. Kajian ini mencadangkan agar model ini diperluaskan pelaksanaannya dalam sistem pendidikan kebangsaan melalui latihan guru, kerjasama dengan pihak industri, serta penyediaan sumber dan persekitaran pembelajaran yang menyokong pelaksanaan PBL berasaskan inovasi digital.

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# PERANAN NILAI DAN AKHLAK DALAM PEMBENTUKAN JATI DIRI MUSLIM: KAJIAN TERHADAP PELAJAR PINTAR DAN BERBAKAT

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***Abstrak***:*Kajian ini bertujuan untuk mengkaji peranan nilai dan akhlak dalam pembentukan jati diri Muslim dalam kalangan pelajar pintar dan berbakat (PPB). Sampel kajian ini terdiri daripada 50 orang PPB yang sedang mengikuti pembelajaran di Kolej PERMATA@Pintar Negara Universiti Kebangsaan Malaysia (UKM) kampus Bangi. Pengumpulan data dilakukan menggunakan set soal selidik yang merangkumi item mengenai kefahaman nilai dan akhlak Islam serta jati diri Muslim. Data yang terkumpul telah dianalisis menggunakan statistik deskriptif (min, sisihan piawai) atau SPPS daripada versi terkini. Dapatan menunjukkan bagi kefahaman nilai Islam dalam kalangan PPB berada pada tahap persetujuan yang sangat tinggi dengan nilai (M=4.69, SP=0.47). Selain itu hasil kajian kefahaman nilai akhlak PPB juga berada tahap persetujuan yang tinggi dengan nilai (M=4.38, Sp.0.71). Bagi hasil dapatan kajian Pembentukan jati diri Muslim, PPB menunjukkan tahap persetujuan yang sangat tinggi dengan nilai (M4.68, SP 0.58). Hasil kajian ini menunjukkan peranan nilai dan akhlak sangat penting dalam pembentukan jati diri Muslim bagi PPB.*

***Kata kunci***: *Nilai, Akhlak, Jati Diri Muslim, Pelajar Pintar Dan Berbakat.*

***Abstract:*** *This study aims to examine the role of Islamic values and ethics in shaping the Muslim identity among gifted and talented students (PPB). The sample of this study consisted of 50 PPB students currently enrolled at Kolej PERMATA@Pintar Negara, Universiti Kebangsaan Malaysia (UKM), Bangi campus. Data collection was carried out using a questionnaire that included items on the understanding of Islamic values and ethics as well as Muslim identity.The collected data were analyzed using descriptive statistics (mean and standard deviation) with the latest version of SPSS.The findings revealed that the understanding of Islamic values among PPB students was at a* very high level of agreement *(M = 4.69, SD = 0.47). Similarly, the understanding of Islamic ethics among PPB students was also at a* high level of agreement *(M = 4.38, SD = 0.71). In terms of the development of Muslim identity, the PPB students demonstrated a* very high level of agreement *(M = 4.68, SD = 0.58). Overall, the results of this study indicate that* Islamic values and ethics play a crucial role in shaping the Muslim identity among gifted and talented students.

***Keywords:*** *Values, Ethics, Muslim Identity, Gifted And Talented Students.*

## Pengenalan

Pembentukan sesebuah negara yang maju adalah merujuk kepada keupayaan sesebuah negara tersebut membangunkan pemikiran dan nilai rakyat dengan sempurna. Hal ini ditegaskan oleh Mohd Ridhuan (2007) yang mengutarakan bahawa kriteria sebuah negara yang ingin mencapai status negara membangun dan maju adalah dengan mempunyai sistem pendidikan yang mantap dan berkesan tidak hanya menitikberatkan kemajuan dari segi pembangunan material tetapi turut membangunkan pembangunan nilai yang meliputi soal tingkah laku manusia. Pembangunan insan adalah satu proses membentuk dan mendidik manusia secara seimbang dan holistik. Ia merangkumi aspek jasmani, emosi, rohani, fizikal, intelektual dan sosial untuk kepentingan duniawi dan ukhrawi. Proses membangunkan manusia ini memerlukan satu usaha yang konsisten dan berterusan agar tidak berlaku kepincangan dalam mana–mana peringkat pelaksanaannya. Usaha pembangunan insan ini merupakan satu usaha pendidikan yang paling utama. Ia bertujuan untuk melahirkan manusia yang berkeupayaan membangunkan seluruh potensi diri dan setiap bakat serta kebolehan yang tersembunyi di dalam diri seseorang. Keupayaan untuk melakukan penyelongkaran dan pembangunan serta pembinaan insan yang seumpama ini akan membantu melahirkan sekaligus menzahirkan diri insan itu seutuhnya atau insan yang paling sempurna.

Dalam kajian-kajian terdahulu menekankan bahawa pembangunan nilai dan akhlak dalam kalangan pelajar pintar dan berbakat (PPB) merupakan aspek penting dalam melahirkan modal insan yang berkualiti. Menurut Mansor Mohd Noor (2018), pelajar pintar dan berbakat yang mempunyai kefahaman nilai moral yang kukuh menunjukkan prestasi akademik yang lebih stabil serta mampu mengawal tekanan dalam situasi pembelajaran yang mencabar. Ini menunjukkan bahawa nilai dan akhlak bukan sahaja membentuk keperibadian, malah membantu dalam pencapaian akademik mereka.Selain itu, kajian oleh Ahmad dan Zainal (2020) mendapati bahawa pelajar berbakat yang mengamalkan nilai seperti kejujuran, tanggungjawab, dan disiplin cenderung menjadi pemimpin yang berwawasan dan mempunyai daya saing tinggi dalam bidang masing-masing. Mereka juga lebih mudah menerima kritikan dan berupaya membina hubungan sosial yang harmoni.

Bagi konteks pembentukan modal insan, Razali et al. (2019) menegaskan bahawa pemupukan nilai dan akhlak sejak peringkat awal pendidikan adalah asas penting dalam membentuk individu yang bukan sahaja cemerlang dari segi ilmu, tetapi juga memiliki integriti yang tinggi. Pendekatan ini memastikan modal insan yang dihasilkan tidak hanya berkemahiran, tetapi turut mempunyai sifat kepimpinan dan etika yang kukuh, yang amat diperlukan dalam menghadapi cabaran pembangunan negara. Sehubungan itu, proses pendidikan itu secara langsung merupakan kitaran hayat insan yang saling memperlengkap dengan seluruh sistem yang wujud di persekitaran sosialnya. Justeru itu dengan pendidikan, seseorang insan itu akan terdidik dengan sifat-sifat kemanusiaannya. Azhar Hj. Wahid dan Zawawi Jahya (2009) menyatakan bahawa pendidikan secara umumnya ialah perubahan ke arah menjadi insan yang baik atau menjadi manusia yang baik sekaligus beradab. Apabila kita memperihalkan tentang pendidikan dalam pengertian yang luas ruang lingkupnya, sebenarnya kita secara langsung atau secara tidak langsung membicarakan soal perubahan yang turut membicarakan agenda pembinaan akhlak dan seluruh kelompok yang termasuk dalam kerangka pendidikan itu. Dengan itu tujuan dan matlamat pendidikan adalah bagi melahirkan insan sempurna (Ahmad Mohd. Salleh, 2008; Ghazali Darusalam, 2004; Hassan Langgulung,1991; Tajul Ariffin Noordin, 1993) seperti yang

dijelaskan dalam al-Quran surah al-Tin: 4 yang bermaksud: "Sesungguhnya kami telah menjadikan manusia dengan sebaik-baik kejadian." Manusia adalah makhluk paling istimewa yang dicipta oleh Allah s.w.t. Menurut Tajul Ariffin Noordin dan Nor 'Aini Dan (2002) manusia sebagai insan disempurnakan sifatnya dengan anugerah akal, potensi pembelajaran dan kemahiran untuk memahami dan menguasai ilmu.

## Kajian Literatur

### *Peranan Akhlak*

Islam amat menitikberatkan ketinggian akhlak bagi melahirkan yang sempurna. Sekiranya tiada akhlak di dalam diri maka tidak sempurna keislaman seseorang individu Muslim. Justeru pembentukan akhlak merupakan agenda utama dalam bidang pendidikan khususnya di dalam Pendidikan Islam Asmawati Suhid et al (2018). Matlamat pendidikan akhlak dalam Islam adalah bertujuan untuk membentuk generasi yang berakhlak mulia, kuat cita-cita, terdidik dan bersopan santun dalam percakapan dan perbuatan, pintar dalam pengurusan tingkah laku, mempunyai kesempurnaan jiwa beradap sopan, ikhlas dan mempunyai jiwa yang bersih. Hasil dari pendidikan akhlak yang mantap akan melahirkan insan yang berkeperibadian dan berwibawa tinggi sesuai dengan keperibadian Islam itu sendiri.

Seterusnya akhlak yang baik dan mulia ini, Yusuf al-Qaradhawi (2012), menyatakan akhlak dan kesopanan telah digariskan sebagai ciri yang kelima dalam membentuk sebuah masyarakat Islam. Ia merujuk kepada masyarakat adil, ihsan, kebajikan, kerahmatan, kebenaran, amanah, menyeru manusia ke arah kebaikan, amar ma'ruf nahi mungkar serta setiap sifat mulia, ciri-ciri terhormat dan budi pekerti yang luhur. Manakala Rohana Tan dan Norhasni (2014) berpendapat akhlak merupakan bahagian dalaman (kejiwaan) seseorang. Manakala perbuatan pula adalah bahagian luaran. Penerapan akhlak yang baik akan menimbulkan perbuatan yang baik sekaligus akan menjadikan seseorang itu anggota masyarakat yang baik dan dipandang mulia. Dalam konteks dunia global yang kompetitif ini, menerusi pendekatan Islam yang dilakukan secara holistik dan efektif dapat mempertingkatkan pembangunan modal insan .

Dalam konteks pelajar pintar dan berbakat, pendidikan akhlak menjadi semakin penting kerana golongan ini memiliki tahap kecerdasan luar biasa yang perlu disertai dengan nilai moral dan spiritual yang mantap agar potensi mereka dapat dimanfaatkan secara seimbang dan beretika. Pelajar pintar dan berbakat bukan sahaja memerlukan pengayaan akademik, tetapi juga bimbingan akhlak untuk memastikan kecemerlangan mereka tidak membawa kepada sifat ego, sombong, riak atau individualistik, yang boleh menjejaskan keseimbangan sahsiah dan hubungan sosial mereka. Menurut kajian yang dijalankan oleh Zakaria *et al.*, (2012) gabungan antara ilmu naqli (ukhrawi) dan aqli (duniawi) mengiktiraf kepentingan kedua-dua aspek pengajaran agama dan ilmu duniawi dalam pembangunan holistik individu. Ini bagi memastikan pelajar menerima pendidikan yang seimbang dan menyeluruh yang merangkumi perkembangan intelektual, rohani, serta moral mereka. Melalui pendidikan yang menyeluruh ini dapat meningkatan tingkat pembangunan jati diri sebagai seorang pelajar Muslim yang sebenarnya.

### Pendidikan Islam Dalam Pembentukan Jati Diri Pelajar.

Pendidikan Islam yang berteraskan al-Quran dan al-Sunnah sudah pasti mengandungi unsur akidah dan ibadah sebagai pengabdian diri kepada Allah, di samping membentuk akhlak yang mahmudah dan juga ke arah membasmi sifat mazmumah. Segala yang terkandung dalam pendidikan Islam ini adalah untuk mencapai matlamat hidup bahagia di dunia dan akhirat. Ini kerana unsur akhlak itu sendiri terkandung dalam empat cabang utama Islam iaitu akidah, ibadat, muamalat dan akhlak. Pembentukan akhlak berdasarkan al-Quran ini menepati jawapan saidatina Aisyah ra. apabila ditanya mengenai akhlak baginda dengan menjelaskan bahawa sesungguhnya akhlak Rasulullah adalah menurut al-Quran.

Menurut pandangan Al-Attas (1999) pula menekankan bahawa matlamat pendidikan dalam Islam bukan sekadar untuk melahirkan tenaga kerja mahir atau warganegara yang baik. Lebih daripada itu, tujuan pendidikan Islam ialah untuk melaksanakan kurikulum menyeluruh bagi melahirkan manusia Muslim yang berilmu, beriman dan beramal soleh. Pendidikan Islam lebih tepat merupakan proses ta'dib meliputi unsur-unsur ilmu, pengajaran dan tarbiyyah. Pandangan ini selari dengan pandangan Imam al-Ghazali yang menyatakan bahawa pendidikan Islam membekalkan individu dengan kemantapan akidah dan amalan ibadah, membentuk akhlak mahmudah dalam diri dan menjauhi sifat-sifat mazmumah, melatih menjauhkan diri daripada perkara shubhah dan haram, berani menghadapi rintangan hidup serta mengutamakan nilai-nilai kerohanian yang akan mendekatkan diri kepada Allah swt supaya dapat mencapai kebahagiaan hidup di dunia dan akhirat H.A Syaefuddin (2005).

Bagi PPB Pendidikan Islam mempunyai pendekatan tersendiri dalam memahami konsep pelajar PPB. Tidak seperti pendekatan konvensional yang menumpukan kepada kecerdasan intelek atau prestasi akademik semata-mata, pendidikan Islam menekankan pembangunan secara menyeluruh (holistic development) yang merangkumi akal (`aql), jasad (fizikal), dan roh (spiritual). Menurut Al-Attas (1991) lagi, menegaskan bahawa tujuan pendidikan dalam Islam ialah untuk melahirkan insan yang menyedari tanggungjawabnya sebagai hamba Allah dan khalifah di muka bumi. Ini bermaksud, pelajar pintar dalam perspektif Islam bukan sahaja mempunyai daya intelek yang tinggi, tetapi juga memiliki nilai-nilai adab, etika dan spiritual yang mantap. Begitu juga, adab ianya merupakan teras dalam pendidikan Islam. Rosnani (2007) menjelaskan bahawa adab bukan hanya sopan santun, tetapi merangkumi penempatan yang betul terhadap sesuatu perkara, termasuk ilmu dan diri sendiri. Justeru, pelajar yang memiliki adab yang tinggi akan menguruskan ilmu dengan hikmah, serta berinteraksi dengan guru, rakan dan masyarakat dengan penuh hormat dan bertanggungjawab. Selain itu penyucian jiwa merupakan proses penting dalam pembentukan pelajar pintar berbakat menurut Islam. Hashim (2014) menyatakan bahawa Pendidikan Islam mesti bermula dengan pembersihan hati, kerana ilmu yang sebenar hanya akan masuk ke dalam hati yang bersih. Pelajar yang berakhlak, ikhlas dan amanah dalam menuntut ilmu akan menjadi individu yang bukan sahaja cemerlang secara akademik tetapi juga menyumbang secara positif kepada masyarakat. Begitulah pentingnya nilai-nilai serta akhlak yang mampu membawa PPB ke arah insan yang lebih berjaya pada hari-hari seterusnya.

Jika diamati, aspek pembentukan jati diri yang ingin dicapai akan berjaya melalui usaha menggalakkan setiap anggota masyarakat untuk menampilkan rekacipta dan hasil yang baru setiap masa. Penekanan kepada budaya intelektual akan menimbulkan keinginan untuk terus belajar dan kesediaan meninggalkan perkara- perkara yang sudah lapuk. Abdul Razak (2006) menjelaskan bahawa pada masa yang sama budaya perkongsian ilmu akan membawa kepada

kesepakatan bersama dalam melakukan aktiviti. Budaya pembangunan diri ini hanya akan terhasil menerusi satu bentuk pendidikan yang ditunjangi model pendidikan yang menitikberatkan semua aspek keperluan insan yang terdiri dari aspek perkembangan kognitif, fizikal dan rohani. Dengan ini, melalui medium pendidikan, jati diri dapat dibentuk dan segala kegiatan yang tidak bermoral akan dapat dikawal dan dihapuskan. Justeru, Pendidikan Islam sewajarnya menjadi teras dalam membangunkan sikap dan mental individu, cara berfikir, keinsafan diri, ketahanan perjuangan dan kefahaman tentang hala tuju realiti sezaman yang pantas berubah (Faridah et al. 2008). Pendapat ini adalah sinonim dengan pendapat Asmawati (2007) yang menyatakan Pendidikan Islam adalah pendidikan yang lebih bersifat holistik kerana perbincangannya meliputi seluruh ruang kehidupan seterusnya dapat mewujudkan sifat taqwa kepada Allah SWT. Oleh yang demikian melalui penerapan pendidikan yang berteraskan Pendidikan Islam yang meliputi semua aspek di atas dapat melahirkan jati diri Muslim yang terbaik terutama dalam kalangan PPB.

## Metodologi

Kajian ini menggunakan pendekatan kuantitatif bagi mendapatkan pemahaman yang lebih mendalam tentang peranan nilai dan akhlak dalam pembentukan jati diri Muslim dalam kalangan pelajar pintar dan berbakat. Pendekatan kuantitatif digunakan untuk menilai tahap penghayatan nilai Islam dan hasil pembentukan jati diri Muslim melalui soal selidik. Populasi kajian terdiri daripada pelajar pintar dan berbakat yang sedang mengikuti program khas di Kolej PERMATA@Pintar Negara UKM di Kampus Bangi. Sampel kajian dipilih secara persampelan berlapis (stratified sampling) untuk memastikan representasi pelajar berdasarkan umur, jantina, dan tahap pendidikan. Jumlah responden dalam kajian ini seramai 50 orang pelajar daripada jumlah 191 jumlah pelajar yang berada di kampus Bangi. Instumen bagi kajian ini adalah menggunakan set soal selidik dengan skala likert 5 mata bagi mengukur peranan nilai dan akhlak bagi pembentukan jati diri Muslim dalam kalangan PPB. Seterusnya hasil dapatan daripada soal selidik dianalisi menggunakan statistik deskriptif (min, sisihan piawai) atau SPPS daripada versi terkini.

## Dapatan Kajian

**Jadual 1: Profile Responden Kajian**

| Maklumat latar belakang | Kategori | Bil. Sampel N=50 | Peratus % |
|---|---|---|---|
| Jantina | Lelaki | 24 | 48 |
| | Perempuan | 26 | 52 |
| Umur | 15 Tahun | 4 | 8 |
| | 16 Tahun | 21 | 42 |
| | 17 Tahun | 25 | 50 |

### *Profil Responden*

Responden kajian terdiri daripada 50 orang pelajar pintar dan berbakat di Malaysia yang sedang mengikuti pembelajaran mereka di Pusat PERMATA@Pintar Negara Universiti Kebangsaan Malaysia (UKM) Kampus Bangi. Responden kajian terdiri daripada pelajar lelaki iaitu (N=24, 48%) dan pelajar perempuan (N=26, 52%). Responden kajian ini memiliki jumlah yang hampir sama dari aspek jantina lelaki dan perempuan. Daripada aspek umur pula responden kajian terdiri daripada tiga peringkat umur berbeza iaitu pelajar 15,16 dan 17 tahun. Didapati bahawa responden yang paling tinggi dalam kajian ini adalah pelajar yang berumur 17 tahun (N=25, 50%), diikuti dengan pelajar tingkatan 4 yang dibahagikan kepada dua umur yang berbeza iaitu pelajar 16 tahun (N=21, 42%) dan 15 tahun (N=4, 8%). Melihat kepada beberapa responden berada pada umur yang muda iaitu 15 tahun tetapi berada di kelas tingkatan 4. Ini menunjukkan bahawa pelajar pintar diukur untuk kemasukan ke Pusat PERMATA@Pintar ini berdasarkan kepada tahap pencapaian IQ dan tidak mengikut kepada faktor umur seperti keadaan normal di sekolah biasa yang lain.

**Jadual 2: Kefahaman Nilai Islam**

| Kefahaman Nilai | Min | Sisihan Piawai | Tahap Persetujuan |
|---|---|---|---|
| Saya memahami maksud nilai dalam Islam | 4.44 | 0.50 | Tinggi (Setuju) |
| Nilai dalam Islam berpandukan kepada Al-Quran dan Sunnah. | 4.84 | 0.37 | Tinggi (Sangat Setuju) |
| Saya dapat membezakan antara nilai Islam dan nilai budaya semata-mata. | 4.56 | 0.65 | Tinggi (Sangat Setuju) |
| Nilai Islam boleh diamalkan dalam semua aspek kehidupan. | 4.82 | 0.39 | Tinggi (Sangat Setuju) |
| Saya boleh mengaitkan ajaran Islam dengan situasi harian saya. | 4.58 | 0.63 | Tinggi (Sangat Setuju) |
| Saya sedar bahawa nilai Islam membantu membentuk jati diri sebagai Muslim. | 4.92 | 0.29 | Tinggi (Sangat Setuju) |
| Keseluruhan | 4.69 | 0.47 | Tinggi (Sangat Setuju) |

***Kefahaman Nilai Islam***

Berdasarkan jadual 2 di atas hasil analisis kefahaman nilai Islam yang diukur berdasarkan kepada enam kategori. Hasil kajian menunjukkan bahawa tahap persetujuan yang tinggi tentang memahami maksud nilai dalam Islam dengan nilai (M=4.44, SP=0.50). Pelajar juga memahami nilai dalam Islam berpandukan kepada Al-Quran dan Sunnah dengan nilai (M=4.84, SP=0.37). Seterusnya dalam aspek dapat membezakan antara nilai Islam dan nilai

budaya menunjukkan tahap persetujuan yang tinggi dengan nilai (M=4.56, SP=0.65). Bagi kefahaman nilai Islam pelajar turut menunjukan kefahaman yang tinggi iaitu menyatakan nilai Islam boleh diamalkan dalam semua aspek kehidupan dengan nilai (M=4.82, SP=0.39). Pelajar juga menyatakan persetujuan yang tinggi dalam aspek ajaran Islam mempunyai kaitan dengan situasi harian dengan nilai (M=4.58, SP=0.63). Bagi aspek terakhir dalam kefahaman pelajar tentang nilai Islam iaitu pelajar sedar bahawa nilai Islam dapat membentuk jati diri sebagai Muslim merupakan nilai min yang tertinggi daripada ke enam-enam kategori kefahaman nilai Islam. Nilainya adalah (M=4.92, SP=0.29) Secara keseluruhan dapatan bagi kefahaman nilai Islam PPB ini berada pada tahap yang tinggi iaitu dengan nilai (M=4.69, SP=0.47). Ini menunjukkan kefahamn nilai Islam yang sangat tinggi dalam kalangan PPB.

**Jadual 3: Kefahaman Akhlak**

| Kefahaman Akhlak | Min | Sisihan Piawai | Tahap Persetujuan |
|---|---|---|---|
| Saya tahu perbezaan antara akhlak mahmudah dan akhlak mazmumah. | 4.38 | 0.79 | Tinggi (Setuju) |
| Saya sentiasa cuba bersikap jujur dan amanah dalam setiap urusan. | 4.38 | 0.69 | Tinggi (Setuju) |
| Saya menjaga akhlak terhadap ibu bapa,guru dan rakan-rakan. | 4.44 | 0.54 | Tinggi (Setuju) |
| Saya berusaha menghindari akhlak tercela seperti sombong dan riak. | 4.54 | 0.63 | Tinggi (sangat setuju) |
| Saya mencontohi akhlak Rasulullah saw dalam kehidupan seharian. | 4.16 | 0.92 | Tinggi (Setuju) |
| Keseluruhan | 4.38 | 0.71 | Tinggi (Setuju) |

***Kefahaman Akhlak***

Jadual 3 di atas merujuk kepada kefahaman akhlak dalam kalangan pelajar pintar dan berbakat. Hasil dapatan diukur melalui lima kategori. Pelajar menunjukkan bahawa mereka mengetahui perbezaan antara akhlak mahmudah dan akhlak mazmumah pada tahap persetujuan yang tinggi dengan nilai (M=4.38, SP=0.79). Bagi kategori pelajar cuba bersikap jujur dan amanah dalam setiap urusan menunjukkan nilai (M=4.38, SP=0.69) iaitu juga tinggi tahap persetujuan. Seterusnya bagi kategori menjaga akhlak terhadap ibu bapa, guru dan rakan-rakan menunjukkan berada pada tahap persetujuan yang tinggi juga dengan nilai (M=4.44, SP=0.54). Pelajar juga menunjukkan tahap persetujuan yang tinggi bagi kategori berusaha menghindari akhlak tercela seperti sombong dan riak dengan nilai (M=4.54, SP=0.63). Bagi kategori mencontohi akhlak Rasulullah saw berada pada tahap persetujuan yang tinggi dngan nilai (M=4.16, SP=0.92). Secara keseluruhan dapatan tentang kefahaman akhlak ini dalam kalangan

pelajar pintar dan berbakat berada pada tahap persetujuan yang tinggi dengan nilai (M=4.38, SP=0.71).

**Jadual 4: Pembentukan Jati Diri Muslim**

| Pembentukan Jati Diri Muslim | Min | Sisihan Piawai | Tahap Persetujuan |
|---|---|---|---|
| Saya berbangga menjadi seorang Muslim. | 4.90 | 0.30 | Tinggi (sangat setuju) |
| Saya mengamalkan ajaran Islam secara konsisten walaupun dalam tekanan akademik. | 4.72 | 0.66 | Tinggi (sangat setuju) |
| Identiti saya sebagai pelajar pintar tidak menghalang saya mengamalkan Islam. | 4.80 | 0.53 | Tinggi (sangat setuju) |
| Saya merujuk kepada Islam apabila membuat keputusan penting dalam hidup. | 4.42 | 0.75 | Tinggi (Setuju) |
| Islam membentuk nilai diri, sikap dan cara hidup dengan sempurna. | 4.58 | 0.64 | Tinggi (Sangat Setuju) |
| Keseluruhan | 4.68 | 0.58 | Tinggi (Sangat Setuju) |

***Pembentukan Jati Diri Muslim***

Jadual 4 di atas ini menunjukkan hasil dapatan daripada pelajar pintar dan berbakat melalui aspek pembentukan jati diri Muslim. Bagi kategori pelajar merasa bangga menjadi seorang Muslim dengan tahap persetujuan yang sangat tinggi dengan nilai (M=4.90, SP=0.30). Bagi amalan ajaran Islam secara konsisten walaupun dengan tekanan akademik menunjukkan pelajar menyokong keadaan ini dengan tahap persetujuan yang tinggi dengan nilai (M=4.72, SP=0.66). Pelajar juga menunjukkan tahap persetujuan yang tinggi bagi kategori identiti sebagai pelajar pintar tidak menghalang untuk mereka mengamalkan Islam dengan nilai (M=4.80, SP=0.53). Seterusnya pelajar menunjukkan Islam merupakan rujukan utama dalam membuat keputusan penting dalam kehidupan dengan nilai (M=4.42, SP=0.75). Akhir sekali bagi hasil dapatan daripada pelajar menyatakan bahawa Islam dapat membentuk nilai diri, sikap dan cara hidup di dunia ini dengan sempurna dengan nilai (M=4.68, SP=0.58). Hasil keseluruhan dapatan yang telah dianalisis bagi aspek pembentukan jati diri Muslim dalam kalangan pelajar pintar dan berbakat menunjukkan ianya berada pada tahap yang tinggi dengan nilai (M=4.68, SP=0.58).

## Perbincangan

Berdasarkan jadual 2 analisis yang telah dijalankan oleh pengkaji mendapati bahawa kefahaman nilai daripada kalangan pelajar pintar dan berbakat berada pada persetujuan yang

sangat tinggi dengan nilai min keseluruhan (M=4.69). Item yang paling tinggi adalah pada item pelajar merasai kesedaran di mana nilai Islam dapat membantu membentuk jati diri sebagai Muslim. Kajian ini disokong oleh Moh. Mahfud & Sofiatus Zahriyah (2024) di mana pelajar yang mempunyai kesedaran nilai-Islam dan ia diinternalisasikan boleh membentuk jati diri yang berteraskan identiti Muslim. Selain itu kajian Haron, Ramli & Jamil, (2024) turut menyatakan bahawa nilai Islam dianggap asas kepada pembentukan moral dan identiti individu dalam persekitaran pembelajaran seterusnya memupuk keberhasilan jati diri Muslim yang baik dan menjadi contoh kepada yang lain.

Bagi hasil kajian kefahaman akhlak dalam kalangan pelajar pintar dan berbakat menunjukkan hasil dapatan yang tinggi dengan nilai keseluruhan (M=4.38) bagi item pelajar menyatakan persetujuan yang tinggi tentang berusaha menghindari akhlak tercela seperti sombong dan riak daripada kehidupan harian. Kajian lepas daripada Salmah S. Hassan et al., (2024) menunjukkan bahawa tahap penghayatan akhlak yang tinggi, ada peluang lebih baik untuk pelajar menghindari akhlak tercela seperti sombong atau riak. Seterusnya kajian daripada Yusoff et al., (2023) pelajar yang amalkan nilai positif berada dalam kelompok yang lebih baik dari segi akhlak. Ini menunjukkan bahawa kefahaman kepada akhlak dapat mengelakkan diri daripada perkara yang tidak baik terumanya berkaitan dengan tingkah laku atau kesalahan melanggar peraturan yang telah ditetapkan.

Seterusnya hasil dapatan dalam kajian ini berkenaan pembentukan jati diri Muslim melalui perspektif pelajar pintar dan berbakat boleh dilihat pada jadual 4. Secara keseluruhannya tahap persetujuan yang ditunjukkan dalam kajian ini adalah sangat tinggi dengan min keseluruhannya iaitu (M=4.68). Item yang paling tinggi adalah pelajar sangat setuju menyatakan bahawa saya berbangga menjadi seorang Muslim dengan nilai (M=4.90) jika dibandingkan dengan item lain yang ditunjukkan. Ini menunjukkan bahawa kebanggaan menjadi seorang Muslim mampu membentuk jati diri yang tinggi dalam kalangan pelajar. Melalui kajian Nazirul Zainudin, (2024) menunjukkan bahawa pembangunan jati diri dalam Islam menuntut keseimbangan aspek-aspek fizikal, rohani, emosi serta penghayatan nilai Islam dalam kehidupan harian dan bukan hanya aspek keilmuan atau ritual semata-mata. Oleh itu pembentukan jati diri ini mengandungi semua aspek supaya jati diri lebih tinggi dan dapat melahirkan perasaan bangga menjadi seorang individu Muslim.

## Kesimpulan

Kajian ini menegaskan bahawa nilai dan akhlak Islam memainkan peranan yang sangat signifikan dalam membentuk jati diri Muslim yang seimbang, khususnya dalam kalangan pelajar pintar dan berbakat. Pembentukan jati diri Muslim bukan sahaja berteraskan keunggulan intelektual dan prestasi akademik, tetapi turut meliputi keseimbangan rohani, emosi, sosial, dan moral yang berpaksikan kepada ajaran Islam. Konsep ini selaras dengan pendekatan pembangunan insan holistik yang menjadi asas kepada falsafah pendidikan Islam, iaitu membangunkan insan yang berilmu, berakhlak, dan bertanggungjawab terhadap diri, masyarakat serta Tuhannya. Kajian Annasaii Jamar (2024) turut menyatakan bahawa pelajar yang mempunyai pengamalan nilai Islam yang lebih aktif mempunyai landasan yang lebih kuat untuk pembentukan jati diri Muslim.

Dalam konteks pelajar pintar dan berbakat, penghayatan nilai Islam seperti ikhlas, amanah, tawadhu', sabar, dan ihsan menjadi asas kepada keseimbangan diri dan kestabilan emosi. Kecemerlangan tanpa nilai dan akhlak berpotensi melahirkan sikap negatif seperti sombong, riak, dan individualistik. Oleh itu, nilai Islam berfungsi sebagai mekanisme kawalan dalaman (inner control) yang menuntun pelajar untuk menggunakan kelebihan dan kebijaksanaan mereka sebagai amanah Allah SWT, bukan sebagai kelebihan untuk bermegah. Penghayatan nilai ini memperkukuh kesedaran spiritual bahawa setiap ilmu dan kejayaan merupakan sebahagian daripada tanggungjawab ibadah dan jihad ilmu yang membawa manfaat kepada ummah.

Seterusnya, kajian yang dijalankan oleh Zakaria Z. et al. (2024) menekankan ciri-ciri seperti "Akhlaqiyyah" (akhlak), "Rabbaniyyah" (ketuhanan), "Insaniyyah" (kemanusiaan) sebagai elemen utama dalam pendidikan termasuk pelajar pintar dan berbakat. Ini menunjukkan bahawa pelajar pintar dan berbakat Muslim perlu dilengkapi dengan nilai dan akhlak yang mendalam kerana melaluinya dapat melahirkan kecemerlangan intelektual yang seiring dengan nilai dan akhlak yang tinggi. Selain itu, integrasi pendidikan nilai dan akhlak dalam sistem pembelajaran mampu memperkukuh jati diri Muslim dengan membina kefahaman diri (self-awareness), empati sosial, disiplin kendiri, dan keseimbangan emosi. Pelajar pintar dan berbakat yang diasuh dengan nilai Islam yang mantap bukan sahaja akan menjadi individu yang berilmu tinggi, tetapi juga memiliki keperibadian unggul, berjiwa besar, dan berorientasikan kesejahteraan masyarakat. Ini menepati ciri generasi Ulul Albab yang dihasratkan oleh sistem pendidikan Islam yang menggabungkan kekuatan akal dan hati dalam mengurus kehidupan berasaskan panduan wahyu. Jelaslah di sini bahawa pendidikan nilai dan akhlak menjadi teras utama kepada pembentukan jati diri Muslim yang holistik.Ini terutamanya dalam dunia yang penuh cabaran bagi mengimbangi antara nilai-nilai murni sejagat dan arus pembangunan negara yang maju. Maka, usaha membangunkan pelajar dengan pembentukan jati diri Muslim yang unggul perlu berpaksikan kepada nilai Islam yang sahih agar kecerdasan mereka dapat dimanfaatkan untuk kemajuan diri, masyarakat, dan ummah.

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# ANALISIS FAKTOR PENEROKAAN DAN KEBOLEHPERCAYAAN INSTRUMEN AMALAN INOVASI TERBUKA DALAM EKOSISTEM PENGKOMERSIALAN PENYELIDIKAN

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***Abstrak:*** *Amalan Inovasi terbuka semakin mendapat perhatian sebagai satu pendekatan yang dapat membantu meningkatkan kadar pengkomersialan hasil penyelidikan. Dalam konteks universiti, amalan inovasi terbuka memainkan peranan penting dalam memupuk kerjasama, perkongsian pengetahuan dan pemindahan teknologi antara akademia dan industri. Kajian ini merupakan kajian rintis yang bertujuan untuk meneroka dan menilai kesahan dan kebolehpercayaan instrumen amalan inovasi terbuka. Kajian ini menggunakan pendekatan kuantitatif dan data dipungut secara tinjauan menggunakan soal selidik kepada 109 orang responden. Responden terdiri daripada pensyarah Universiti awam Malaysia yang terlibat secara aktif dalam pengkomersialan hasil penyelidikan. Hasil analisis deskriptif mendapati bahawa responden sering kali mengamalkan inovasi terbuka dalam mengkomersialkan hasil penyelidikan mereka. Dalam Analisis Faktor Penerokaan (EFA), keputusan menunjukkan bahawa nilai Kaiser-Meyer-Olkin (KMO) melebihi 0.50 dan ujian Barlett's Test of Sphericity menunjukkan hasil yang signifikan. Tidak ada item yang dihapus dalam kajian ini. Manakala hasil ujian kebolehpercayaan bagi 9 item instrumen amalan inovasi terbuka ini adalah diterima dengan nilai alfa Cronbach 0.916. Kesimpulannya, penemuan kajian ini menunjukkan bahawa instrumen tersebut mempunyai kesahan dan kebolehpercayaan yang tinggi dan sedia untuk diuji pada peringkat seterusnya.*

***Kata kunci:*** *amalan inovasi terbuka; pengkomersialan hasil penyelidikan; analisis faktor penerokaan*

## Pengenalan

Inovasi terbuka adalah konsep yang dicadangkan oleh Profesor Henry W. Chesbrough pada tahun 2003. Ia menekankan kepentingan kerjasama dan perkongsian pengetahuan antara organisasi untuk memacu inovasi dan membawa kejayaan pengkomersialan. Apabila bercakap mengenai universiti dan hasil penyelidikan mereka, amalan inovasi terbuka memainkan peranan penting dalam merapatkan jurang antara akademik dan industri (APEC Policy 2018). Universiti terkenal dengan keupayaan penyelidikan mereka dan sering menjana harta intelek yang berharga melalui aktiviti penyelidikan. Walau bagaimanapun, proses menterjemah hasil penyelidikan ini ke dalam aplikasi dunia sebenar dan produk komersial merupakan satu cabaran bagi penyelidik universiti. Di sinilah amalan inovasi terbuka memainkan peranan, memudahkan pemindahan pengetahuan dan teknologi daripada universiti ke sektor komersial (Razak et al. 2014).

Kajian semasa turut menunjukkan bahawa pengkomersialan di universiti awam Malaysia masih berdepan halangan struktural dan sistemik seperti pengurusan IP, kekangan pasaran dan jurang kerjasama industri (Azlin Abd Jamil et al., 2024). MOSTI juga memperkenalkan BioInnovation Launchpad 2025 bagi menangani cabaran pengkomersialan hasil penyelidikan tempatan, menandakan komitmen negara terhadap ekosistem inovasi universiti–industri (MOSTI, 2025).

Salah satu falsafah teras inovasi terbuka seperti yang diketengahkan oleh Chesbrough ialah keperluan untuk syarikat melibatkan diri dalam kerjasama luar (APEC Policy 2018). Dalam konteks universiti, ini bermakna universiti bekerjasama dengan industri, usahawan dan pihak berkepentingan lain untuk memanfaatkan hasil penyelidikan mereka untuk tujuan komersial. Dengan mencari kerjasama luar secara aktif, universiti boleh memanfaatkan kepakaran tambahan, sumber dan pasaran yang boleh menyumbang kepada kejayaan pengkomersialan penyelidikan mereka (Álvarez-Castañón & Palacios-Bustamante 2021).

Tambahan itu, dapatan global mutakhir menunjukkan bahawa artikel penyelidikan akademik yang diterbitkan sebagai open access meningkatkan peluang disitir dalam paten, sekali gus memperlihatkan pengaruh langsung universiti terhadap pembangunan teknologi industri (Dorta-González et al., 2025).

Pengkomersialan hasil penyelidikan terutamanya dari universiti di Malaysia telah diiktiraf sebagai sumber pendapatan yang menyumbang kepada ekonomi negara. Pada tahun 2019, kadar pengkomersialan hasil penyelidikan dan pembangunan di universiti awam adalah 4.3% dan masih berada di bawah paras antarabangsa iaitu 5% (Unit Perancang Ekonomi 2021). Berdasarkan kepada status produk dan teknologi di dalam Portal Rasmi Pusat Maklumat Sains dan Teknologi Malaysia (MASTIC), bilangan produk dan teknologi yang telah didaftarkan di bawah status berpotensi untuk dikomersialkan adalah berjumlah 1,205 pendaftaran. Namun, hanya 214 (17.76%) projek sahaja telah berjaya dikomersialkan (Portal Rasmi MASTIC 2022). Halangan ini turut disahkan oleh kajian terkini yang mengenal pasti kekurangan pengurusan sumber, birokrasi universiti dan hubungan industri yang lemah sebagai faktor penghalang utama (Habidin & Yahaya, 2024; Razak et al., 2024).

Justeru, adalah satu kerugian jika perkara ini tidak dikaji. Oleh itu, dengan mempertimbangkan amalan inovasi terbuka sebagai faktor yang mempengaruhi pengkomersialan hasil penyelidikan, kajian ini bertujuan meneroka dan menilai kesahan dan kebolehpercayaan item-item bagi mengukur konstruk amalan inovasi terbuka yang digunakan dalam kalangan pensyarah universiti awam di Malaysia.

## Sorotan Literatur

### *Pengkomersialan Hasil Penyelidikan*

Kementerian Pendidikan Tinggi telah memacu aktiviti penyelidikan dan pembangunan (R&D) dalam kalangan universiti melalui penubuhan budaya penyelidikan (2006–2008), memacu penyelidikan yang berkualiti (2008–2010) dan kemudiannya mempromosikan kecemerlangan penyelidikan dengan penghasilan inovasi dan pengkomersialan (2011–2012) (Aziz et al. 2011). Secara umum, pengkomersialan menggambarkan proses mengubah penyelidikan ke dalam aplikasi praktikal dengan potensi komersial, mendapatkan hak perlindungan paten untuk

inovasi dan kemudian memindahkannya ke industri melalui perjanjian pelesenan atau syarikat terbitan (Bansi 2016).

Selain itu, pengkomersialan adalah proses yang mengubah pengetahuan yang dihasilkan dalam organisasi penyelidikan ke dalam produk yang dapat dipasarkan dalam pasaran (Salter & Martin 2001). Menurut Åstebro (2004), pengkomersialan adalah proses atau perkhidmatan baharu yang membawa kepada pertumbuhan ekonomi negara, peningkatan pekerjaan dan keuntungan kepada syarikat. Bagi ahli akademik, mengkomersialkan penyelidikan bertujuan untuk mendapatkan pengiktirafan dan kemajuan dalam kerjaya. Selain itu, aktiviti komersial juga dapat menjana dana penyelidikan serta sebagai faktor motivasi dalaman mereka (Ismail et al. 2015).

Kajian mutakhir menunjukkan bahawa hubungan antara universiti, industri dan kerajaan kini semakin kompleks. Jeong et al. (2025) membuktikan bahawa jaringan inovasi nasional yang heterogen mempengaruhi aliran pengetahuan, sekali gus memberi kesan kepada peluang pengkomersialan. Selain itu, Habidin & Yahaya (2024) mengenal pasti peranan pengurusan harta intelek (IP) sebagai faktor kritikal dalam memastikan hasil penyelidikan dapat dipasarkan dengan berkesan.

Keupayaan ahli akademik untuk memindahkan pengetahuan secara berkesan kepada industri adalah kunci kepada universiti bagi mencapai misi keusahawanan (Miller et al. 2018). Selain itu, kepentingan pemindahan pengetahuan dari universiti sebagai sumber idea dan ciptaan baru telah meletakkan universiti sebagai pelopor utama dalam sistem inovasi serantau (Schmitz et al. 2017). Kajian terbaru di Malaysia turut memperincikan bagaimana komersialisasi memberi kesan kepada daya saing institusi dan hubungan strategik dengan industri (Razak, Abdul Rahim & Hashim, 2024).

### *Amalan Inovasi Terbuka*

Inovasi adalah penting untuk kelebihan daya saing dan kejayaan sesebuah organisasi. Semua organisasi memerlukan inovasi untuk meningkatkan bahagian pasaran (Johannessen et al. 2001). Organisasi mendapat motivasi kerana pengantarabangsaan dan persaingan dalam inovasi (Harris et al. 2013). Perkataan inovasi berasal daripada perkataan Latin iaitu innovate yang bermaksud memperbaharui atau mengubah (Mckeown 2014).

Pada tahun 2003, Henry Chesbrough memperkenalkan pendekatan inovasi baru yang disebut inovasi terbuka. Konsep ini semakin berkembang dan kini diaplikasikan oleh organisasi awam, termasuk universiti, bagi meningkatkan prestasi inovasi (Alves de Lima Júnior et al., 2024). Inovasi terbuka memberi peluang kepada organisasi untuk bergerak melampaui perspektif tradisional, mencipta nilai dengan mempertimbangkan aliran pengetahuan masuk dan keluar bagi mempercepatkan inovasi dalaman (Chesbrough 2006).

Kajian terkini di Malaysia turut menunjukkan bahawa amalan inovasi terbuka secara signifikan mempengaruhi kejayaan pengkomersialan penyelidikan (Muhammad Razaki et al., 2023). Tambahan itu, instrumen pengukuran amalan inovasi terbuka yang dibangunkan dan divalidasi oleh Razaki, Ismail & Anuar (2023) memberikan asas penting bagi menilai tahap keterbukaan inovasi dalam kalangan akademik.

Selain itu, penyelidikan mendapati bahawa idea dan inovasi yang berharga kini semakin kerap berasal daripada pelbagai sumber dalaman dan luaran, termasuk rakan industri, kerajaan dan komuniti inovasi (Chesbrough 2012; Freixanet et al. 2021). Ini menunjukkan kepentingan ekosistem inovasi terbuka yang inklusif dan saling bergantung.

### *Amalan Inovasi Terbuka dalam Pengkomersialan Hasil Penyelidikan*

Amalan inovasi terbuka membenarkan ilmu, teknologi dan idea bergerak masuk dan keluar organisasi. Projek atau penyelidikan boleh dijalankan menggunakan sumber teknologi dalaman atau luaran, dan hasilnya boleh dipasarkan melalui pelesenan, spin-off atau perkongsian industri (Razak & Murray 2017).

Kajian antarabangsa menunjukkan bahawa amalan inovasi terbuka meningkatkan peluang kejayaan komersial melalui kerjasama dan integrasi pengetahuan (Camerani et al. 2016). Di Malaysia, dapatan empirikal mengesahkan bahawa akademik yang aktif mengamalkan inovasi terbuka menunjukkan kecenderungan lebih tinggi untuk mengkomersialkan penyelidikan mereka (Muhammad Razaki et al., 2023).

Dalam konteks universiti, inovasi terbuka sering melibatkan kerjasama dengan industri sewaktu fasa pembangunan, pengeluaran dan pemasaran (Ismail et al. 2012; Azmi & Alavi 2013). Model inovasi terbuka ini kini menjadi lebih penting berikutan cabaran baharu yang dihadapi spin-off universiti dari segi pembiayaan, kapasiti inovasi dan penembusan pasaran (Tumeran & Johan, 2025).

Selanjutnya, kajian global 2025 menunjukkan bahawa aliran pengetahuan akademik yang terbuka mempunyai kebarangkalian lebih tinggi memberi kesan langsung kepada inovasi industri melalui sitasi paten (Dorta-González et al., 2025), sekali gus menguatkan lagi rasional penggunaan inovasi terbuka dalam pengkomersialan penyelidikan.

## Metodologi Kajian

Sebelum menjalankan kajian sebenar atau lapangan, kajian rintis perlu dilakukan bagi mengesahkan soal selidik yang telah dibentuk supaya dapat difahami dengan baik oleh responden kajian. Kajian rintis merupakan kajian yang berskala kecil sebelum kajian sebenar dijalankan (Anderson 1998). Menurut Zikmund (2003), pra ujian merupakan langkah percubaan sebelum melaksanakan kajian sebenar ke atas kumpulan responden dengan tujuan memastikan keberkesanan reka bentuk kajian yang digunakan. Dalam konteks kajian ini, kajian rintis dapat membantu penyelidik dalam memperbaiki item-item soal selidik terutamanya dari segi bahasa, ketepatan soalan dan arahan serta anggaran masa yang diperlukan bagi responden menjawab soal selidik tersebut. Kajian rintis ini telah dilakukan ke atas 109 orang responden dalam kalangan pensyarah yang terlibat dengan pengkomersialan hasil penyelidikan. Bilangan ini menepati ciri-ciri kajian rintis yang mencadangkan sekurang-kurangnya 100 sampel untuk mendapatkan keputusan yang sah bagi analisis faktor penerokaan dijalankan (Hair et al. 2017). Teknik persampelan yang digunakan adalah persampelan rawak mudah dimana setiap responden mempunyai kebarangkalian yang sama untuk dipilih sebagai sampel kajian.

Dalam kajian ini, dilakukan Analisis faktor penerokaan (EFA) dengan tujuan untuk mengenal pasti dan menyusun sebilangan besar item soal selidik ke dalam komponen-komponen di bawah konstruk tertentu (Tabachnick & Fidell 2014). EFA bertujuan untuk menentukan apakah item-item yang terdapat dalam konstruk terpilih dapat digunakan dalam kajian sebenar.

Manakala kebolehpercayaan instrumen pula dilakukan bagi melihat tahap ketekalan dalam konstruk kajian dan ia merupakan kaedah yang paling tepat digunakan bagi pendekatan kuantitatif (Sekaran 2006). Dalam kajian ini, kebolehpercayaan instrumen dinilai dengan melihat nilai alfa Cronbach. Menurut Sekaran dan Bougie (2016), nilai alfa Cronbach yang tinggi adalah lebih baik dan menurut Hair et al. (2010), nilai alfa Cronbach 0.70 dan ke atas sebagai nilai kebolehpercayaan yang dapat diterima.

Pengukuran bagi konstruk amalan inovasi terbuka diukur menggunakan sembilan item pengukuran yang diperoleh daripada kajian Chesbrough dan Brunswicker (2014); Freixanet et al. (2021) dan Razak & Murray (2017). Skala yang digunakan adalah skala likert frekuensi lima mata iaitu 1=Tidak pernah; 2=Jarang sekali; 3=Kadang-kadang; 4=Selalu dan 5=Sangat kerap. Pengukuran sembilan item yang dirasakan relevan bagi amalan inovasi terbuka ditunjukkan dalam Jadual 1.

**Jadual 1: Item Yang Mewakili Amalan Inovasi Terbuka**

| Item | | Kod |
|---|---|---|
| 1 | Saya menjalinkan kerjasama formal dengan orang lain untuk memperoleh idea pengkomersialan | AIT1 |
| 2 | Saya mendapatkan idea pengkomersialan dari orang di luar universiti | AIT2 |
| 3 | Saya berkongsi idea pengkomersialan saya dengan orang lain di luar universiti saya | AIT3 |
| 4 | Saya mempromosikan idea pengkomersialan saya kepada orang di luar universiti saya | AIT4 |
| 5 | Saya outsource sebahagian projek penyelidikan kepada orang di luar universiti saya | AIT5 |
| 6 | Saya menyumbangkan idea saya kepada orang lain | AIT6 |
| 7 | Saya memperoleh idea (berkaitan harta intelek) daripada orang lain | AIT7 |
| 8 | Saya menggunakan idea dari orang lain untuk penyelidikan dan pembangunan selanjutnya | AIT8 |
| 9 | Saya mendapat input daripada orang lain untuk memperbaiki idea penyelidikan saya | AIT9 |

## Dapatan Kajian

### *Profil Responden*

Hasil analisis kekerapan dan peratusan bagi demografi responden yang menggunakan perisian *Statistical Package for the Social Sciences* (SPSS) versi 25 dapat dilihat dalam Jadual 2. Terdapat enam ciri demografi responden yang diterangkan iaitu jenis universiti, jawatan, jantina, umur, pengalaman sebagai penyelidik dan bidang penyelidikan. Berdasarkan jenis universiti, sebanyak 40.4 peratus responden adalah dari universiti berfokus manakala 31.2 peratus dari universiti penyelidikan dan selebihnya 28.4 peratus dari universiti komprehensif.

Bagi kategori jawatan pula, sebanyak 41.3 peratus responden adalah berjawatan profesor madya, 30.3 peratus berjawatan profesor, 26.6 peratus adalah pensyarah kanan dan hanya 1.8 peratus merupakan pensyarah. Dari segi jantina pula, majoriti responden adalah lelaki iaitu sebanyak 65.1 peratus dan responden perempuan hanya 34.9 peratus. Ini menunjukkan responden lelaki lebih responsif terhadap tinjauan ini berbanding reponden perempuan. Apabila melihat taburan umur, didapati majoriti responden adalah dalam lingkungan umur 40 hingga 49 tahun iaitu sebanyak 56 peratus. Masing-masing 23.9 peratus dan 18.3 peratus merupakan responden yang berumur antara 50 hingga 59 tahun dan 30 hingga 39 tahun. Sementara itu, sebanyak 1.8 peratus adalah mereka yang berumur 60 tahun ke atas. Dari segi pengalaman sebagai seorang penyelidik, hampir keseluruhan responden yang terlibat dalam pengkomersialan hasil penyelidikan ini mempunyai lebih dari 10 tahun pengalaman sebagai penyelidik iaitu sebanyak 84.4 peratus. Bagi bidang penyelidikan pula, sebanyak 40.4 peratus adalah dari bidang sains tulen dan gunaan diikuti dengan bidang teknologi dan kejuruteraan sebanyak 28.4 peratus. Bidang yang paling sedikit yang menjadi responden dalam kajian ini adalah bidang teknologi maklumat dan komunikasi iaitu hanya 1.8 peratus.

**Jadual 2: Demografi Responden (n = 109)**

| Demografi Responden | Kekerapan | Peratusan (%) |
|---|---|---|
| **Jenis Universiti** | | |
| Universiti Penyelidikan | 34 | 31.2 |
| Universiti Komprehensif | 31 | 28.4 |
| Universiti Berfokus | 44 | 40.4 |
| **Jawatan** | | |
| Profesor | 33 | 30.3 |
| Profesor Madya | 45 | 41.3 |
| Pensyarah Kanan | 29 | 26.6 |
| Pensyarah | 2 | 1.8 |
| **Jantina** | | |
| Lelaki | 71 | 65.1 |
| Perempuan | 38 | 34.9 |
| **Umur** | | |
| 30 – 39 tahun | 20 | 18.3 |
| 40 – 49 tahun | 61 | 56.0 |
| 50 – 59 tahun | 26 | 23.9 |
| >= 60 tahun | 2 | 1.8 |
| **Pengalaman sebagai Penyelidik** | | |
| 6 – 10 tahun | 17 | 15.6 |
| Lebih 10 tahun | 92 | 84.4 |
| **Bidang Penyelidikan** | | |
| Sains Tulen & Gunaan | 44 | 40.4 |
| Teknologi & Kejuruteraan | 31 | 28.4 |
| Sains Sosial | 16 | 14.7 |
| Teknologi Maklumat dan Komunikasi | 2 | 1.8 |
| Sains Kesihatan dan Klinikal | 11 | 10.1 |
| Sastera & Sastera Ikhtisas | 5 | 4.6 |

***Analisis Deskriptif***

Skor min keseluruhan bagi amalan inovasi terbuka adalah 3.47 dengan sisihan piawai 0.756 ditunjukkan dalam Jadual 3. Item AIT6 iaitu saya menyumbangkan idea saya kepada orang lain mendapat nilai purata tertinggi berbanding item lain iaitu dengan nilai min 3.74 diikuti item AIT3 iaitu saya berkongsi idea pengkomersialan saya dengan orang lain di luar universiti (nilai min 3.71). Selain itu, responden juga hampir selalu menjalinkan kerjasama formal dengan orang lain untuk memperoleh idea pengkomersialan (AIT1) iaitu dengan nilai min 3.66, mendapat input dari orang lain untuk memperbaiki idea penyelidikan (AIT9) dengan nilai min 3.62 dan mempromosikan idea pengkomersialan kepada orang diluar universiti (AIT4) dengan nilai min 3.56. Taburan data dalam analisis deskriptif juga menjelaskan responden kadang-kadang mendapatkan idea pengkomersialan dari orang di luar universiti (AIT2), memperoleh idea (berkaitan harta intelek) daripada orang lain (AIT7), *outsource* sebahagian projek penyelidikan kepada orang di luar universiti (AIT5) dan menggunakan idea dari orang lain untuk penyelidikan dan pembangunan selanjutnya (AIT8).

**Jadual 3: Analisis Deskriptif Instrumen Amalan Inovasi Terbuka**

| Item | Nilai Min | Sisihan Piawai |
|---|---|---|
| AIT1 | 3.66 | 0.945 |
| AIT2 | 3.45 | 1.004 |
| AIT3 | 3.71 | 1.021 |
| AIT4 | 3.56 | 0.957 |
| AIT5 | 3.08 | 1.001 |
| AIT6 | 3.74 | 0.966 |
| AIT7 | 3.39 | 0.980 |
| AIT8 | 3.03 | 1.013 |
| AIT9 | 3.62 | 0.911 |
| Keseluruhan | 3.47 | 0.756 |

***Analisis Faktor Penerokaan***

Amalan Inovasi Terbuka terdiri daripada 9 item. Ujian *Kaiser-Meyer-Olkin* (KMO) mempamerkan *multicollinearity* yang membantu mengenal pasti sama ada item-item dalam konstruk ini sesuai atau pun tidak sesuai untuk dijalankan analisis faktor. Berdasarkan dapatan kajian ini, nilai KMO untuk amalan inovasi terbuka ialah 0.885 dan ini menunjukkan data tidak mempunyai masalah *multicollinearity* yang serius dan sesuai untuk dijalankan analisis faktor. Ujian *Bartlett's Test of Sphericity* pula digunakan bagi mengenal pasti sama ada korelasi antara item memadai atau pun tidak untuk analisis faktor dijalankan. Nilai *Bartlett's Test of Sphericity* bagi konstruk amalan inovasi terbuka adalah signifikan iaitu $p < 0.05$ dan ini menunjukkan bahawa korelasi antara item adalah memadai dan boleh dilakukan analisis faktor. Dari segi varians kumulatif, jumlah varians amalan inovasi terbuka ialah 69.142% iaitu lebih besar daripada nilai minimum 60% yang dicadangkan oleh Hair *et al.* (2010). Jadual 4 membentangkan nilai perincian muatan faktor untuk amalan inovasi terbuka antara 0.781 hingga 0.887. Nilai muatan faktor melebihi 0.45 boleh diterima (Tabachnick & Fidell 2014). Kesimpulannya, kesemua item yang terkandung adalah menggambarkan konstruk amalan inovasi terbuka.

**Jadual 4: Analisis Faktor bagi Amalan Inovasi Terbuka**

| Item | Muatan Faktor |
|---|---|
| AIT1 | 0.887 |
| AIT2 | 0.831 |
| AIT3 | 0.878 |
| AIT4 | 0.874 |
| AIT5 | 0.845 |
| AIT6 | 0.781 |
| AIT7 | 0.782 |
| AIT8 | 0.808 |
| AIT9 | 0.790 |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | 0.885 |
| Bartlett's Test of Sphericity | |
| Approx. Chi-Square | 812.562 |
| df | 36 |
| Sig. | 0.000 |
| Total | 6.223 |
| % of Variance | 69.142 |

***Analisis Kebolehpercayaan***

Berdasarkan keputusan analisis kebolehpercayaan bagi 9 item instrumen amalan inovasi terbuka menunjukkan tahap kebolehpercayaan yang baik telah dicapai dengan nilai alfa Cronbach 0.916 iaitu lebih besar dari 0.70 (Hair *et al*. 2017) seperti dalam Jadual 5. Kesemua item bagi konstruk amalan inovasi terbuka masih dikekalkan untuk diuji dalam kajian sebenar. Justeru, dapat disimpulkan bahawa pengukuran konstruk ini adalah sesuai dan relevan digunakan dalam konteks pensyarah di Universiti awam Malaysia.

**Jadual 5: Analisis Kebolehpercayaan Instrumen Amalan Inovasi Terbuka**

| Item | Nilai Alfa Cronbach |
|---|---|
| AIT1 | 0.902 |
| AIT2 | 0.901 |
| AIT3 | 0.905 |
| AIT4 | 0.903 |
| AIT5 | 0.910 |
| AIT6 | 0.908 |
| AIT7 | 0.911 |
| AIT8 | 0.913 |
| AIT9 | 0.899 |
| Keseluruhan | 0.916 |

**Perbincangan dan Kesimpulan**

Secara umumnya, kertas kajian ini bertujuan untuk meneroka dan menilai konstruk amalan inovasi terbuka yang digunakan dalam aktiviti pengkomersialan hasil penyelidikan di Universiti secara tinjauan awal. Hasil kajian menunjukkan bahawa instrumen ini mempunyai

kesahan dan kebolehpercayaan yang tinggi. Oleh itu, kajian lanjut akan dijalankan bagi mendapatkan data dengan lebih mendalam. Amalan inovasi terbuka boleh dijadikan faktor utama kepada para pensyarah untuk lebih aktif menjalankan penyelidikan sekaligus menghasilkan penyelidikan yang dapat dikomersialkan. Pada hari ini, pengkomersialan hasil penyelidikan membolehkan universiti untuk mengubah pengetahuan dan hasil penemuan menjadi produk atau perkhidmatan yang bernilai komersial. Dengan mengkomersialkan hasil penyelidikan, universiti dapat mencipta peluang perniagaan baru, mendorong inovasi dan menyumbang pada pertumbuhan ekonomi negara.

## Penghargaan

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# AYAT KURSI SEBAGAI TERAPI KOGNITIF TAUHIDI: ANALISIS TAFSIR DAN PSIKOLOGI KOGNITIF

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***Abstrak:*** *Ayat Kursi (al-Baqarah 2:255) merupakan antara ayat paling agung dalam al-Qur'an yang menegaskan konsep ketuhanan secara komprehensif. Selain kedudukannya dalam tradisi tafsir, ayat ini mempunyai nilai psikoterapeutik yang signifikan, khususnya dalam aspek ketenangan kognitif, kestabilan emosi, dan pembinaan makna diri. Kajian ini menganalisis potensi Ayat Kursi sebagai "Terapi Kognitif Tauhidi," iaitu proses pembetulan struktur kognitif manusia melalui pemahaman tauhid rubūbiyyah, ulūhiyyah, dan asmā' wa ṣifāt. Melalui analisis tafsir klasik (al-Ṭabarī, al-Qurṭubī, Ibn Kathīr) dan tafsir kontemporari (Sayyid Quṭb, al-Sha'rāwī), kajian meneliti dimensi-dimensi pemikiran yang dibentuk oleh ayat ini. Dapatan menunjukkan bahawa Ayat Kursi mengandungi empat elemen kognitif utama: (1) pengukuhan core belief tauhidi, (2) penghapusan distorsi kognitif berkaitan takut dan bimbang, (3) pemulihan kawalan diri berasaskan tawakal, dan (4) penstrukturan semula makna hidup melalui kesedaran rububiyyah Allah. Kajian ini mengemukakan model awal "Tauhidi Cognitive Restructuring (TCR)" sebagai asas psikoterapi Islam berasaskan wahyu. Implikasi kajian mencadangkan supaya Ayat Kursi digunakan sebagai modul intervensi kognitif dalam kaunseling dan terapi Islam kontemporari.*

***Kata Kunci:*** *Ayat Kursi, terapi kognitif tauhidi, psikologi kognitif, tafsir al-Qur'an, psikoterapi Islam.*

## Pengenalan

Ayat Kursi merupakan ayat yang paling agung dalam al-Qur'an berdasarkan hadis sahih *(Muslim, 810)*, sebagaimana dijelaskan dalam perbahasan tentang kedudukan *Kutub al-Sittah* termasuk *Sahih Muslim* sebagai sumber hadis sahih utama (Harmuliani, Rubino, & Putra, 2023). Ia menegaskan kekuasaan Allah, keesaan-Nya, ilmu-Nya yang menyeluruh, dan penjagaan-Nya yang mutlak, sebagaimana dihuraikan dalam kajian tentang maksud teologi dan akidah Ayat Kursi yang menjelaskan sifat-sifat ketuhanan dan keagungan Allah (Al-Rifai, 2022).

Para ulama menegaskan bahawa inti kandungan Ayat Kursi ialah tauhid yang meliputi aspek pemikiran, jiwa, dan tingkah laku, sebagaimana dijelaskan dalam *Tafsīr al-Qurṭubī* dan karya ulama Andalusia yang mengulas tafsir ini secara mendalam (Ruano, 2017; Sakka, 2025). Dalam konteks psikologi moden, *Cognitive Behavioural Therapy (CBT)* menekankan pembetulan pemikiran tidak rasional (Abas, 2021). Namun, CBT bersifat sekular dan tidak menyentuh aspek ketuhanan.

Oleh itu, sarjana terapi Islam seperti Malik Badri (2000), Rothman (2018), dan Haque (2018) menegaskan perlunya pembangunan terapi berasaskan wahyu, bukan hanya Islamisasi model Barat. Kajian terkini oleh Abas dan Sahad (2021) menyokong pandangan Malik Badri bahawa CBT boleh diintegrasikan dengan prinsip Qur'ani melalui pendekatan *Qur'anic Cognitive*

*Therapy* yang membetulkan "kepercayaan" (*iṣlāḥ*) secara spiritual. Kajian ini bertujuan meneroka Ayat Kursi sebagai struktur kognitif tauhidi yang mampu berfungsi sebagai terapi bagi menghapuskan *distorsi kognitif* seperti ketakutan melampau, keresahan, dan rasa tidak selamat — seperti dibincangkan dalam psikologi klinikal dan terapi berasaskan al-Qur'an (Suyanto, 2017; Ady, Mustofa, & Nadlir, 2024).

## Sorotan Literatur

### *Tafsir Ayat Kursi: Dimensi Tauhid dan Ketenangan Jiwa*

Dalam tradisi tafsir klasik, Ayat Kursi dilihat sebagai ayat yang mengandungi pengesaan Allah secara menyeluruh, merangkumi kekuasaan-Nya, ilmu-Nya, dan penjagaan-Nya yang tidak pernah terputus. Al-Ṭabarī menjelaskan bahawa penegasan Allah sebagai "الْحَيُّ الْقَيُّومُ" memberikan ketenangan kepada jiwa mukmin kerana ia menghapuskan ketakutan dan kerisauan terhadap kelemahan manusia — Allah tidak pernah tidur, tidak pernah lalai, dan sentiasa mengurus segala hal makhluk-Nya secara berterusan. Perspektif ini ditegaskan dalam kajian tentang metodologi tafsir Al-Ṭabarī yang menampilkan keseimbangan antara aspek teologi dan rasionalisme dalam memahami sifat-sifat Ilahi (Frolov & Zaripov, 2023; Karimi Nia, 2017).

Ibn Kathīr pula menekankan aspek rububiyyah Allah sebagai sumber ketenteraman rohani, kerana kesedaran bahawa seluruh langit dan bumi berada dalam penguasaan Allah membina rasa aman yang mendalam. Kajian perbandingan tafsir klasik mendapati bahawa Ibn Kathīr mengutamakan sumber bil-ma'thūr (al-Qur'an dan hadis) bagi menegaskan bahawa tiada sesuatu pun berlaku tanpa ilmu dan izin Allah (Imaduddin, Faturrohman, & Jamarudin, 2023; Permatasari & Rhain, 2024).

Dalam tafsir al-Qurṭubī, Ayat Kursi turut dikaitkan dengan penghapusan was-was syaitan kerana kekuatan maknanya yang meneguhkan aqidah dapat menangkis gangguan kognitif yang menimbulkan ketakutan dan keresahan (B.A & Haq, 2024). Tafsir ini menunjukkan orientasi etika dan spiritual yang kuat, yang menurut Qurtubi bersumber daripada pemahaman mendalam terhadap tauhid rububiyyah dan uluhiyyah.

Pandangan tafsir kontemporari pula mengembangkan dimensi psikospiritual Ayat Kursi dengan melihatnya sebagai struktur mental dan emosi yang membina tasawwur islami (cara pandang hidup Islam). Sayyid Quṭb menjelaskan bahawa ayat ini mencipta suasana ketenangan eksistensial kerana ia menempatkan manusia dalam alam yang dipimpin Tuhan Yang Maha Mengetahui dan Maha Berkuasa (Aliyu, 2025). Manakala al-Sha'rāwī menegaskan bahawa ketenangan itu lahir daripada kesedaran mendalam bahawa Allah mengurus setiap urusan hamba-Nya, yang menghapuskan rasa takut dan gelisah (Usman, Ahmad, & Possumah, 2024).

### *Psikologi Kognitif dan Terapi Kognitif*

Psikologi kognitif menegaskan bahawa tingkah laku dan emosi manusia dipengaruhi oleh struktur pemikiran (schemas dan core beliefs). Apabila struktur ini tidak seimbang, ia menghasilkan distorsi kognitif yang mencetuskan keresahan dan stres. Bentuk-bentuk distorsi seperti catastrophizing, overgeneralization, dan emotional reasoning dikenal pasti sebagai punca utama masalah emosi dalam psikologi klinikal (Dobson & Dozois, 2019).

Cognitive Behavioural Therapy (CBT) kemudian dibangunkan bagi membetulkan pemikiran negatif melalui proses cognitive restructuring, membantu individu menggantikan kepercayaan teras yang salah dengan kepercayaan yang lebih rasional dan berasaskan realiti. Kajian menunjukkan bahawa CBT berkesan menangani masalah seperti kebimbangan, kemurungan, dan pemikiran obsesif, serta diadaptasi untuk populasi Muslim dengan pendekatan budaya yang sesuai (Abas & Sahad, 2021).

***Integrasi Islam–Psikologi: Tauhidi Cognitive Therapy***

Dalam usaha menyatukan psikologi moden dengan prinsip Islam, sarjana kontemporari mengembangkan pendekatan psikoterapi berasaskan aqidah dan nilai spiritual. Haque (2018) dan Abdullah (2020) membangunkan model Islamic-CBT, yang menggabungkan teknik cognitive restructuring dengan nilai-nilai tauhid dan akhlak. Kajian kontemporari menunjukkan bahawa pendekatan ini menekankan pemulihan kesedaran spiritual (ruhani) sebagai asas perubahan kognitif (Rothman & Coyle, 2021).

Selain itu, Islamic Integrated Psychotherapy oleh Rothman dan Coyle menekankan keharmonian antara dimensi spiritual, kognitif, dan tingkah laku, berbeza daripada CBT sekular yang hanya fokus pada pemikiran logikal (Fahdzlan Ginting, 2023). Malik Badri (2000) pula memperkenalkan pendekatan tazkiyah-based therapy, yang berasaskan penyucian jiwa sebagai kunci terapi psikospiritual.

Walaupun banyak usaha integrasi dilakukan, kajian yang meneliti ayat al-Qur'an secara spesifik sebagai modul terapi sistematik masih terhad. Seperti yang dijelaskan oleh Abas (2021), Ayat Kursi memiliki struktur kognitif tauhidi yang berpotensi berfungsi sebagai alat cognitive restructuring dalam konteks terapi keislaman. Kajian ini mengisi kekosongan tersebut dengan mengusulkan pendekatan "Tauhidi Cognitive Therapy" yang berpaksikan kepada kandungan wahyu, bukan sekadar Islamisasi model Barat.

**Metodologi**

Kajian ini menggunakan pendekatan analisis dokumen kualitatif yang menekankan penelitian mendalam terhadap teks-teks tafsir dan teori psikologi kognitif. Pendekatan kualitatif ini sesuai untuk meneliti makna teks al-Qur'an secara kontekstual dan analitis, sebagaimana digunakan dalam kajian tafsir tematik dan hermeneutik moden (Fahdzlan Ginting, 2023). Reka bentuk ini dipilih kerana objektif utama kajian ialah memahami kandungan Ayat Kursi secara tekstual dan menafsirkannya melalui lensa psikologi kognitif. Kaedah ini memungkinkan peneliti menelusuri makna ayat secara komprehensif sambil menghubungkannya dengan kerangka pemikiran moden dalam psikoterapi.

Dari sudut analisis tafsir (textual exegesis), kajian ini menggunakan metod tafsir maudhu'i (tematik) yang menumpukan kepada tema khusus, iaitu dimensi kognitif tauhidi dalam Ayat Kursi. Kaedah tafsir ini menekankan pengumpulan ayat-ayat yang berkaitan dengan satu tema dan dianalisis secara sistematik untuk mendapatkan pemahaman menyeluruh (Rahendra Maya, Alfarisi, Rokim, & Bulloh, 2023). Pendekatan maudhu'i ini turut disokong oleh analisis semantik, iaitu analisis terhadap struktur kata, makna, dan gaya bahasa untuk memahami makna teologi dan psikospiritual ayat (Luhuringbudi, Raya, Liza, & Utami, 2024).

Untuk tujuan ini, kajian merujuk kepada sejumlah sumber tafsir utama, termasuk Tafsir al-Ṭabarī, al-Qurṭubī, Ibn Kathīr, al-Sa'dī, Fi Ẓilāl al-Qur'ān oleh Sayyid Quṭb, dan Tafsir al-Sha'rāwī. Pemilihan ini berdasarkan keterwakilan pelbagai pendekatan tafsir klasik dan kontemporari (Usman, Ahmad, & Possumah, 2024; Anshory, 2020; Nettler, 1994). Tafsir klasik menonjolkan aspek teologi dan filologi, sementara tafsir moden seperti Fi Ẓilāl al-Qur'ān memberikan penekanan terhadap aspek tematik dan psikospiritual (Husain & Tahir, 2019).

Seterusnya, bagi analisis psikologi kognitif, kajian ini menggunakan kerangka teori utama daripada Cognitive Psychology dan Cognitive Behavioural Therapy (CBT). Ayat Kursi dianalisis berdasarkan konsep asas seperti schemas, core beliefs, dan cognitive distortions yang merupakan penyebab utama keresahan dan disfungsi emosi. Teori Beck (2011) tentang cognitive restructuring menjadi asas rujukan utama dalam mengenal pasti bagaimana perubahan pemikiran dapat mempengaruhi kestabilan emosi dan tingkah laku (Dobson & Dozois, 2019).

Melalui gabungan kedua-dua pendekatan ini, kajian meneliti bagaimana mesej tauhidi dalam Ayat Kursi dapat difahami sebagai struktur kognitif yang membetulkan pemikiran, menstabilkan emosi, dan memulihkan ketenangan jiwa. Kaedah integrasi ini sejalan dengan usaha penyelidik kontemporari yang menggabungkan tafsir psikospiritual dengan teori psikologi moden untuk membangunkan pemahaman Qur'ani yang kontekstual (Khairi & Widayati, 2025).

Akhirnya, hasil analisis silang antara tafsir dan teori psikologi ini membolehkan kajian mengemukakan satu kerangka integratif yang dinamakan "Tauhidi Cognitive Restructuring (TCR)", iaitu model kognitif berasaskan tauhid yang bertujuan membentuk keutuhan pemikiran dan ketenangan spiritual. Pendekatan ini memberikan asas ilmiah bagi menjadikan Ayat Kursi sebagai modul intervensi kognitif dalam psikoterapi Islam yang berteraskan wahyu dan rasionalisme ilmiah.

## Dapatan Kajian

Analisis terhadap Ayat Kursi melalui perspektif tafsir dan psikologi kognitif mendedahkan empat dimensi utama yang membentuk asas kepada Terapi Kognitif Tauhidi (Tauhidi Cognitive Therapy). Keempat-empat dimensi ini saling berkaitan dalam mempengaruhi struktur pemikiran, kestabilan emosi, dan persepsi individu terhadap diri, kehidupan, dan Allah. Model ini menunjukkan bahawa Ayat Kursi bukan sahaja mengandungi nilai aqidah yang kukuh, tetapi juga menawarkan mekanisme terapi kognitif spiritual yang sejajar dengan prinsip cognitive restructuring dalam psikologi moden (Muaz, Huda, & Prasetyo, 2020; Choudhury, 2020).

### *Pengukuhan Core Belief Tauhidi*

Dapatan kajian menunjukkan bahawa bahagian awal Ayat Kursi — yang menyebut Allah sebagai "الْحَيُّ الْقَيُّومُ" (Yang Maha Hidup dan Maha Berdiri Mengatur makhluk-Nya) —

berfungsi sebagai pengukuhan core belief tauhidi. Dalam psikologi kognitif, core belief ialah kepercayaan teras yang membentuk cara seseorang menilai dirinya dan dunia sekeliling.

Kajian An-Nufus oleh Muaz, Huda, dan Prasetyo (2020) menegaskan bahawa dua nama Allah ini menggambarkan sifat eksistensi dan ketuhanan yang sempurna — "al-Hayyu" menandakan kehidupan mutlak, sementara "al-Qayyum" menegaskan kekuasaan dan penjagaan Allah secara berterusan. Dalam konteks terapi kognitif Islam, keyakinan ini menangkis distorsi seperti helplessness dan isolation, dengan menanamkan kesedaran bahawa Allah sentiasa hidup, berkuasa, dan menjaga setiap aspek kewujudan (Laude, 2014).

Individu yang memiliki core belief tauhidi yang kukuh akan menghadapi tekanan hidup dengan lebih tenang kerana mereka yakin bahawa segala urusan berada dalam pengawasan Ilahi — suatu bentuk kestabilan emosi yang lahir daripada iman yang rasional (Ramadhani & Taufiq, 2024).

***Penghapusan Distorsi Kognitif Berkaitan Ketakutan***

Bahagian "لَا تَأْخُذُهُ سِنَةٌ وَلَا نَوْمٌ" menegaskan bahawa Allah tidak pernah mengantuk atau tidur, yang secara psikologi menghapuskan cognitive distortion seperti catastrophizing — iaitu kecenderungan membayangkan senario paling buruk.

Kajian tafsir teologi oleh Al-Rifai (2022) menunjukkan bahawa sifat Allah yang "tidak tidur dan tidak lalai" menggambarkan penjagaan yang berterusan terhadap makhluk. Hal ini memberikan jaminan psikospiritual kepada manusia bahawa mereka tidak pernah ditinggalkan tanpa kawalan Ilahi. Dalam konteks psikologi kognitif, konsep ini membantu menggantikan kepercayaan tidak rasional seperti "semuanya bergantung kepada aku" dengan pemikiran rasional dan spiritual bahawa "Allah sentiasa mengurus segala urusan."

Kajian kontemporari dalam psikologi Islam menunjukkan bahawa kepercayaan kepada pengawasan Allah mengurangkan simptom kebimbangan dan ketakutan yang berpunca daripada rasa kehilangan kawalan (Suyanto, 2017; Ady, Mustofa, & Nadlir, 2024).

***Pemulihan Kawalan Diri melalui Tawakal***

Frasa "لَهُ مَا فِي السَّمَاوَاتِ وَمَا فِي الْأَرْضِ" menegaskan hak milik mutlak Allah terhadap seluruh ciptaan. Dapatan kajian menunjukkan bahawa ayat ini memberikan kesan signifikan terhadap pemulihan kawalan diri (sense of control) melalui konsep tawakal.

Kajian tematik oleh Adil Gondal (2024) menegaskan bahawa tawakkul adalah keyakinan mendalam terhadap kuasa Allah sambil tetap berusaha, diikuti dengan penerimaan penuh terhadap ketentuan-Nya. Kajian empirikal oleh Gondal, Adil, Yasin, & Shujja (2021) turut menunjukkan bahawa individu dengan tahap tawakkul tinggi memiliki kestabilan emosi dan kesejahteraan psikologi yang lebih baik.

Ayat ini membantu membetulkan kecenderungan over-control yang sering dikaitkan dengan kebimbangan, dengan menggantikan kepercayaan "aku mesti kawal semuanya" kepada "Allah pemilik segala urusan, tugasku hanyalah berusaha." Ini mewujudkan keseimbangan antara

ikhtiar dan tawakal, sebagaimana dibincangkan dalam kajian teoretikal oleh Nasrin (2025) tentang nilai spiritual tawakkul dan sabr sebagai asas kesihatan mental dalam pendidikan Islam.

***Penstrukturan Semula Makna Hidup (Meaning Reconstruction)***

Bahagian "وَلَا يُحِيطُونَ بِشَيْءٍ مِنْ عِلْمِهِ" mengingatkan manusia tentang keterbatasan ilmu mereka berbanding ilmu Allah yang Maha Luas. Dalam psikologi moden, kesedaran tentang keterbatasan ini menjadi asas kepada meaning reconstruction, iaitu proses menilai semula makna hidup berdasarkan realiti diri dan kebergantungan kepada Tuhan.

Kajian tafsir dan falsafah Islam oleh Laude (2014) dan Zaini & Fauziah (2024) menunjukkan bahawa pengakuan terhadap keterbatasan manusia membuka ruang bagi tafakkur (renungan spiritual), yang melahirkan penerimaan (acceptance) dan keinsafan. Individu yang mencapai tahap kesedaran ini cenderung memiliki cognitive flexibility dan emotional regulation yang lebih baik kerana mereka tidak lagi cuba memahami atau mengawal semua perkara, tetapi melihat kehidupan sebagai sebahagian daripada kehendak Ilahi.

Dengan demikian, Ayat Kursi membimbing manusia ke arah struktur pemikiran tauhidi yang menenangkan jiwa dan membentuk keutuhan psikospiritual yang seimbang antara akal, emosi, dan iman (Muaz, Huda, & Prasetyo, 2020).

**Perbincangan**

Dapatan kajian menunjukkan bahawa Ayat Kursi bukan sekadar ayat yang menegaskan keesaan dan kekuasaan Allah, tetapi turut berfungsi sebagai struktur kognitif tauhidi yang mempunyai mekanisme terapi sejajar dengan prinsip utama Cognitive Behavioural Therapy (CBT). Namun, berbeza dengan CBT yang bersifat sekular dan bertumpu kepada rasionaliti manusia (Beck, 2011; Dobson & Dozois, 2019), Ayat Kursi menawarkan pendekatan kognitif yang lebih komprehensif, dengan menggabungkan unsur metafizik, kebergantungan kepada Allah (tawakkul), dan sistem makna transendental (Habibi, 2024; Choudhury, 2016).

Model ini menunjukkan bahawa cognitive restructuring dalam al-Qur'an berfungsi bukan hanya untuk menangkis pemikiran tidak rasional, tetapi juga menanamkan sistem kepercayaan (belief system) yang berasaskan tauhid rububiyyah, sekali gus membentuk kesejahteraan psikospiritual menyeluruh (Anwar & Elfiah, 2019; Aziz et al., 2019).

***Perbandingan dengan Kerangka CBT***

Hasil analisis perbandingan antara Ayat Kursi dan CBT mendapati bahawa kedua-duanya memiliki persamaan dari segi tujuan terapeutik, iaitu membetulkan pemikiran negatif, mengurangkan cognitive distortion, dan membina tingkah laku adaptif. Namun, perbezaan asasnya terletak pada sumber perubahan kognitif.

Dalam CBT, perubahan pemikiran dilakukan melalui logik manusia dan bukti empirikal, manakala dalam struktur Ayat Kursi, perubahan kognitif dilakukan melalui peneguhan iman dan kesedaran terhadap sifat-sifat Allah (Abas, 2021). Pendekatan ini menegaskan bahawa penyembuhan psikologi tidak dapat dipisahkan daripada pemulihan spiritual dan kesedaran

tauhidi, sebagaimana dinyatakan oleh Malik Badri bahawa terapi yang berkesan mesti melibatkan dimensi iman dan penyucian jiwa (tazkiyah al-nafs) (Mustafa & Yakob, 2019).

Oleh itu, Ayat Kursi berperanan sebagai bentuk "Tauhidi Cognitive Restructuring" (TCR) yang menghubungkan dimensi spiritual dengan dimensi kognitif — sesuatu yang tidak terdapat dalam model CBT sekular (Haque, 2018; Rothman & Coyle, 2021).

***Komponen Model Tauhidi Cognitive Restructuring (TCR)***

Model TCR yang dibentuk daripada dapatan kajian ini merangkumi empat komponen utama, yang secara sinergi membentuk sistem terapi berasaskan tauhid:

1. Tauhid-Based Core Belief Correction – Pembetulan kepercayaan teras melalui pengukuhan keyakinan kepada sifat Allah yang Maha Hidup (al-Ḥayy) dan Maha Mengurus (al-Qayyūm). Ini seiring dengan gagasan epistemologi tauhid yang dikemukakan oleh al-Faruqi, bahawa semua pengetahuan dan makna mesti berpunca daripada kesatuan Ilahi (Habibi, 2024).
2. Distortion Cleansing through Divine Assurance – Penghapusan distorsi kognitif melalui keyakinan bahawa Allah tidak pernah lalai atau tidur, sebagaimana diterangkan dalam kajian tafsir teologi oleh Al-Rifai (2022). Keyakinan ini memberi kestabilan psikospiritual dan menenangkan minda yang cemas.
3. Tawakal-Based Adaptive Behaviour – Pembinaan tingkah laku adaptif berdasarkan keseimbangan antara usaha manusia dan ketundukan kepada kekuasaan Allah, selaras dengan prinsip tawhidi epistemology (Choudhury, 2020). Kajian empirikal menunjukkan bahawa tawakkul meningkatkan ketahanan psikologi dan mengurangkan tekanan (Gondal et al., 2021).
4. Meaning Reconstruction via Rububiyyah Consciousness – Pembinaan semula makna hidup berasaskan kesedaran terhadap keterbatasan manusia dan keluasan ilmu Allah. Pendekatan ini berfungsi seumpama meaning reconstruction dalam psikologi positif, tetapi disandarkan kepada rububiyyah consciousness, iaitu kesedaran bahawa Allah mengatur segalanya secara hikmah (Laude, 2014; Mulyawan & Mahmudi, 2024).

***Implikasi Teoretikal dan Praktikal***

Model TCR ini memberikan bukti bahawa Ayat Kursi mampu menjadi asas teori bagi psikoterapi Islam berasaskan wahyu. Pendekatan ini memperkukuh gerakan Islamization of Psychology, sebagaimana diusulkan oleh Malik Badri dan Ismail al-Faruqi — bahawa semua pendekatan saintifik perlu berpaksikan kepada epistemologi tauhid, bukan sekadar adaptasi teori Barat (Habibi, 2024; Mustafa & Yakob, 2019).

Implikasinya terhadap amalan kaunseling Islam adalah signifikan. TCR menawarkan intervensi integratif yang menggabungkan pembetulan kognitif dengan spiritual reframing, menjadikan wahyu sebagai sumber utama cognitive therapy. Ini selaras dengan pandangan Nur Afifah Abas (2021) bahawa al-Qur'an dapat berfungsi sebagai pelengkap CBT-Q bagi klien Muslim melalui psychoeducational content yang berasaskan ayat-ayat tertentu.

Pendekatan ini juga memperkukuh epistemologi tauhid dalam psikologi moden, iaitu pemulihan kesatuan antara akal, jiwa, dan iman (Bakar, 2012; Yussof, 2020). Dengan itu, Ayat Kursi bukan sahaja difahami sebagai teks aqidah, tetapi sebagai kerangka intervensi psikospiritual yang boleh diaplikasikan dalam rawatan keresahan, tekanan, dan kekosongan makna hidup.

## Kesimpulan

Kajian ini menegaskan bahawa Ayat Kursi mempunyai potensi besar sebagai modul intervensi psikoterapeutik dalam konteks psikologi Islam. Analisis terhadap ayat ini menunjukkan bahawa ia berfungsi bukan sahaja sebagai teks aqidah, tetapi sebagai struktur kognitif tauhidi yang mampu membentuk keseimbangan antara minda, emosi, dan spiritual (Ibrahim, 2022; Choudhury, 2020).

Pertama, Ayat Kursi membina core belief tauhidi, iaitu keyakinan asas bahawa hanya Allah yang Maha Hidup dan Maha Mengurus segala sesuatu. Core belief ini menjadi asas kestabilan jiwa dan menghapuskan kebergantungan berlebihan terhadap kuasa manusia semata-mata (Ramadhani & Taufiq, 2024; Asyari et al., 2024). Kajian dalam bidang Islamic psychology turut menunjukkan bahawa individu yang berpaksikan tawhid memiliki ketahanan emosi dan makna hidup yang lebih kukuh (Tekke, 2017).

Kedua, Ayat Kursi membetulkan distorsi kognitif dengan menegaskan bahawa Allah tidak pernah lalai atau tidur — satu jaminan ilahi yang menenangkan minda dan menurunkan catastrophic thinking (Apriyadi, 2022). Keyakinan ini membantu menstrukturkan semula pola pemikiran negatif, sebagaimana ditunjukkan dalam model Islamic Modified Cognitive Behavioral Therapy (ICBT) yang menggabungkan konsep tawakkul dan sabr sebagai mekanisme terapi (Çınaroğlu, 2024).

Ketiga, Ayat Kursi menstabilkan emosi melalui konsep tawakkul dan kesedaran bahawa Allah memiliki seluruh langit dan bumi. Ini membantu individu mengurangkan rasa cemas dan over-control, serta meningkatkan penerimaan terhadap qada' dan qadar (Gondal et al., 2021; Rofi'atin, Dewi, & Fadillahwati, 2021). Kajian empirikal menunjukkan bahawa tahap tawakkul yang tinggi berkorelasi dengan kesejahteraan psikologi dan penurunan simptom tekanan (Mujahidah, Zahra, & Hariyadi, 2024).

Keempat, Ayat Kursi memberi makna hidup dengan mengingatkan manusia tentang keterbatasan ilmu mereka dan keluasan ilmu Allah. Kesedaran ini menjadi asas kepada meaning reconstruction dan existential acceptance, membantu individu menerima kekurangan diri serta mengurangkan tekanan eksistensial dan overthinking (Utami, 2022). Hal ini selaras dengan pandangan Laude (2014) bahawa ayat-ayat al-Qur'an berfungsi sebagai tanda-tanda (ayat) yang membawa manusia kepada kesedaran tentang kehadiran dan kekuasaan Ilahi.

Secara keseluruhannya, dapatan ini menyokong idea bahawa Ayat Kursi dapat dijadikan modul intervensi psikologi Islam yang berasaskan wahyu, sesuai digunakan dalam menangani isu kecemasan, rasa tidak selamat, tekanan eksistensial, dan overthinking dalam kalangan individu Muslim. Pendekatan ini selaras dengan gagasan Tauhidi Cognitive Restructuring (TCR) yang menggabungkan prinsip CBT dengan epistemologi tawhidic, menjadikan wahyu bukan sekadar

rujukan spiritual, tetapi juga asas saintifik dalam membentuk kesejahteraan psikospiritual manusia (Habibi, 2024; Alkatiri, 2021).

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# ANALISIS KEPERLUAN ELEMEN DAN REKABENTUK BAGI PROTOTAIP APLIKASI MUDAH ALIH CONLERT

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***Abstrak:*** *Acara akademik seperti seminar, persidangan dan bengkel memainkan peranan penting dalam menyokong perkongsian ilmu serta pembentukan jaringan profesional dalam bidang pendidikan. Namun, usaha mendapatkan maklumat yang tepat dan terkini mengenai acara-acara tersebut sering berhadapan dengan cabaran disebabkan sumber yang berselerak dan kurang diselaraskan. Bagi menangani isu ini, kajian ini memberi tumpuan kepada pembangunan dan penilaian CONLERT, iaitu sebuah prototaip aplikasi mudah alih yang dibangunkan untuk memudahkan proses pencarian serta pengurusan acara akademik. Dengan teknologi kecerdasan buatan, CONLERT menawarkan notifikasi yang diperibadikan berdasarkan keutamaan pengguna, sekali gus meningkatkan kemudahan dan keterlibatan dalam mengakses maklumat semasa. Kajian ini meneliti elemen serta keperluan reka bentuk bagi prototaip aplikasi mudah alih CONLERT. Kaedah Fuzzy Delphi digunakan untuk mendapatkan kesepakatan pakar dalam mengenal pasti komponen utama yang diperlukan bagi menghasilkan aplikasi yang berkesan dan mesra pengguna. Hasil kajian menunjukkan tahap persetujuan tinggi terhadap semua elemen reka bentuk utama, termasuk aspek antara muka, kandungan, teks, grafik, audio dan integrasi kecerdasan buatan. Navigasi yang teratur, penggunaan bahasa yang jelas serta paparan visual yang mudah difahami merupakan keutamaan dalam memastikan kebolehgunaan aplikasi. Dapatan ini memberikan panduan penting kepada pembangun dalam menambah baik pengalaman pengguna serta meningkatkan keberkesanan CONLERT sebagai platform penyampaian maklumat acara akademik yang responsif, mudah diakses dan relevan dengan keperluan pengguna.*

***Keywords:*** *Acara akademik; kecerdasan buatan; pemberitahuan acara; aplikasi mudah alih.*

## Pengenalan

Acara akademik seperti seminar, persidangan, bengkel dan syarahan ilmiah merupakan elemen penting dalam ekosistem pendidikan serta penyelidikan kerana berfungsi sebagai medium perkongsian ilmu, perbincangan idea dan pembentangan penemuan terkini. Menurut Seidenberg et al. (2021), platform akademik ini menyediakan ruang pembelajaran dan jaringan profesional yang signifikan kepada komuniti penyelidik.

Perkembangan teknologi digital turut mengubah bentuk penganjuran acara akademik daripada pertemuan fizikal kepada platform maya yang dapat diakses secara global. Kajian

menunjukkan bahawa persidangan maya meningkatkan akses dan penyertaan kerana tidak lagi dibatasi kos dan jarak (Hofstädter-Thalmann, 2022; Fang et al., 2021).
Namun, pertambahan jumlah acara akademik setiap tahun menimbulkan keperluan untuk sistem yang lebih teratur bagi mengurus dan menyalurkan maklumat acara. Hal ini selari dengan dapatan Hurst et al. (2022) yang menekankan bahawa keberkesanan acara maya bergantung pada kejelasan dan susunan maklumat. Justeru, pembangunan aplikasi mudah alih yang menghimpunkan maklumat acara secara sistematik dapat membantu pengguna mendapatkan maklumat yang tepat, mudah dan terkini.

### *Latar Belakang Kajian*

Kajian ini dijalankan bagi menilai keperluan pengguna sasaran, khususnya dalam kalangan ahli akademik, terhadap aplikasi mudah alih CONLERT. Nama CONLERT, yang merupakan adaptasi daripada istilah "*Conference Alert*", menggambarkan fungsinya sebagai platform notifikasi acara akademik serta pusat sehenti (*one stop center*) yang menghimpunkan maklumat berkaitan persidangan, seminar, bengkel dan sebagainya dalam satu sistem. Pendekatan ini bertujuan memudahkan pengguna mengakses maklumat tanpa perlu merujuk kepada pelbagai sumber dan platform yang berasingan.

Aplikasi ini turut dilengkapi dengan ciri notifikasi berasaskan kecerdasan buatan (AI) bagi memastikan maklumat yang diterima lebih relevan dan disesuaikan dengan bidang dan minat pengguna. Integrasi ciri ini dijangka dapat meningkatkan keberkesanan aplikasi serta memberikan pengalaman penggunaan yang lebih peribadi dan responsif.

Pada fasa awal pembangunan, kajian ini memberi tumpuan kepada analisis keperluan pengguna serta elemen asas dalam reka bentuk aplikasi. Pemahaman yang menyeluruh terhadap keperluan ini penting bagi memastikan CONLERT dibangunkan secara lebih efektif dan menepati fungsinya sebagai alat sokongan akademik. Melalui usaha ini, CONLERT diharapkan dapat menjadi platform yang praktikal untuk membantu ahli akademik mengikuti dan mengurus maklumat acara secara lebih sistematik dan teratur.

### Pernyataan Masalah

Acara akademik seperti persidangan dan seminar penting untuk penyebaran ilmu, namun maklumat acara sering berpecah di pelbagai sumber dan platform, menyukarkan pengguna menjejak maklumat yang tepat dan terkini (Jones & Smith, 2020; Seidenberg et al., 2021). Kaedah penyebaran tradisional juga tidak lagi berkesan dan menyebabkan ramai terlepas peluang mengikuti acara akademik yang penting (Kumar et al., 2019). Selain itu, maklumat yang tidak tersusun akibat penggunaan teknologi yang tidak optimum menyukarkan lagi pengguna (Chen & Li, 2021; Hurst et al., 2022).

Oleh itu, wujud keperluan untuk satu sistem bersepadu yang menghimpunkan maklumat acara secara sistematik. Teknologi mudah alih berpotensi menjadi penyelesaian kerana menawarkan notifikasi masa nyata (*real time*) dan akses maklumat dalam satu platform (Nurul Ibtisam et al., 2025; Cai, 2022; Zhang et al., 2022). Justeru, pembangunan aplikasi CONLERT diperlukan dalam menyediakan penyampaian maklumat acara akademik dengan lebih teratur, efisien dan mudah dicapai.

## Objektif Kajian

Untuk menganalisis elemen dan keperluan reka bentuk yang diperlukan bagi pembangunan aplikasi mudah alih CONLERT.

## Sorotan Literatur

Acara akademik seperti persidangan, seminar, bengkel, dan pertandingan inovasi memainkan peranan penting sebagai medium penyebaran ilmu, perbincangan ilmiah serta pembentukan jaringan profesional. Persidangan menjadi wadah utama bagi para penyelidik dan ahli akademik berkongsi penemuan serta perkembangan bidang masing-masing (Li & Tan, 2020; Lestari & Jaya, 2021). Kajian terkini turut menunjukkan bahawa aplikasi mudah alih dapat meningkatkan akses dan keterlibatan pengguna dalam aktiviti akademik serta menyokong pembangunan profesional (Palshkov et al., 2024).

Pembangunan aplikasi mudah alih untuk tujuan pengurusan acara akademik melibatkan pertimbangan terhadap reka bentuk antara muka, fungsi, keselamatan dan keserasian peranti (Kim & Yun, 2021). Mekanisme notifikasi masa nyata menjadi elemen penting bagi memastikan pengguna menerima makluman segera tentang perubahan jadual atau pengumuman berkaitan (Cao et al., 2019). Selain itu, integrasi AI membolehkan aplikasi menghasilkan notifikasi yang diperibadikan mengikut minat dan tingkah laku pengguna, sekali gus meningkatkan interaksi dan penggunaan aplikasi (Chen & Zhang, 2020; Hosseini et al., 2019; Lu et al., 2025).

Aplikasi berasaskan AI untuk acara akademik berpotensi berfungsi sebagai pusat sehenti yang menyediakan pelbagai maklumat seperti jadual program, sesi pembentangan, profil penceramah dan cadangan acara yang relevan secara automatik. Notifikasi pintar yang tepat dan responsif membantu pengguna merancang penyertaan dengan lebih berkesan serta mengurangkan risiko terlepas peluang pembelajaran dan jaringan penting.

Bagi menilai reka bentuk aplikasi, Fuzzy Delphi Method (FDM) sering digunakan untuk mendapatkan konsensus pakar mengenai komponen seperti antara muka pengguna, kandungan dan aspek kebolehgunaan (Yusof et al., 2022; Roldán et al., 2021). Kajian terdahulu membuktikan bahawa FDM sangat efektif dalam menilai aplikasi pendidikan dan penyelesaian mudah alih, dengan nilai penyahkaburan (*defuzzification*) yang tinggi menunjukkan tahap persetujuan pakar yang kuat terhadap kriteria yang diuji (Rosly et al., 2022). Dalam konteks aplikasi pembelajaran mudah alih, faktor kebolehgunaan seperti navigasi, kejelasan maklumat dan struktur kandungan dikenal pasti sebagai elemen penting (Kumar et al., 2019; Arain et al., 2016).

Reka bentuk antara muka turut memberi pengaruh terhadap persepsi, kepercayaan dan penerimaan pengguna. Reka bentuk minimalis dengan navigasi yang jelas serta susun atur yang konsisten telah terbukti meningkatkan kecekapan penggunaan (Zieglmeier & Lehene, 2022; Norman, 2022). Kandungan yang relevan, padat dan mudah difahami juga menyumbang kepada kepuasan pengguna (Kim & Lee, 2011; Nielsen, 2000). Elemen tipografi seperti jenis fon, saiz dan kontras warna mempengaruhi tahap kebolehbacaan (Günay, 2024; Bernard et al.,

2003), manakala grafik dan ikon yang jelas dapat mempertingkat fungsi aplikasi serta menyokong komunikasi visual (Mayer, 2020; Shneiderman et al., 2016). Tambahan pula, penggunaan audio notifikasi yang sesuai membantu meningkatkan interaksi dan menjadikan aplikasi lebih responsif kepada pengguna (Cinel et al., 2022).

Dari perspektif AI, ia memainkan peranan penting dalam memperibadikan pengalaman pengguna melalui sistem cadangan dan penapisan kandungan (Jannach et al., 2021). Walaupun kajian berkaitan integrasi AI dalam kaedah FDM masih terhad, penemuan menunjukkan bahawa elemen pintar semakin diberi perhatian dalam penilaian aplikasi pendidikan (Rosly et al., 2022). Selain itu, aplikasi yang mudah digunakan dan mudah dipelajari lebih berpotensi untuk diterima oleh pengguna, sejajar dengan dapatan kajian berhubung aplikasi pembelajaran mudah alih (Zhou et al., 2019; Naveed et al., 2023).

## Metodologi

### *Populasi dan Subjek Kajian*

Kajian ini memfokuskan kepada sekumpulan pakar dalam bidang reka bentuk, pembangunan aplikasi dan AI. Pemilihan pakar sebagai subjek kajian dibuat kerana kepakaran mereka mampu memberikan pandangan mendalam yang menghubungkan aspek teknikal dengan pemahaman konseptual. Sumbangan mereka juga penting bagi memastikan cadangan yang dibangunkan adalah praktikal, relevan dan disokong oleh asas teori yang kukuh.

### *Sampel Kajian*

Seramai 13 orang pakar terlibat dalam kajian ini, terdiri daripada 5 pakar dalam bidang reka bentuk, 5 pakar pembangunan aplikasi dan 3 pakar AI. Pemilihan pakar dilakukan berdasarkan beberapa kriteria khusus, termasuk pengalaman profesional atau akademik sekurang-kurangnya lima tahun dalam bidang masing-masing, penglibatan aktif dalam penyelidikan atau projek berkaitan aplikasi mudah alih atau AI, serta pemahaman terhadap prinsip reka bentuk berpusatkan pengguna. Komposisi sampel yang berfokus namun pelbagai ini selari dengan cadangan kajian Fuzzy Delphi, yang mencadangkan antara 10 hingga 15 pakar sebagai jumlah optimum untuk memastikan kebolehpercayaan konsensus (Birko et al., 2015; Hsu & Sandford, 2007; Pazilah et al., 2024).

### *Instrumen Kajian*

Item soal selidik dibangunkan berdasarkan dapatan dan pengetahuan yang diperoleh melalui sorotan literatur daripada kajian-kajian lepas yang relevan.

### *Teknik Analisis Data*

Analisis data dalam kajian ini dilaksanakan menggunakan Kaedah Analisis Fuzzy Delphi.

## Dapatan dan Perbincangan

### *Latar Belakang Responden*

Sebanyak 53.8% daripada responden terdiri daripada lelaki, manakala 46.2% lagi merupakan perempuan.

***Analisis Elemen Antara Muka***

Dapatan kajian menunjukkan kesepakatan penuh dalam kalangan pakar, dengan semua item mencapai konsensus 100% dan berada pada tahap penerimaan yang sangat tinggi. Item "Navigasi yang jelas membolehkan pengguna menggunakan aplikasi mudah alih CONLERT dengan mudah, tanpa terlalu banyak langkah untuk mengakses fungsi atau maklumat" mencatat skor fuzzy tertinggi iaitu 0.958.

Keputusan ini membuktikan keutamaan yang jelas terhadap semua elemen antara muka yang dinilai serta mengukuhkan kebolehpercayaan dapatan kajian. Penemuan ini turut menyokong kajian terdahulu (Nielsen & Norman, 2020; Shneiderman & Plaisant, 2016; Lim et al., 2019), yang menekankan bahawa antara muka yang jelas, intuitif dan teratur dapat meningkatkan kebolehgunaan dan penglibatan pengguna. Dapatan ini juga selari dengan kajian lebih terkini oleh Perrig et al. (2023), yang menunjukkan bahawa estetika dan susun atur antara muka aplikasi mudah alih memberi kesan signifikan terhadap pengalaman dan prestasi pengguna.

***Analisis Elemen Kandungan***

Analisis elemen kandungan menunjukkan tahap konsensus pakar antara 81.8% hingga 90.9%, yang menandakan penerimaan tinggi walaupun tidak mencapai konsensus mutlak seperti elemen antara muka. Item "Penggunaan bahasa dalam aplikasi mudah alih CONLERT membantu menyampaikan maklumat mengenai acara akademik dengan berkesan" memperoleh skor fuzzy tertinggi iaitu 0.864.

Dapatan ini menunjukkan bahawa semua elemen kandungan dianggap penting dan relevan dalam menyokong keberkesanan aplikasi. Penemuan ini juga konsisten dengan kajian terdahulu (Lim et al., 2019; Muhammad et al., 2020; Chen et al., 2021), yang menekankan bahawa kandungan yang jelas, relevan dan menarik dapat meningkatkan interaksi serta memudahkan capaian maklumat pengguna. Kajian oleh Almaiah et al. (2022) turut menegaskan bahawa kualiti kandungan dan kejelasan maklumat memainkan peranan penting dalam meningkatkan kebolehgunaan serta pengalaman pengguna dalam aplikasi mudah alih.

***Analisis Elemen Teks***

Semua pakar mencapai persetujuan penuh (100%) bagi elemen teks, menunjukkan kesepakatan kuat tentang kepentingannya dalam reka bentuk aplikasi. Item "Aplikasi mudah alih CONLERT menggunakan warna teks yang sesuai" memperoleh skor fuzzy tertinggi iaitu 0.897.

Dapatan ini selari dengan kajian terdahulu (Nielsen & Norman, 2020; Lim et al., 2019; Chen et al., 2021), yang menekankan bahawa teks yang jelas dan ringkas dapat meningkatkan kefahaman, mengurangkan kekeliruan serta menyokong kebolehgunaan aplikasi. Kajian terkini oleh Ansyah et al. (2023) turut menunjukkan bahawa kejelasan teks dan penyampaian maklumat yang teratur memberi kesan langsung terhadap persepsi dan interaksi pengguna,

sekali gus mengukuhkan kepentingan elemen teks dalam meningkatkan pengalaman penggunaan aplikasi mudah alih.

***Analisis Elemen Grafik***

Semua pakar mencapai persetujuan penuh (100%) terhadap elemen grafik, menunjukkan penerimaan yang sangat tinggi. Item "Grafik yang dimuat naik dalam aplikasi mudah alih CONLERT mempunyai resolusi yang sesuai untuk memastikan kejelasan pada pelbagai saiz skrin" dan Item "Aplikasi mudah alih CONLERT perlu mempunyai ikon yang mudah dikenal pasti mengikut fungsinya" mencatat skor tertinggi iaitu 0.891.

Dapatan ini selaras dengan kajian terdahulu (Marcus, 2018; Perrig et al., 2023), yang menekankan peranan elemen visual dalam meningkatkan pengalaman pengguna serta kebolehgunaan aplikasi. Kajian terkini oleh Gao et al. (2024) turut menyokong pandangan ini dengan menunjukkan bahawa reka bentuk visual yang baik memberi kesan langsung terhadap persepsi dan tingkah laku interaksi pengguna. Secara keseluruhannya, elemen grafik bukan sekadar bersifat estetik, tetapi menjadi komponen penting dalam memastikan aplikasi CONLERT berfungsi dengan berkesan dan mesra pengguna.

***Analisis Elemen Audio***

Elemen audio menunjukkan skor fuzzy (A) sebanyak 0.809 dengan persetujuan pakar 90.9%, menandakan tahap penerimaan yang tinggi walaupun sedikit lebih rendah berbanding kategori lain seperti antara muka, grafik dan teks. Ini menunjukkan bahawa audio tetap dianggap relevan kerana peranannya dalam meningkatkan pengalaman pengguna, menyokong pelbagai gaya pembelajaran dan membantu memperkukuh kefahaman.

Penemuan ini selari dengan kajian terdahulu (Ismail & Hassan, 2021), yang membuktikan bahawa audio yang jelas dan relevan mampu mengurangkan beban kognitif, menyokong visual dan memperbaiki interaksi pengguna. Kajian terkini oleh Chen dan Lehto (2025) turut menunjukkan bahawa reka bentuk audio yang berkualiti, termasuk penggunaan suara sintetik berasaskan AI, dapat meningkatkan pengalaman pendengar dan menjadikan penyampaian maklumat lebih efektif. Oleh itu, elemen audio masih merupakan komponen penting dalam pembangunan aplikasi yang efektif dan mesra pengguna.

***Analisis Elemen Kecerdasan Buatan***

Elemen kecerdasan buatan menunjukkan tahap konsensus pakar yang tinggi dengan persetujuan 90.9%. Item "Aplikasi mudah alih CONLERT diintegrasikan dengan AI berasaskan kata kunci, yang menyediakan cadangan mengikut keutamaan pengguna" memperoleh skor fuzzy tertinggi iaitu 0.879.

Penemuan ini selaras dengan kajian terdahulu (Brown et al., 2022; Russell & Norvig, 2021; Huang & Rust, 2021), yang menegaskan bahawa integrasi AI meningkatkan responsiviti, personalisasi dan pemprosesan data masa nyata. Kajian terkini oleh Nwanna et al. (2025) turut menyokong dapatan ini dengan menunjukkan bahawa personalisasi berasaskan AI mampu meningkatkan pengalaman dan penglibatan pengguna secara signifikan dalam aplikasi mudah

alih. Secara keseluruhannya, dapatan ini mengesahkan bahawa AI merupakan komponen kritikal dalam pembangunan aplikasi moden yang efektif dan mesra pengguna.

### *Analisis Elemen Kebolehgunaan*

Dapatan menunjukkan konsensus pakar yang tinggi bagi elemen kebolehgunaan, dengan memperoleh persetujuan melebihi 80%. Item "Aplikasi mudah alih CONLERT seharusnya mudah untuk dikendalikan" mencatat skor fuzzy tertinggi iaitu 0.933.

Secara keseluruhan, keputusan ini menunjukkan bahawa kebolehgunaan merupakan aspek utama dalam reka bentuk aplikasi kerana ia meningkatkan pengalaman, penerimaan dan penggunaan aplikasi oleh pengguna. Penemuan ini juga konsisten dengan kajian terdahulu (Davis, 1989; Venkatesh et al., 2003; Nielsen & Norman, 2020), yang menekankan bahawa kemudahan penggunaan adalah faktor penting dalam penerimaan teknologi. Kajian terkini oleh Weichbroth (2024) turut mengukuhkan dapatan ini dengan menunjukkan bahawa kerangka ujian kebolehgunaan yang baik dapat meningkatkan keberkesanan reka bentuk aplikasi mudah alih. Oleh itu, kebolehgunaan kekal sebagai faktor kritikal dalam kejayaan penerimaan aplikasi CONLERT.

## Implikasi dan Cadangan Kajian Lanjutan

Kajian ini memberikan beberapa implikasi penting kepada pembangunan aplikasi mudah alih, khususnya dalam konteks pengurusan acara akademik. Dapatan konsensus pakar menunjukkan bahawa elemen antara muka, kandungan, grafik, audio, kecerdasan buatan dan kebolehgunaan memainkan peranan kritikal dalam meningkatkan pengalaman pengguna. Penemuan ini selaras dengan pandangan Nielsen dan Norman (2020) serta Weichbroth (2024), yang menekankan bahawa aplikasi yang mempunyai reka bentuk jelas, intuitif dan mudah digunakan berpotensi meningkatkan penerimaan serta menurunkan beban kognitif pengguna. Selain itu, integrasi AI yang diperibadikan turut memperkukuh fungsi aplikasi, seperti yang disokong oleh kajian Chen dan Lehto (2025) yang menunjukkan bahawa audio dan ciri pintar dapat mempertingkatkan pengalaman pengguna secara signifikan.

Terdapat beberapa limitasi yang dihadapi sepanjang menjalankan kajian ini. Saiz sampel pakar yang terhad dan fokus kajian pada peringkat reka bentuk awal mengehadkan generalisasi dapatan. Sesi pengujian bersama pengguna sebenar belum dijalankan, dan aspek teknikal seperti ketepatan data masa nyata, kebolehpercayaan algoritma AI serta isu privasi masih belum dinilai sepenuhnya.

Untuk itu, kajian lanjutan dicadangkan untuk melibatkan ujian kebolehgunaan bersama pengguna sasaran dengan menggunakan kerangka seperti Model Penerimaan Teknologi (TAM) (Venkatesh et al., 2003) bagi menilai persepsi kegunaan, kemudahan penggunaan dan niat penggunaan. Kajian lanjutan juga disarankan agar dapat menambah baik integrasi AI melalui pembelajaran mesin, menguji aspek keselamatan data serta menilai prestasi aplikasi dalam situasi sebenar. Pendekatan ini akan memastikan prototaip CONLERT dapat berkembang menjadi aplikasi yang lebih baik dan berkesan dalam jangka masa panjang.

## Kesimpulan

Kajian ini telah mengenal pasti elemen kritikal dalam pembangunan prototaip aplikasi CONLERT melalui konsensus pakar menggunakan Kaedah Fuzzy Delphi. Dapatan menunjukkan bahawa aspek antara muka, kandungan, grafik, teks, audio, kecerdasan buatan dan kebolehgunaan merupakan komponen penting yang menyumbang kepada reka bentuk aplikasi yang berkesan dan mesra pengguna. Penemuan ini memberi implikasi praktikal kepada pembangun, terutamanya dalam memastikan reka bentuk intuitif, kandungan relevan dan integrasi AI yang mampu memperibadikan pengalaman pengguna.

Walaupun begitu, kajian ini mempunyai batasan, termasuk saiz sampel pakar yang terhad dan penilaian yang hanya tertumpu pada fasa reka bentuk awal. Sehubungan itu, kajian lanjutan dicadangkan untuk melibatkan pengguna sebenar melalui ujian kebolehgunaan, menilai aplikasi menggunakan model seperti TAM, serta meneroka integrasi AI yang lebih canggih, aspek keselamatan data dan prestasi aplikasi dalam situasi sebenar.

Secara keseluruhan, kajian ini menyediakan asas yang kukuh untuk pembangunan dan penambahbaikan CONLERT sebagai platform pengurusan acara akademik yang lebih efektif, cekap dan berdaya maju.

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# KAJIAN KEBERKESANAN DAN PENERIMAAN PELAJAR TERHADAP APLIKASI E-AQIDAH DALAM PEMBELAJARAN AKIDAH

# A STUDY ON THE EFFECTIVENESS AND STUDENT ACCEPTANCE OF THE E-AQIDAH APPLICATION IN AQIDAH EDUCATION

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***Abstrak:*** *Dalam era pendidikan abad ke-21, integrasi teknologi digital semakin menjadi keperluan dalam mengukuhkan keberkesanan proses pembelajaran di sekolah. Walau bagaimanapun, penguasaan konsep akidah dalam kalangan pelajar masih menghadapi cabaran kerana pendekatan pengajaran tradisional kurang berupaya menarik minat dan mengekalkan tumpuan pelajar. Kajian ini dijalankan untuk menguji keberkesanan penggunaan aplikasi E-Aqidah terhadap pemahaman pelajar mengenai topik-topik dalam domain Akidah Tingkatan Satu di bawah mata pelajaran Pendidikan Islam. Kajian ini menggunakan reka bentuk kuantitatif melibatkan 136 orang pelajar Tingkatan Satu di Sekolah Menengah Kebangsaan di daerah Kuala Nerus melalui soal selidik yang terdiri daripada dua bahagian. Bahagian A menilai pemahaman pelajar terhadap empat subtopik Akidah Tingkatan Satu melalui ujian pra dan pasca, manakala bahagian B mengumpul data mengenai minat pelajardalam menggunakan aplikasi E-Aqidah menggunakan skala Likert empat kategori. Dapatan kajian menunjukkan peningkatan signifikan merentasi semua item ujian, dengan peningkatan antara 45.57% hingga 145% selepas penggunaan aplikasi. Peningkatan skor ini*

*melibatkan soalan fakta asas dan juga konsep abstrak seperti fitrah dan tauhid, sekali gus menunjukkan keberkesanan aplikasi dalam menyokong pelajar berbeza tahap penguasaan. Item yang mendapat markah rendah dalam ujian pra turut mencatat peningkatan ketara dalam ujian pasca, manakala pola peningkatan konsisten merentasi beberapa subtopik mengukuhkan bukti bahawa pendekatan digital interaktif dapat memantapkan penguasaan akidah. Maklum balas Bahagian B turut menunjukkan majoriti pelajar berada pada tahap "setuju" dan "sangat setuju" terhadap keberkesanan aplikasi dari segi reka bentuk mesra pengguna, audio-visual dan aktiviti kuiz yang membantu tumpuan serta motivasi. Secara keseluruhannya, penggunaan aplikasi yang menampilkan ciri-ciri interaktif seperti audio-visual dan gamifikasi berupaya meningkatkan pemahaman serta dapat menggalakkan minat pelajar terhadap topik Akidah secara khusus dan terhadap mata pelajaran Pendidikan Islam secara amnya.*

***Kata kunci:*** *Pendidikan Abad Ke-21, Pembelajaran Berpusatkan Pelajar, Aplikasi Digital, Pendidikan Islam.*

***Abstract:*** *In the era of 21st-century education, the integration of digital technology is increasingly becoming a necessity in strengthening the effectiveness of the learning process in schools. Nevertheless, the mastery of aqidah (creed) concepts among students still faces challenges as traditional teaching approaches are less capable of attracting interest and maintaining student focus. This study was conducted to test the effectiveness of using the E-Aqidah application on students' comprehension of topics within the Form One Akidah domain under the subject of Islamic Education. This study employs a quantitative design involving 136 Form One students at national secondary schools in the Kuala Nerus district through a questionnaire consisting of two parts. Part A assesses student comprehension of four Form One Aqidah subtopics through a pre-test and post-test, while Part B collects data on student interest in using the E-Aqidah application using a four-category Likert scale. The study findings indicate a significant increase across all test items, with improvements ranging from 45.57% to 145% after using the application. This increase in scores involves basic factual questions as well as abstract concepts such as innate nature (fitrah) and monotheism (tauhid), thus demonstrating the application's effectiveness in supporting students with different levels of proficiency. Items that received low marks in the pre-test also recorded a significant increase in the post-test, while a consistent pattern of improvement across several subtopics reinforces the evidence that an interactive digital approach can strengthen the mastery of faith (aqidah). Feedback from Part B also showed that the majority of students were at the "agree" and "strongly agree" levels regarding the application's effectiveness in terms of user-friendly design, audio-visuals, and quiz activities that aid focus and motivation.Overall, the use of applications featuring interactive characteristics such as audio-visual and gamification can increase comprehension while simultaneously encouraging students' interest towards the topic of Aqidah specifically, and towards the subject of Islamic Education generally.*

***Keywords:*** *21st- Century Education, Student-Centered Learning, Digital Application, Islamic Education*

## Pengenalan

Bidang Akidah merupakan komponen asas dalam mata pelajaran Pendidikan Islam yang berperanan membentuk kefahaman keimanan, pemikiran dan sahsiah pelajar sejak peringkat

awal sekolah menengah. Penguasaan akidah yang mantap penting bagi memastikan pelajar bukan sekadar mengetahui fakta malah mampu memahami dan menghayati konsep keimanan dalam kehidupan seharian. Namun, kajian terdahulu menunjukkan bahawa penguasaan akidah dalam kalangan pelajar sekolah menengah masih berada pada tahap sederhana dengan kecenderungan pelajar menghafal tanpa memahami konsep secara mendalam (Mas'od et al., 2024; Zainuddin et al., 2023).
Dalam konteks pendidikan semasa, pendekatan pengajaran tradisional yang berpusatkan guru dan kurang interaktif didapati kurang berkesan dalam membantu pelajar memahami konsep abstrak dalam akidah. Hambali et al. (2022) menegaskan bahawa pengintegrasian teknologi dalam Pendidikan Islam perlu diperkasakan bagi meningkatkan penglibatan dan kefahaman pelajar. Seiring dengan itu, penggunaan media pembelajaran interaktif yang menggabungkan elemen audio, visual dan interaksi aktif telah dikenal pasti sebagai pendekatan yang berpotensi meningkatkan keberkesanan pembelajaran (Trimansyah, 2021; Bitu et al., 2024).

Selain itu, faktor minat pelajar turut mempengaruhi keberkesanan proses pengajaran dan pembelajaran. Menurut Baham et al. (2022), minat pelajar mempunyai hubungan yang signifikan dengan strategi pengajaran yang digunakan, khususnya strategi yang melibatkan penglibatan aktif pelajar. Elemen gamifikasi dan pembelajaran interaktif berasaskan teknologi mampu menjadikan pembelajaran lebih menarik serta membantu pelajar memahami kandungan dengan lebih bermakna (Zulfikri et al., 2023; Mulyati et al., 2021).

Dalam pembelajaran Akidah yang melibatkan dalil al-Qur'an dan konsep ketuhanan, penggunaan media audio dan audio-visual didapati dapat membantu pelajar memahami konteks ayat serta mengukuhkan daya ingatan mereka (Azzahra et al., 2025; Raudatussolihah, 2022; Kaimin et al., 2016). Di samping itu, pembelajaran kendiri yang fleksibel dan mengikut tempo pelajar (self-paced learning) turut menyokong kefahaman yang lebih mendalam, terutamanya melalui penggunaan aplikasi digital yang mudah diakses dan menyediakan nota ringkas serta aktiviti interaktif (Heng, 2018; Salame et al., 2024).

Sehubungan itu, pembangunan aplikasi E-Aqidah sebagai medium pembelajaran digital interaktif dilihat selari dengan keperluan pedagogi abad ke-21 yang menekankan pembelajaran berpusatkan pelajar. Penggunaan aplikasi pembelajaran yang fleksibel juga membolehkan pelajar melakukan ulang kaji secara kendiri tanpa terikat dengan masa dan tempat tertentu (Abidin et al., 2023 seperti dipetik dalam Arigiyati et al., 2021; Mohamad, 2020). Oleh itu, kajian ini dijalankan untuk menilai keberkesanan dan penerimaan pelajar terhadap penggunaan aplikasi E-Aqidah dalam pembelajaran Akidah.

Walaupun pelbagai inisiatif telah dilaksanakan untuk meningkatkan kualiti pengajaran Pendidikan Islam, tahap kefahaman pelajar terhadap topik Akidah masih menunjukkan jurang yang ketara. Kebiasaannya terdapat masalah dalam memahami konsep abstrak, dalil naqli dan kaitannya dengan penghayatan akhlak dalam kehidupan seharian (Zainuddin, 2023; Mas'od et al., 2024). Pendekatan pengajaran konvensional yang berpusatkan guru dan kurang interaktif menyebabkan pelajar lebih cenderung menghafal tanpa memahami secara mendalam sekali gus menurunkan motivasi dan minat mereka terhadap subjek tersebut (Hambali et al., 2022). Tambahan pula, penggunaan aplikasi digital dalam pembelajaran Akidah masih kurang dinilai secara empirikal dari segi keberkesanan terhadap kefahaman pelajar serta tahap penerimaan mereka, hakikatnya media pembelajaran interaktif dan berasaskan teknologi ini berpotensi

meningkatkan penglibatan, pemahaman dan minat pelajar (Hambali et., 2022; Zainuddin, 2023). Oleh itu, sebuah kajian menjadi satu keperluan bagi menilai sejauh mana aplikasi E-Aqidah mampu menjadi medium pembelajaran yang berkesan, meningkatkan kefahaman, penglibatan dan penerimaan pelajar secara lebih bermakna selaras dengan objektif kajian ini. Sehubungan itu, satu aplikasi interaktif telah dibangunkan khusus untuk bab Akidah Tingkatan Satu. Aplikasi ini boleh diakses melalui link secara mudah dan menyediakan pelbagai bahan pembelajaran yang menyeluruh, termasuk nota ringkas untuk rujukan cepat, nota lengkap yang padat bagi pemahaman mendalam serta pelbagai jenis latihan interaktif dan kuiz. Pembangunan aplikasi ini bertujuan untuk meningkatkan minat dan motivasi pelajar, memudahkan pemahaman konsep akıdah secara menyeluruh dan menyokong pembelajaran kendiri di luar waktu kelas, sejajar dengan pedagogi abad ke-21 dan keperluan pembelajaran generasi digital. Aplikasi ini diharapkan dapat menutup jurang antara kaedah tradisional dan keperluan pembelajaran masa kini serta membantu pelajar mengaplikasikan konsep akidah dalam kehidupan seharian secara lebih efektif.

Objektif utama kajian ini adalah seperti berikut: i. Membangunkan aplikasi interaktif E-Aqidah bagi menyokong pembelajaran Akidah secara berpusatkan pelajar; ii. Menilai keberkesanan aplikasi E-Aqidah dalam meningkatkan kemahiran pelajar dalam pembacaan dan pengecaman tulisan Jawi serta kefahaman terhadap konsep asas Akidah; iii. Mengenal pasti cabaran utama yang dihadapi pelajar termasuk hafalan tanpa pemahaman mendalam, motivasi rendah dan keterbatasan kaedah pengajaran tradisional yang kurang interaktif; iv. Menilai potensi aplikasi dalam meningkatkan minat dan penglibatan pelajar; serta v. Membangunkan aplikasi mengikut prinsip reka bentuk pedagogi digital kontemporari dengan penggunaan nota ringkas, latihan interaktif, audio untuk pelajar auditori dan video animasi untuk pelajar visual selaras dengan literatur semasa (Hambali et al., 2022).

## Metodologi Kajian

Kajian ini menggunakan reka bentuk kajian kuantitatif dengan pendekatan soal selidik bagi menilai keberkesanan penggunaan aplikasi E-Aqidah dalam membantu pemahaman pelajar terhadap topik Akidah Tingkatan Satu. Reka bentuk kajian ini dipilih kerana sesuai untuk mengumpul data secara sistematik berkaitan tahap kefahaman dan minat pelajar melalui respons berpandukan skor dan skala yang ditetapkan.

Jumlah populasi pelajar Tingkatan Satu di Sekolah Menengah Kebangsaan di daerah Kuala Nerus yang terpilih adalah seramai 210 orang. Menurut Krejcie et al. (1970), sampel kajian bagi populasi 210 orang adalah seramai 136 orang. Oleh itu, pengkaji telah memilih 136 orang responden daripada sejumlah populasi tersebut yang terdiri daripada 84 orang pelajar perempuan dan 52 orang pelajar lelaki sebagai sampel kajian.

Instrumen kajian yang digunakan ialah borang soal selidik yang mengandungi dua bahagian utama dengan keseluruhan 10 soalan. Bahagian A berfungsi sebagai instrumen ujian pra dan pasca intervensi yang berbentuk ujian kefahaman terhadap topik Akidah Tingkatan Satu, merangkumi empat subtopik utama iaitu Islam sebagai agama fitrah, asas akidah Islam, beriman kepada Allah, serta nama-nama Allah al-Khaliq dan al-Musawwir. Penggunaan instrumen berasaskan kandungan kurikulum ini adalah selaras dengan pandangan

Arsaythamby Veloo (2011) yang menyatakan bahawa pengukuran penguasaan pelajar perlu menggunakan alat ukur yang menepati kandungan kursus.

Bahagian B pula terdiri daripada tiga soalan bagi mendapatkan data berkaitan minat dan kecenderungan pelajar terhadap penggunaan aplikasi E-Aqidah, khususnya dalam memahami tajuk-tajuk di bawah bidang Akidah Tingkatan Satu. Hal ini bertepatan dengan pandangan Ahmad Jafri Baham et al. (2022) yang menyatakan bahawa minat pelajar mempunyai hubungan dengan strategi pengajaran dan pembelajaran dalam memberi kesan terhadap keberkesanan pembelajaran. Soalan-soalan dalam Bahagian B menggunakan skala Likert empat mata iaitu (4) sangat setuju, (3) setuju, (2) tidak setuju dan (1) sangat tidak setuju.

Borang soal selidik Bahagian A diberikan sebanyak dua kali, iaitu sebelum dan selepas penggunaan aplikasi E-Aqidah. Skor yang diperoleh daripada kedua-dua ujian ini direkodkan dan dibandingkan bagi menilai tahap peningkatan kefahaman pelajar selepas intervensi. Bagi Bahagian B pula, soal selidik hanya dijawab oleh pelajar selepas penggunaan aplikasi E-Aqidah bagi menilai persepsi serta minat pelajar terhadap penggunaan aplikasi tersebut

## Keputusan Dan Perbincangan

Bahagian A: Ujian Pra dan Pasca

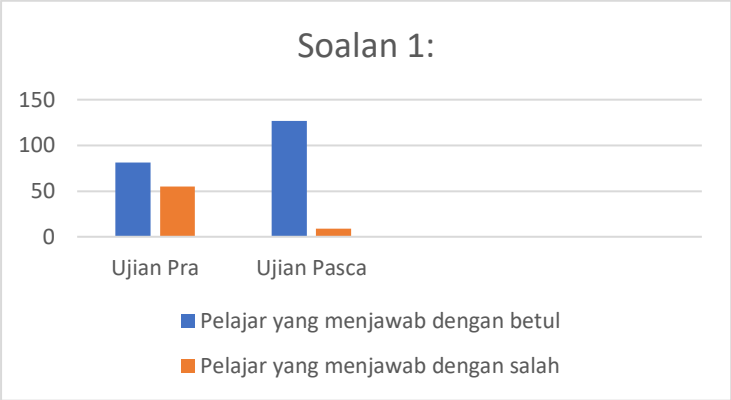
Berdasarkan borang soal selidik bahagian A, terdapat 7 soalan berbentuk aneka pilihan jawapan yang terdiri daripada pilihan jawapan A, B, C dan D. Soalan yang dikemukakan diambil daripada kandungan-kandungan dalam bidang Akidah Tingkatan Satu iaitu subtopik Islam sebagai agama fitrah, asas akidah Islam, beriman kepada Allah, dan nama-nama Allah Al-Khaliq dan al-Musawwir.

Merujuk kepada Jadual 1, berikut merupakan instrumen kajian berbentuk soalan yang digunakan dalam borang soal selidik untuk mengukur tahap kefahaman pelajar sebelum dan selepas penggunaan aplikasi E-Aqidah.

**Jadual 1: Borang Soal Selidik Bahagian A**

| Bil | Item |
|---|---|
| 1. | Apakah maksud Islam sebagai agama fitrah? |
| 2. | Akidah dari segi istilah ialah |
| 3. | Berdasarkan surah ar-Rum ayat 30, manusia diciptakan oleh Allah dalam keadaan… |
| 4. | Apakah bukti bahawa Islam merupakan agama fitrah? |
| 5. | Dalil naqli beriman kepada Allah yang maha mencipta dan memiliki alam ini sepenuhnya adalah |
| 6. | Asas iman seseorang ialah |

7. Allah Maha Mencipta makhluk dengan pelbagai rupa dan identiti yang tersendiri tanpa berpandukan sebarang contoh sebelumya. Perkara ini perujuk kepada nama Allah yang mana?

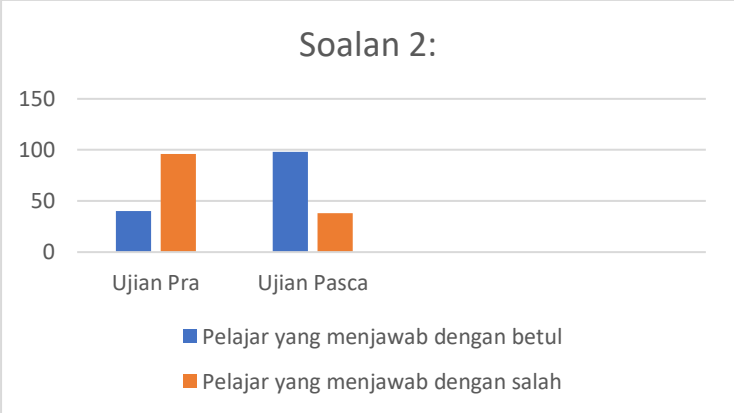



**Rajah 1: Bilangan Pelajar Yang Menjawab Soalan 1**

Berpandukan rajah 1 bagi soalan "Apakah maksud Islam sebagai agama fitrah?" didapati bahawa daripada 136 orang responden, 81 orang pelajar dapat menjawab soalan 1 dengan betul manakala 55 orang yang lain menjawab dengan salah pada ujian pra. Peningkatan sebanyak 56.8% telah berlaku setelah penggunaan aplikasi E-Aqidah apabila pelajar yang menjawab soalan 1 dengan betul telah meningkat kepada 127 orang manakala yang salah hanya 9 orang sahaja.

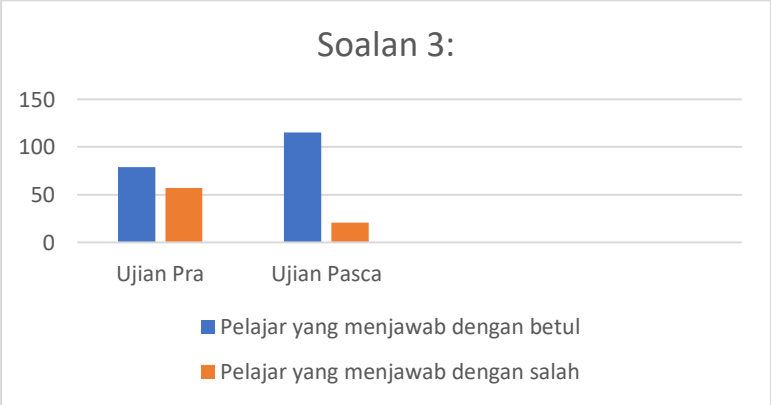
Peningkatan yang berlaku ini adalah berfaktor daripada penggunaan media pembelajaran interaktif yang terdapat di dalam aplikasi E-Aqidah. Media pembelajaran interaktif adalah sistem penyampaian pengajaran yang menyajikan bahan dengan berbagai media seperti video rakaman dengan pengendalian komputer kepada pelajar yang tidak hanya mendengar dan melihat video dan suara, tetapi juga memberikan respon yang aktif dan respon itu yang menentukan kecepatan dan hasil keberkesanan (Trimansyah, 2021). Melalui pembelajaran yang interaktif, pelajar akan lebih menunjukkan minat terhadap pembelajaran dan dapat meningkatkan motivasi dalam memahami topik-topik. Melalui keterlibatan diri dan motivasi yang tinggi, pelajar cenderung untuk menjadi lebih aktif dalam proses belajar yang seterusnya dapat meningkatkan hasil pembelajaran mereka (Yuliana Sesi Bitu et al., 2024). Ini membuktikan bahawa aplikasi ini telah berjaya meningkatkan kefahaman pelajar pada soalan.

**Rajah 2: Bilangan Pelajar Yang Menjawab Soalan 2**




Rajah 2 merupakan graf bagi soalan "Akidah dari segi istilah ialah" menunjukkan 40 orang pelajar menjawab soalan 2 dengan betul dan 96 orang menjawab dengan jawapan yang salah ketika ujian pra dijalankan. Keputusan ujian pasca pula menunjukkan seramai 98 orang pelajar menjawab soalan dengan betul dan 38 orang pelajar telah menjawab jawapan yang salah. Ini telah mencatatkan peratusan kenaikan sebanyak 145%.

Hal ini menunjukkan bahawa soalan 2 mencatatkan peningkatan yang paling tinggi di antara kesemua soalan yang lain. Peningkatan yang signifikan ini dipercayai disebabkan oleh integrasi elemen gamifikasi dalam aplikasi, iaitu permainan interaktif yang menarik dan tidak membosankan. Perkara ini disokong oleh Zulfikri et al. (2022) yang menyatakan bahawa strategi belajar melalui bermain perlu disepadukan dengan penggunaan teknologi melalui pelbagai medium. Gamifikasi juga turut termasuk di dalam media pembelajaran interaktif sepertimana yang telah dibincangkan. Menurut Tri Mulyati et al. (2021), kelebihan dari pembelajaran interaktif adalah dapat menjadikan pelajar lebih bebas dalam mengungkapkan rasa ingin tahu dalam dirinya sehingga hasil belajar yang diperoleh jadi lebih bermakna. Justeru, faktor-faktor ini menjelaskan peningkatan tinggi yang dicatatkan pada soalan 2.



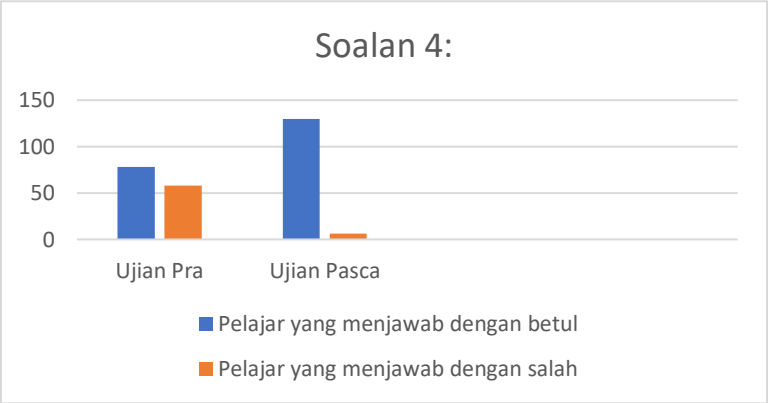

**Rajah 3: Bilangan Pelajar Yang Menjawab Soalan 3**

Rajah 3 adalah mewakili soalan "Berdasarkan surah ar-Rum ayat 30, manusia diciptakan oleh Allah dalam keadaan…" telah mencatatkan 79 orang pelajar menjawab soalan 3 dengan betul

pada ujian pra dan selebihnya menjawab jawapan yang salah. Setelah melaksanakan ujian pasca, bilangan pelajar yang menjawab dengan betul meningkat kepada 115 orang dan menjadikan peratus kenaikan 45.57%.

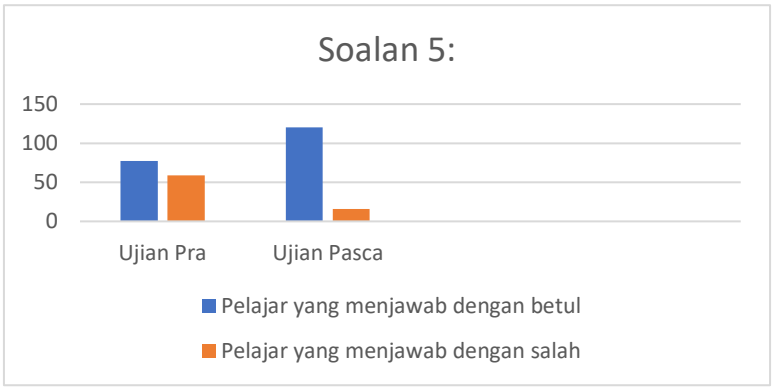
Soalan 3 melibatkan pemahaman pelajar terhadap konteks ayat al-Qur'an daripada surah ar-Rum ayat 30. Peningkatan ini dipercayai disebabkan oleh penyertaan unsur audio dalam aplikasi E-Aqidah. Menurut Azzahra et al. (2025), penggunaan media audio dalam pembelajaran membolehkan pelajar mendengar cerita atau arahan, sekali gus meningkatkan tahap pemahaman melalui pendengaran serta mengukuhkan ingatan mereka terhadap maklumat verbal. Semasa ujian pra, pelajar membaca sendiri soalan 3, manakala pada ujian pasca mereka mendengar audio bacaan ayat al-Qur'an daripada aplikasi. Oleh itu, unsur audio terbukti membantu pelajar memahami konteks ayat dan menjawab soalan dengan lebih tepat.

**Rajah 4: Bilangan Pelajar Yang Menjawab Soalan 4**




Berdasarkan rajah 4 bagi soalan "Apakah bukti bahawa Islam merupakan agama fitrah?" seramai 78 orang menjawab soalan 4 dengan betul dan 58 orang menjawab dengan salah pada tahap awal. Ujian pasca mencatatkan peningkatan sebanyak 66.67%.

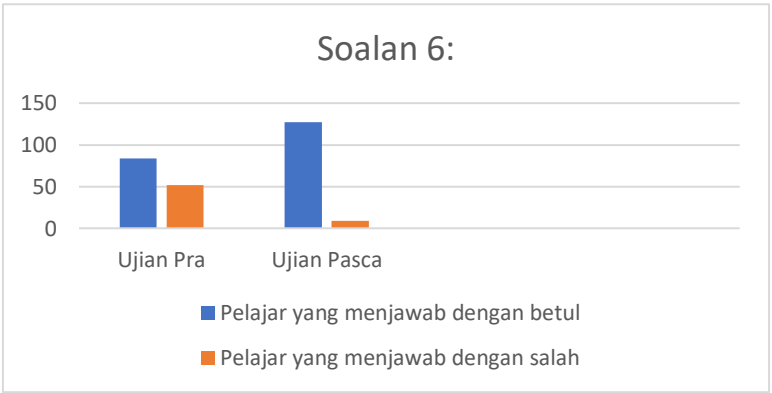
Selain mengetengahkan elemen audio semata-mata, aplikasi ini turut menggunakan elemen gabungan iaitu audio-visual. Pekara ini juga turut membantu kefahaman pelajar dalam memahami isi kandungan pembelajaran seterusnya dapat menjawab soalan dengan baik. Komunikasi dan informasi yang dapat disalurkan melalui media ini adalah dalam bentuk komunikasi verbal dan nonverbal yang menjurus kepada penglihatan mahupun pendengaran (Raudatussolihah, 2022). Menurut Siti Khadizah Kaimin et al. (2016), penggunaan audio visual dapat meningkatkan daya ingatan dan kemahiran murid. Media audio-visual diterapkan di dalam E-Aqidah melalui segmen penerangan ringkas setiap topik dan animasi ringkas. Dalam aplikasi E-Aqidah, media audio-visual diterapkan melalui segmen penerangan dan animasi ringkas setiap topik, yang menyokong kefahaman pelajar.




**Rajah 5: Bilangan Pelajar Yang Menjawab Soalan 5**

Rajah 5 mewakili soalan "Dalil naqli beriman kepada Allah yang maha mencipta dan memiliki alam ini sepenuhnya adalah" memperlihatkan 77 orang pelajar berjaya menjawab soalan 5 dengan betul manakala 59 orang lagi menjawab salah pada ujian pra. Penggunaan aplikasi E-Aqidah dilihat mempengaruhi skor para pelajar apabila berlaku peningkatan sebanyak 55.84% daripada bilangan pelajar yang menjawab dengan betul pada ujian pra.

Soalan 5 juga berkaitan dengan pemahaman pelajar terhadap konteks ayat al-Qur'an seperti soalan 3. Peningkatan daripada hanya 77 orang sahaja yang menjawab dengan betul kepada 120 orang membuktikan bahawa kaedah audio menjadi perangsang yang amat baik untuk meningkatkan kefahaman dan daya ingatan pelajar terdapat ayat-ayat al-Qur'an. Oleh itu, kaedah audio terbukti menyokong pemahaman pelajar terhadap kandungan al-Qur'an secara lebih mendalam.

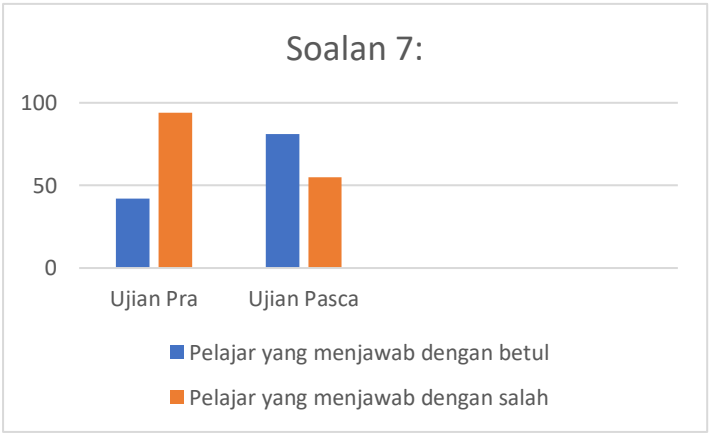



**Rajah 6: Bilangan Pelajar Yang Menjawab Soalan 6**

Rajah 6 adalah soalan "Asas iman seseorang ialah" menunjukkan seramai 84 orang menjawab soalan 6 dengan betul sebelum penggunaan aplikasi E-Aqidah, manakala peratus meningkat kepada 51.19% apabila bilangan pelajar yang betul meningkat kepada 127 orang.

Selain faktor media pembelajaran interaktif, gamifikasi, audio dan audio-visual, peningkatan pada soalan 6 turut menjelaskan bagaimana pembelajaran berasaskan tempo pelajar dapat membantu pelajar dalam pembelajaran. Hal ini kerana, penggunaan aplikasi E-Aqidah adalah

fleksibel dan mudah. Pelajar boleh menghentikan pembelajaran pada mana-mana bahagian yang tidak difahami, kemudian menyambung semula selepas mereka jelas dengan kandungan tersebut. Keupayaan untuk mengulang sesi pembelajaran sebanyak yang diperlukan turut membantu mengukuhkan pemahaman secara lebih mendalam. "Self-paced learning" berupaya menyumbang kepada pengalaman belajar yang lebih bersifat peribadi dan sesuai dengan keperluan individu (Heng, 2018).




**Rajah 7 Menunjukkan Bilangan Pelajar Yang Menjawab Soalan 7**

Rajah 7 mewakili soalan "Allah Maha Mencipta makhluk dengan pelbagai rupa dan identiti yang tersendiri tanpa berpandukan sebarang contoh sebelumya. Perkara ini perujuk kepada nama Allah yang mana?" memaparkan seramai 42 orang pelajar menjawab soalan 7 dengan betul, manakala 94 orang yang lain memilih jawapan yang salah pada ujian pra. Namun begitu, bilangan pelajar yang betul meningkat pada ujian pasca iaitu kepada 81 orang dan menjadikan peratus kenaikan sebanyak 92.86%.

Peningkatan peratus pelajar yang dapat menjawab dengan betul pada soalan 7 berfaktor daripada nota-nota padat dan mudah yang tersedia di dalam aplikasi E-Aqidah berbeza dengan buku teks yang memerlukan beberapa muka surat, aplikasi ini menyediakan nota padat yang merangkumi keseluruhan bab dalam satu paparan skrin sahaja. Oleh itu, pelajar dapat mengakses maklumat dengan lebih mudah dengan masa yang lebih singkat. Sebagaimana menurut Salame et al. (2024), nota ringkas dan padat membantu pelajar faham maklumat dengan lebih mudah dan ingat semula dengan lebih senang.

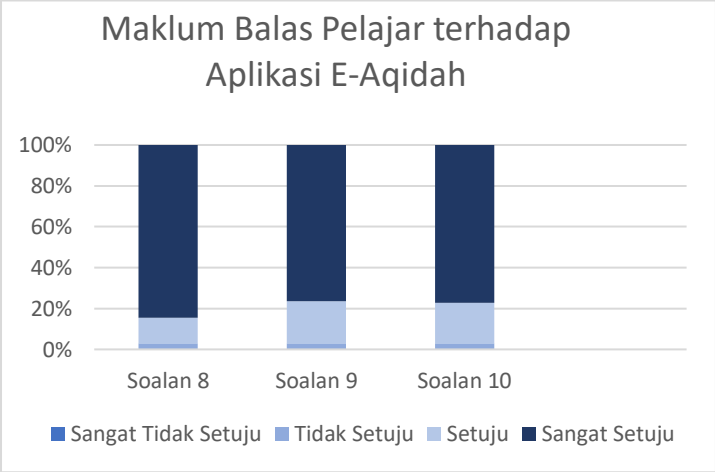
Bahagian B: Minat dan Pengalaman Pelajar Terhadap Aplikasi E-Aqidah

Pada bahagian B borang soal selidik ini dikemukakan tiga soalan yang bertujuan untuk mendapatkan maklum balas daripada pelajar mengenai aplikasi ini. Pelajar perlu memilih antara empat pilihan jawapan iaitu Sangat Setuju, Setuju, Tidak Setuju dan Sangat Tidak Setuju kepada soalan-soalan yang diberikan.

Merujuk kepada Jadual 2, berikut merupakan instrumen kajian yang digunakan untuk mengetahui kecenderungan pelajar khususnya terhadap pengalaman penggunaan aplikasi.

**Jadual 2: Borang Soal Selidik Bahagian B**

| Bil. | Item |
|---|---|
| 1. | Aplikasi mudah digunakan |
| 2. | Nota dan permainan dalam aplikasi membantu saya memahamai konsep akidah dengan baik |
| 3. | Saya akan menggunakan aplikasi ini untuk membuat ulangkaji |




**Rajah 8: Maklum Balas Pelajar Terhadap Aplikasi E-Aqidah**

Rajah 8 menunjukkan maklum balas 136 orang pelajar terhadap tiga soalan bahagian B iaitu soalan 8 "Aplikasi mudah digunakan", soalan 9 "Nota dan permainan dalam aplikasi membantu saya memahami konsep dengan baik" dan soalan 10 "Saya akan menggunakan aplikasi ini unutk membuat ulangkaji. Untuk soalan 8, 2.94% memilih Tidak Setuju, 12.5% Setuju dan 84.56% Sangat Setuju. Soalan 9, 2.94 % Tidak Setuju, 20.59% Setuju dan 76.47% Sangat Setuju. Manakala soalan 10, 2.94% Tidak Setuju, 19.85% Setuju dan 77.21% Sangat Setuju. Ini menunjukkan majoriti pelajar memberikan maklum balas positif terhadap aplikasi.

Selain menguji keberkesanan aplikasi E-Aqidah melalui ujian pra dan pasca, pengkaji juga telah menilai kerelevenan penggunaan aplikasi E-Aqidah daripada pengalaman pengguna iaitu 136 orang responden yang sama. Majoriti pelajar bersetuju bahawa aplikasi ini mudah untuk digunakan. Mereka juga bersetuju bahawa nota dan permainan yang terdapat di dalam aplikasi membantu mereka memahami topik dengan baik dan bersetuju bahawa aplikasi ini boleh dijadikan sebagai salah satu medium untuk mengulangkaji pelajaran terutamanya bagi bidang Akidah Tingkatan Satu. Aplikasi yang boleh diakses di telefon pintar ataupun komputer berupaya memberikan pengalaman pembelajaran yang lebih fleksibel, kerana pelajar tidak terikat dengan waktu dan tempat tertentu, mereka dapat belajar di mana saja dan bila-bila masa sahaja sesuai dengan keperluan mereka (Abidin et al., 2023, seperti dipetik dalam Arigiyati, Kuncoro and Kusumaningrum, 2021). Perkara ini juga bertepatan dengan matlamat pendidikan abad ke-21 yang ingin mengalihkan kaedah PdP kepada *"student-centered learning"* iaitu pembelajaran yang berpusatkan pelajar, manakala guru hanya berperanan sebagai fasilitator atau pembimbing. Penggunaan aplikasi dalam pendidikan menyokong pembelajaran berpusatkan pelajar. Ia juga boleh dipraktikkan ketika hendak melakukan proses ulangkaji. Menurut Amirul Mukminin Mohamad (2020), proses ulangkaji yang dintegrasikan dengan

gaya pembelajaran abad ke-21 menggunakan pembelajaran berpusatkan pelajar merupakan satu langkah alternatif untuk tabiat pembelajaran yang lebih berkesan. Justeru, dapat dirumuskan bahawa penggunaan aplikasi E-Aqidah dapat meningkatkan kefahaman, motivasi, dan minat pelajar di samping dapat mengintegrasikan teknologi dalam pengajaran dan pembelajaran, sekaligus mengamalkan pedagogi moden yang berpusatkan pelajar.

## Penutup

Kesimpulannya, hasil kajian ini membuktikan bahawa penggunaan aplikasi E-Aqidah telah memberikan kesan yang sangat positif terhadap tahap kefahaman pelajar dalam topik akidah, khususnya berkaitan konsep Islam sebagai agama fitrah. Perbandingan antara keputusan ujian pra dan ujian pasca menunjukkan peningkatan yang ketara dalam bilangan pelajar yang menjawab soalan dengan betul bagi semua item yang diuji. Peningkatan peratusan yang direkodkan bagi setiap soalan membuktikan bahawa aplikasi ini berkesan dalam membantu pelajar memahami konsep akidah dengan lebih jelas dan berkesan. Selain itu, peningkatan prestasi pelajar ini juga mencerminkan keberkesanan pendekatan pembelajaran berasaskan teknologi yang diaplikasikan melalui E-Aqidah. Kandungan pembelajaran yang disusun secara sistematik serta penggunaan elemen interaktif seperti nota ringkas dan permainan pembelajaran berjaya menarik minat pelajar serta meningkatkan penglibatan aktif mereka dalam proses pembelajaran. Hal ini secara tidak langsung membantu pelajar mengukuhkan pemahaman terhadap konsep-konsep asas akidah seperti fitrah manusia, asas iman serta nama dan sifat Allah SWT. Dapatan maklum balas pelajar turut menunjukkan tahap penerimaan yang sangat baik terhadap aplikasi E-Aqidah. Majoriti pelajar bersetuju bahawa aplikasi ini mudah digunakan, membantu pemahaman konsep dan sesuai dijadikan bahan ulang kaji. Maklum balas positif ini membuktikan bahawa aplikasi E-Aqidah bukan sahaja berkesan dari segi pencapaian akademik, malah mampu meningkatkan motivasi dan minat pelajar terhadap pembelajaran akidah. Oleh itu, aplikasi ini wajar dijadikan sebagai bahan sokongan pengajaran dan pembelajaran Pendidikan Islam secara lebih meluas.

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# MEMPERKASA PENDIDIKAN ISLAM MELALUI PENDEKATAN *FIQHORIA* SEBAGAI PEMBELAJARAN DIGITAL INTERAKTIF BERPUSATKAN PELAJAR

(Empowering Islamic Education Through the *Fiqhoria* Approach as Student-Centered Interactive Digital Learning)

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***Abstrak:*** *Kajian ini bertujuan menilai keberkesanan Laman Web Fiqhoria sebagai platform pembelajaran digital interaktif yang dibangunkan untuk memperkukuh penguasaan Fiqah dan menyokong pendekatan pembelajaran berpusatkan pelajar (SCL) dalam Pendidikan Islam. Kajian ini mengguna pakai reka bentuk kuasi-eksperimen satu kumpulan melalui pra–ujian dan pasca–ujian yang melibatkan 120 pelajar dari Sekolah Menengah Kebangsaan Ibrahim Fikri, Sekolah Menengah Kebangsaan Kompleks Gong Badak, Sekolah Menengah Kebangsaan Bukit Tunggal dan Sekolah Menengah Agama Persekutuan Kajang. Kajian ini turut disokong oleh soal selidik terhadap 176 responden terdiri daripada pelajar, guru dan ibu bapa. Fiqhoria dibangunkan melalui model ADDIE dengan pengintegrasian modul visual, nota interaktif dan kuiz gamifikasi bagi meningkatkan keberkesanan pedagogi digital. Dapatan menunjukkan peningkatan ketara skor min daripada 13.75 kepada 16.57 serta penghapusan sepenuhnya julat skor rendah dalam ujian pasca, menandakan peningkatan signifikan dalam penguasaan konsep Fiqah. Persepsi pengguna turut memperlihatkan penerimaan yang amat positif, termasuk 83% pelajar yang melaporkan peningkatan kefahaman, 100% guru yang mengesahkan sokongan terhadap pembelajaran kendiri serta lebih 92% ibu bapa yang berpendapat bahawa Laman Web Fiqhoria memudahkan pembelajaran di rumah. Secara keseluruhan, kajian ini mengesahkan bahawa platform ini berupaya menjadi medium pembelajaran digital yang berimpak tinggi melalui penyediaan pengalaman pembelajaran*

*yang interaktif, moden dan selaras dengan aspirasi Kementerian Pendidikan Malaysia dalam Dasar Pendidikan Digital.*

***Kata Kunci:*** *Pembelajaran Digital, Fiqah, Laman Web Fiqhoria, Pembelajaran Berpusatkan Pelajar, Pendidikan Islam*

***Abstract:*** *This study aims to evaluate the effectiveness of the Fiqhoria website as an interactive digital learning platform developed to enhance students mastery of Fiqh and strengthen student-centred learning within Islamic Education. This study employed a one-group quasi-experimental pretest–posttest design involving 120 students from Sekolah Menengah Kebangsaan Ibrahim Fikri, Sekolah Menengah Kebangsaan Kompleks Gong Badak, Sekolah Menengah Kebangsaan Bukit Tunggal and Sekolah Menengah Agama Persekutuan Kajang. The research was further supported by survey data collected from 176 respondents comprising students, teachers and parents. Fiqhoria website was developed using the ADDIE instructional design model, integrating visual modules, interactive notes and gamified quizzes to enhance digital pedagogy. The findings revealed a substantial increase in the mean score from 13.75 to 16.57, accompanied by the complete elimination of low-score ranges in the posttest, indicating a significant improvement in the mastery of Fiqh concepts. User perceptions were also highly positive, with 83% of students reporting improved understanding, all teachers affirming its support for self-directed learning, and more than 92% of parents acknowledging that the Fiqhoria website facilitates home-based learning. Overall, this study confirms that Fiqhoria website serves as a high-impact digital learning medium by providing an interactive and modern learning experience aligned with the aspirations of the Ministry of Education Malaysia under the Digital Education Policy.*

***Keywords:*** *Digital Learning, Fiqh, Fiqhoria Website, Student-Centred Learning, Islamic Education*

## Pengenalan

Perkembangan teknologi digital dalam pendidikan masa kini telah mengubah kaedah proses pengajaran dan pembelajaran (PdP). Dalam konteks Pendidikan Islam, penggunaan sistem digital yang merangkumi sesi pembelajaran, modul interaktif, kuiz dalam talian dan video interaktif semakin meningkat kerana ia boleh menjadikan pembelajaran lebih menyeronokkan, mudah dan kendiri (Faizahton et al., 2023). Pada masa yang sama, pendekatan pembelajaran berpusatkan pelajar (SCL) telah menjadi keperluan penting dalam kurikulum abad ke-21. Pembelajaran digital benar-benar mempunyai keupayaan yang hebat untuk membantu SCL kerana ia memberi ruang kepada pelajar untuk belajar, bekerjasama dan menggunakan pembelajaran secara aktif (Ismul Huda, 2016). Dalam konteks ini, dasar pendidikan digital Kementerian Pendidikan Malaysia (KPM) menekankan keperluan penguasaan kemahiran dan penggunaan teknologi yang signifikan di dalam bilik darjah bagi mengembangkan penglibatan serta pengetahuan pelajar.

Dalam usaha ini, penggunaan Laman Web *Fiqhoria* sebagai platform pembelajaran digital interaktif yang berpusatkan pelajar (SCL) dapat dilihat sebagai pendekatan inovatif dan relevan terhadap keperluan terkini. *Fiqhoria* direka bentuk untuk mengaplikasikan kaedah pembelajaran bersasarkan pelajar (SCL) dengan menggabungkan modul digital interaktif, nota

visual, video animasi, kuiz berasaskan gamifikasi dan pembelajaran kendiri untuk meningkatkan minat, motivasi dan pengalaman pelajar terhadap bidang Fiqah. Tambahan pula, *Fiqhoria* juga dapat membantu mereka mengaitkan pengalaman kehidupan seharian. Kaedah ini selaras dengan dapatan kajian yang menunjukkan bahawa penggunaan pembelajaran interaktif dalam Pendidikan Islam telah berjaya meningkatkan minat dan motivasi pelajar ke arah pembelajaran (Zur'ain Zaini & Khadijah Abdul Razak, 2022). Selain itu, tinjauan sistematik tentang gamifikasi dalam Pengajaran dan Pemudahcaraan (PdPc) Pendidikan Islam mendapati bahawa gamifikasi dalam pembelajaran mewujudkan keseronokan, menggalakkan penglibatan yang aktif dan dapat meningkatkan kepuasan pelajar (Kitikedizah Hambali & Maimun Aqsha Lubis, 2022). Oleh yang demikian, penemuan ini menyokong keperluan untuk menggabungkan elemen permainan digital dan interaktif dalam struktur pembelajaran inovatif seperti *Fiqhoria*.

Walau bagaimanapun, kajian menunjukkan bahawa pembelajaran digital khususnya dalam bidang Fiqah masih belum digunakan sepenuhnya. PdP masa kini kebanyakan masih bersifat konvensional di mana ia bergantung sepenuhnya kepada penyampaian guru dan buku teks. Subjek Pendidikan Islam masih lagi ketinggalan jauh dalam penggunaan digital berbanding bidang yang lain, di mana lebih daripada 60% guru Pendidikan Islam masih memfokuskan pada penyampaian secara kuliah konvensional dan buku teks semata-mata untuk mengajar bidang Fiqah sedangkan penggunaan teknologi digital masih lagi di tahap minimum (Suhaida Mohd Sukis et al., 2023). Isu ini bercanggah dengan keperluan pendidikan abad ke-21 yang menekankan pendekatan pembelajaran berpusatkan pelajar (SCL), di mana pelajar diberi peluang untuk meneroka, bekerjasama dan mengambil bahagian secara aktif dalam proses pembelajaran Pendidikan Islam terutamanya bidang Fiqah.

Masalah-masalah kajian yang dapat dikesan adalah keterbelakangan penggunaan bahan digital interaktif berkualiti, PdP masih bersifat *teacher-centred* serta tahap penglibatan dan literasi digital pelajar yang belum cukup tinggi untuk membantu pembelajaran kendiri. Selain itu, terdapat kajian yang menunjukkan bahawa ibu bapa memerlukan pendekatan pembelajaran agama yang lebih fleksibel, mudah diakses dan mampu menyokong pembelajaran di rumah tanpa bergantung sepenuhnya kepada guru atau kelas tambahan (Norhayati et al., 2024). Hal ini perlu dipertimbangkan bagi menangani isu jurang kemahiran digital yang wujud. Ia bertujuan untuk mengoptimumkan penglibatan pelajar secara aktif serta memperkukuh literasi digital spiritual dalam kalangan pelajar (Mohd Hatta Md Hani et al., 2025).

Bagi merealisasikan aspirasi dasar pendidikan digital dan tuntutan KPM, kajian ini bertujuan untuk: i) mengkaji konsep pembelajaran berpusatkan pelajar (SCL) dan perkaitannya dengan penggunaan digital dalam subjek Pendidikan Islam; ii) menganalisis penggunaan pembelajaran digital dan tahap integrasinya dalam pengajaran Pendidikan Islam; dan iii) menilai potensi *Fiqhoria* dalam memperkasa penglibatan ibu bapa untuk meningkatkan keyakinan dan penguasaan Fiqah pelajar. Hasilnya, *Fiqhoria* merupakan platform pembelajaran digital interaktif yang berpotensi meningkatkan motivasi dan pengetahuan pelajar secara sistematik. Jika diterapkan dalam PdP, kemungkinan besar pelajar akan lebih bersemangat meneroka ilmu dan mengaitkan hukum-hukum Fiqah dengan situasi kehidupan sebenar (Rohana Mohd Nawi et al., 2024). Oleh yang demikian, kajian ini dilihat penting dalam memberikan rujukan dan panduan komprehensif kepada guru serta pihak sekolah mengenai potensi pembelajaran digital

interaktif terutamanya *Fiqhoria* untuk meningkatkan keyakinan dan penguasaan Pendidikan Islam terutamanya bidang Fiqah.

## Sorotan Literatur

Dalam konteks Pendidikan Islam di peringkat sekolah menengah khususnya bidang Fiqah, pendekatan pembelajaran berpusatkan pelajar (SCL) semakin dilihat sebagai keperluan untuk membina kefahaman mendalam dan Kemahiran Berfikir Aras Tinggi (KBAT) dalam kalangan pelajar. Integrasi teknologi digital melalui multimedia, *Learning Management System* (LMS) dan aplikasi interaktif pula memudahkan guru merancang aktiviti kolaboratif, perbincangan, kuiz dalam talian dan tugasan reflektif yang boleh dijalankan secara bersemuka, dalam talian ataupun secara hibrid. Malah, Guru Pendidikan Islam (GPI) yang mengamalkan strategi pembelajaran berpusatkan pelajar (SCL) dalam pengajaran Fiqah di sekolah menengah berjaya menjadikan proses pengajaran lebih berkesan dan selari dengan kehendak Pembelajaran Abad ke-21 (PAK-21) (Amirul Amin, 2024). Hal ini menjadikan kajian terhadap keberkesanan pendekatan digital berasaskan pelajar (SCL) dalam PdP Fiqah semakin penting untuk memastikan proses pembelajaran lebih relevan, interaktif dan berimpak positif terhadap pelajar.

Seterusnya, penggunaan media digital seperti video, *e-book*, aplikasi mudah alih dan sistem interaktif semakin ketara dalam proses PdP subjek Pendidikan Islam. Platform digital ini dilaporkan berpotensi meningkatkan kejayaan dan motivasi pelajar sekali gus menjadikan proses pembelajaran lebih interaktif. Sokongan terhadap trend pembelajaran ini diperkukuh oleh kajian literatur sistematik mengenai trend Pendidikan Islam dari tahun 2020 hingga 2024, yang menekankan keperluan untuk mengintegrasikan peralatan digital yang direka khusus dalam bidang Pendidikan Islam (Norliza Ab Halim et al., 2025). Mereka turut menekankan kerangka Pedagogi Kandungan Teknologi Islam (TPIC), di mana kejayaan pembelajaran digital Islam amat bergantung kepada pendidikan guru, pembangunan kandungan yang sesuai dengan budaya dan infrastruktur teknologi yang stabil. Implikasinya, pembelajaran digital mempunyai keupayaan yang besar untuk meningkatkan kualiti bidang Fiqah dalam Pendidikan Islam. Walau bagaimanapun, kejayaan integrasi ini memerlukan sokongan padu dari segi kurikulum yang relevan, pendidikan guru yang komprehensif dan penilaian kandungan yang telus.

Penglibatan ibu bapa menjadi salah satu faktor kritikal yang mempengaruhi kejayaan dan perkembangan holistik pelajar. Terdapat kajian yang menegaskan bahawa sokongan sosial daripada ibu bapa seperti sokongan emosi, galakan dan bimbingan amat penting dalam meningkatkan keyakinan diri dan harga diri (*self-esteem)* pelajar di mana kedua-dua aspek ini adalah pemangkin kepada pencapaian akademik yang lebih baik (Yang et al., 2023). Oleh itu, peranan ibu bapa sebagai agen sokongan dan pemudah cara di rumah adalah sangat penting dalam konteks pembelajaran digital Fiqah. Justeru, kajian ini bertujuan menilai potensi *Fiqhoria* sebagai platform digital untuk memperkasa keterlibatan ibu bapa, seterusnya meningkatkan keyakinan dan penguasaan Fiqah pelajar.

## Metodologi kajian

Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kuasi-eksperimen satu kumpulan atau dikenali (*one-group pretest–posttest design*) serta kaedah tinjauan untuk menilai kebolehgunaan dan keberkesanan Laman Web *Fiqhoria* sebagai platform pembelajaran digital interaktif dalam Pendidikan Islam. Pembangunan *Fiqhoria* berpandukan

Model ADDIE yang meliputi fasa *analysis, design, development, implementation* dan *evaluation* dengan penekanan kepada penyusunan semula kandungan Fiqah Tingkatan Satu dalam bentuk visual, nota interaktif, kuiz dan elemen digital berpusatkan pelajar (Branch, 2009). Penilaian pengguna melibatkan 296 yang terdiri daripada 30 pelajar dari setiap sekolah iaitu SMK Ibrahim Fikri, SMK Kompleks Gong Badak, SMK Bukit Tunggal dan SMA Persekutuan Kajang yang dipilih melalui persampelan bertujuan. Pautan *Fiqhoria* turut diedarkan secara dalam talian kepada pelajar, guru dan ibu bapa bagi mendapatkan maklum balas tambahan melalui *Google Form*. Instrumen kajian terdiri daripada soal selidik Skala Likert tiga mata, iaitu 1 = Sangat Setuju (SS), 2 = Setuju (S) dan 3 = Tidak Setuju (TS) bagi menilai persepsi terhadap kebolehgunaan, kefahaman dan motivasi manakala pra-ujian dan pasca-ujian digunakan untuk mengukur perubahan pencapaian pelajar sebelum dan selepas penggunaan *Fiqhoria*. Data kuantitatif dianalisis menggunakan statistik deskriptif seperti min, sisihan piawai dan peratusan serta ujian-t sampel berpasangan bagi membandingkan skor pra dan pasca ujian (Pallant, 2020).

Keperluan fungsional dan bukan fungsional dikenal pasti melalui analisis keperluan pengguna, seterusnya dijadikan asas kepada pembinaan seni bina sistem Laman Web *Fiqhoria* menggunakan rangka kerja *CodeIgniter4* berasaskan *Model View Controller* (MVC) (Gomaa, 2011). Pangkalan data dibangunkan menggunakan *Structured Query Language* (SQL) bagi memastikan integriti, konsistensi dan kecekapan pengurusan maklumat. Reka bentuk antaramuka pengguna dibangunkan secara responsif melalui penggunaan *HyperText Markup Language* (HTML), *Cascading Style Sheets* (CSS) dan *Bootstrap* dengan mempertimbangkan prinsip kebolehgunaan serta pengalaman pengguna bagi memastikan penyampaian maklumat yang jelas dan sistematik (Garrett, 2011). Fasa pembangunan melibatkan pelaksanaan logik pelayan melalui bahasa (PHP) serta penerapan ciri keselamatan asas seperti ketepatan input dan perlindungan *Cross Site Request Forgery* untuk menjamin ketahanan sistem. Akhir sekali, pelaksanaan ujian fungsi, integrasi, kebolehgunaan dan ujian penerimaan pengguna dijalankan secara menyeluruh bagi memastikan keselarasan operasi serta kestabilan platform.

## Dapatan dan Perbincangan Kajian

Bahagian ini membentangkan dapatan kuantitatif daripada ujian pra–ujian dan pasca–ujian serta dapatan soal selidik yang melibatkan tiga kumpulan responden iaitu pelajar, guru dan ibu bapa. Huraian dapatan disusun mengikut keutamaan kajian, diikuti dengan analisis deskriptif dan perbincangan terhadap faktor yang menjelaskan perubahan, sokongan teori dan hubungan dengan kajian-kajian terdahulu.

### *Dapatan Ujian Pra-Ujian dan Pasca-Ujian*

Ujian pra dan pasca dijalankan untuk menilai keberkesanan Laman Web *Fiqhoria* yang meningkatkan penguasaan konsep Fiqah dalam kalangan pelajar tingkatan satu. Intervensi pembelajaran merangkumi penggunaan bahan digital seperti infografik, nota ringkas, kuiz

interaktif dan penerangan multimedia yang dibangunkan mengikut model reka bentuk instruksional ADDIE. Dapatan berdasarkan analisis yang melibatkan 120 responden yang diringkaskan dalam Jadual 1.

**Jadual 1: Perbandingan Taburan Skor Pra–Ujian dan Pasca–Ujian Pelajar (N = 120)**

| Julat Skor | Pra-Ujian | Pasca-Ujian |
|---|---|---|
| 4 - 5 | 14 | 0 |
| 9 - 10 | 11 | 0 |
| 12 - 13 | 23 | 0 |
| 14 - 15 | 20 | 31 |
| 16 - 17 | 35 | 61 |
| 18 - 20 | 17 | 28 |
| **Min Purata** | **13.75** | **16.57** |

Dapatan kajian menunjukkan peningkatan pencapaian yang ketara selepas pelajar mengikuti intervensi menggunakan Laman Web *Fiqhoria*. Nilai min pra-ujian sebanyak 13.75 meningkat kepada 16.57 dalam ujian pasca menunjukkan peningkatan yang jelas dalam prestasi akademik. Lebih menarik lagi, keseluruhan julat skor rendah (4–10) yang sebelum ini menunjukkan kelemahan asas dalam menguasai konsep Fiqah telah hilang sepenuhnya dalam ujian pasca. Pada masa yang sama, bilangan pelajar yang mencapai skor tinggi (16–20) meningkat dengan ketara dapat mencerminkan perubahan dalam taburan pencapaian dari tahap rendah kepada tahap tinggi yang konsisten. Perubahan corak ini memberikan gambaran empirikal bahawa intervensi melalui *Fiqhoria* menghasilkan kesan pembelajaran yang efektif dan komprehensif.

Peningkatan ini secara khusus menunjukkan keberkesanan *Fiqhoria* sebagai platform pembelajaran digital yang mampu mengukuhkan pemahaman konsep Fiqah termasuk kemahiran kognitif asas, pemikiran analitikal dan keupayaan untuk mengaplikasikan hukum dalam kehidupan. Topik Pendidikan Islam yang kebiasaannya memerlukan penjelasan yang terperinci menjadi lebih mudah difahami apabila dibentangkan melalui elemen multimedia seperti ikon, infografik, animasi dan kuiz interaktif (Faizahton et al., 2023). Hal ini dibuktikan dalam kajian bahawa persembahan multimedia turut mempengaruhi pencapaian akademik pelajar (Said et al., 2015). Ini kerana anjakan penggunaan Alat Bahan Bantu Mengajar (AABM) yang dibina berasaskan perisian multimedia telah memberi peluang kepada pelajar untuk bebas mengawal pembelajaran dengan lebih baik melalui pengalaman pembelajaran secara kumpulan, interaktif atau kendiri (Nurul Syadiah & Ramlah, 2020).

Menurut teori beban kognitif, pelajar dapat belajar dengan lebih baik apabila ingatan kerja mereka tidak dibebankan. Dengan adanya Laman Web *Fiqhoria* membantu mengurangkan beban ini dengan memecahkan maklumat kepada bahagian kecil dan mudah difahami sekali gus membolehkan pelajar memberi tumpuan kepada pembinaan pengetahuan baharu. Penstrukturan *Fiqhoria* berpandukan teori ini amat memainkan peranan utama dalam menentukan bagaimana keberkesanan strategi pembelajaran yang digunakan (Yusniza et al., 2016). Dapatan ini secara tidak langsung dapat memperlihatkan keperluan untuk memperkasa penggunaan platform digital dalam pendidikan yang menghasilkan impak positif terhadap kefahaman, aksesibiliti dan keberkesanan pembelajaran. Peningkatan skor yang ketara selepas intervensi juga mengesahkan keselarasan *Fiqhoria* dengan aspirasi Dasar Pendidikan Digital KPM 2027, yang menekankan pendigitalan bahan pembelajaran, penyediaan akses pembelajaran kendiri dan pengurangan kebergantungan pada bahan bercetak. Platform ini menyediakan ekosistem pembelajaran yang fleksibel dan mudah diakses sekali gus menyokong transformasi pendidikan Islam ke arah model pembelajaran digital yang lebih moden, inklusif dan mampan.

### *Dapatan Borang Soal Selidik*

Dapatan demografi menunjukkan responden kajian terdiri daripada 176 orang responden daripada tiga kategori utama iaitu pelajar, guru dan ibu bapa. Majoriti responden ialah perempuan dan kumpulan pelajar paling dominan memberikan maklum balas terhadap soal selidik. Keseluruhan soal selidik ini menggambarkan bahawa kajian melibatkan responden pelbagai latar yang relevan dengan penggunaan *Fiqhoria*.

### *Demografi Responden*

**Jadual 2: Status atau Kategori**

| Bil | Status/Kategori | Bilangan | Peratus (%) |
|---|---|---|---|
| **1** | Pelajar | 106 | 60.2 |
| **2** | Guru | 18 | 10.2 |
| **3** | Ibu Bapa | 52 | 29.5 |
| | Jumlah | 176 | 100 |

Sumber: Soal Selidik 2025

Kajian ini melibatkan seramai 176 orang responden, yang terdiri daripada 132 orang responden perempuan atau bersamaan 75% daripada keseluruhan sampel kajian manakala baki 44 orang responden lagi ialah lelaki, iaitu sebanyak 25%. Perincian demografi responden berdasarkan status atau kategori penglibatan dalam soal selidik ditunjukkan dalam Jadual 2 bagi memberikan gambaran yang lebih jelas tentang komposisi sampel kajian. Daripada keseluruhan responden yang terlibat, seramai 106 orang atau 60.2% merupakan pelajar, diikuti oleh 52 orang atau 29.5% yang terdiri daripada ibu bapa manakala 18 orang responden atau 10.2% adalah dalam kalangan guru. Taburan demografi ini menunjukkan bahawa majoriti

responden ialah pelajar selaras dengan objektif kajian yang memfokuskan penilaian terhadap penggunaan dan keberkesanan *Fiqhoria* dalam konteks pembelajaran Pendidikan Islam. Penglibatan ibu bapa dan guru pula melengkapkan dapatan kajian dengan menyediakan sudut pandang sokongan daripada pihak berkepentingan utama sekali gus menyumbang kepada pemahaman yang lebih menyeluruh dan seimbang terhadap penerimaan serta kebolehgunaan platform digital yang dibangunkan.

***Dapatan Pelajar***

**Jadual 3: Persepsi Pelajar Terhadap Laman Web *Fiqhoria***

| Bil | Pernyataan | (1=SS) | (2=S) | (3=TS) |
|---|---|---|---|---|
| **1** | Saya lebih berminat belajar Fiqah melalui *Fiqhoria* | 86 (81.1%) | 10 (18.9%) | 0 |
| **2** | Kandungan menarik perhatian saya | 76 (71.7%) | 30 (28.3%) | 0 |
| **3** | Saya lebih fokus semasa menggunakan *Fiqhoria* | 58 (54.7%) | 48 (45.3%) | 0 |
| **4** | Saya faham Fiqah dengan lebih baik | 88 (83.0%) | 18 (17.0%) | 0 |

Sumber: Soal Selidik 2025

Jadual 3 menunjukkan tahap persetujuan yang sangat tinggi untuk semua item yang dibentangkan kepada pelajar. Antara item yang paling dominan ialah peningkatan pemahaman pelajar tentang Fiqah selepas menggunakan *Fiqhoria* 83% sangat setuju. Di samping itu, 81.1% pelajar menyatakan bahawa platform ini meningkatkan minat mereka dalam mempelajari Fiqah. Ketiadaan respons "Tidak Setuju" untuk empat item menunjukkan penerimaan yang sangat baik terhadap keberkesanan reka bentuk interaktif platform. Sebahagian besar pelajar turut setuju bahawa *Fiqhoria* dapat menarik perhatian serta membantu fokus semasa pembelajaran dengan anggaran melebihi 50%-70% berada pada tahap setuju dan sangat setuju. Dapatan pelajar ini menunjukkan bahawa penggunaan *Fiqhoria* selari dengan prinsip *constructive alignment* iaitu apabila objektif pembelajaran, penyampaian digital dan pentaksiran disepadukan untuk menghasilkan pengalaman pembelajaran yang lebih bermakna (Yiqing Mao, 2023). Integrasi bahan visual, elemen interaktif dan reka bentuk laman web yang mesra pengguna bukan sahaja berjaya mencapai hasil pembelajaran yang diingini malah turut memperkasa penggunaan teknologi digital dalam Pengajaran dan Pembelajaran (PdP) Pendidikan Islam secara lebih sistematik dan bermakna. Pendekatan ini secara tidak langsung membantu mengatasi dominasi kaedah hafalan semata-mata dengan menyediakan pengalaman pembelajaran yang lebih autentik dan berpusatkan pembinaan pengetahuan pelajar. Hal ini disokong oleh dapatan tinjauan sistematik berkaitan gamifikasi dalam Pengajaran dan Pemudahcaraan (PdPc) Pendidikan Islam yang menunjukkan bahawa penerapan elemen gamifikasi dalam pembelajaran mampu mewujudkan suasana pembelajaran yang menyeronokkan, menggalakkan penglibatan aktif pelajar serta meningkatkan tahap kepuasan mereka terhadap proses pembelajaran (Kitikedizah Hambali & Maimun Aqsha Lubis, 2022).

Dari sudut isu semasa, pelajar masa kini lebih cenderung kepada penggunaan teknologi dan bahan visual yang menarik sekali gus menjadikan pendekatan digital sebagai alternatif yang lebih berkesan dalam meningkatkan minat terhadap mata pelajaran agama berbanding kaedah

pengajaran tradisional yang bersifat sehala (Fatin et al., 2021). Buku teks Pendidikan Islam yang tebal dan kurang elemen visual didapati turut menjejaskan motivasi pelajar selaras dengan dapatan kajian yang menunjukkan bahawa aspek visual dan reka letak bahan pembelajaran memainkan peranan penting dalam mempengaruhi minat serta keterlibatan pelajar (Yi Yi Lau et al., 2020). Dalam konteks ini, pembangunan dan pelaksanaan *Fiqhoria* dilihat berupaya memenuhi aspirasi Dasar Pendidikan Digital KPM 2027, khususnya Teras T1 (Murid Fasih Digital) dan Teras T5 (Kandungan Digital Berkualiti), yang menekankan penggunaan teknologi interaktif, penyampaian kandungan yang jelas secara visual serta penyediaan platform pembelajaran digital yang mesra pengguna dan berimpak tinggi (KPM, 2023). Pelaksanaan pendekatan digital sedemikian juga bertujuan untuk mengoptimumkan penglibatan pelajar secara aktif serta memperkukuh literasi digital spiritual dalam kalangan pelajar selaras dengan keperluan pembentukan sahsiah dan kefahaman agama dalam persekitaran pembelajaran berasaskan teknologi (Mohd Hatta Md Hani et al., 2025).

***Dapatan Guru***

**Jadual 4: Persepsi Guru Terhadap Laman Web *Fiqhoria***

| Bil | Pernyataan | (1=SS) | (2=S) | (3=TS) |
|---|---|---|---|---|
| **1** | Kandungan *Fiqhoria* selari dengan KSSM | 16 (88.9%) | 2 (11.1%) | 0 |
| **2** | Ia menyokong pembelajaran kendiri pelajar | 18 (100%) | 0 | 0 |
| **3** | Selari dengan Dasar Pendidikan Digital | 16 (88.9%) | 2 (11.1%) | 0 |
| **4** | Rekaan platform memenuhi keperluan abad ke- 21 | 16 (88.9%) | 2 (11.1%) | 0 |

Sumber: Soal Selidik 2025

Jadual 4 menunjukkan bahawa persepsi guru terhadap *Fiqhoria* adalah sangat positif. Hasil dapatan menggambarkan keyakinan yang utuh terhadap keberkesanan platform ini dalam PdPc Pendidikan Islam. Majoriti guru 88.9% mengesahkan bahawa kandungan *Fiqhoria* selari dengan Kurikulum Standard Sekolah Menengah (KSSM). Persetujuan tinggi 100% terhadap keupayaan *Fiqhoria* menyokong pembelajaran kendiri menunjukkan potensi platform ini dalam memperkukuh pemikiran pelajar selaras dengan literasi digital abad ke-21. Dapatan soal selidik guru menunjukkan bahawa elemen multimedia dalam *Fiqhoria* meningkatkan kefahaman pelajar serta reka bentuk platform memenuhi keperluan PdP abad ke-21 mendapat persetujuan majoriti 88.9%**.**

Perbincangan dapatan ini menunjukkan bahawa penggunaan *Fiqhoria* menyokong pendekatan pembelajaran berpusatkan pelajar (SCL), di mana guru berperanan sebagai fasilitator yang membimbing, memantau dan menyediakan sokongan semasa pelajar meneroka kandungan secara kendiri. SCL ini juga memberi ruang kepada pelajar untuk belajar, bekerjasama dan menggunakan pembelajaran secara aktif (Ismul Huda, 2016). Reka bentuk platform *Fiqhoria* membantu pelajar mengolah pengetahuan secara aktif selaras dengan asas teori konstruktivisme yang menekankan bahawa pembelajaran lebih berkesan apabila pelajar cuba menghubungkan pengalaman baharu dengan pengetahuan sedia ada (Fatin et al., 2021). Penggunaan grafik dan elemen visual bukan sahaja menarik perhatian pelajar malah

memudahkan pemahaman konsep berbanding penerangan secara deskriptif semata-mata (Sharul et al., 2020). Dalam *Fiqhoria*, paparan visual dan video animasi serta latihan pengukuhan yang ditawarkan membantu menjadikan konsep abstrak lebih mudah dicapai dan meningkatkan keberkesanan PdP dan jika ia diterapkan dalam PdP kemungkinan besar pelajar akan lebih bersemangat meneroka ilmu dan mengaitkan hukum-hukum Fiqah dengan situasi kehidupan sebenar (Rohana Mohd Nawi et al., 2024). Tambahan pula, *Fiqhoria* dapat membantu mereka mengaitkan pengalaman dengan kehidupan seharian kerana penggunaan pembelajaran interaktif dalam Pendidikan Islam mampu meningkatkan minat dan motivasi pelajar ke arah pembelajaran (Zur'ain Zaini & Khadijah Abdul Razak, 2022).

Keberkesanan *Fiqhoria* dalam proses PdPc guru juga menggambarkan pelaksanaan yang berjaya berasaskan Model ADDIE sebagai satu model reka bentuk pengajaran yang sistematik dalam menghasilkan bahan pembelajaran berkomputer yang memberi impak dan mesra pengguna (Baharuddin et al., 2002). Penyediaan Laman Web *Fiqhoria* ini merangkumi lima fasa utama, iaitu *analysis, design, development, implementation* dan *evaluation* yang membolehkan platform ini berfungsi sebagai alat pembelajaran tambahan yang tersusun, terarah dan boleh dioptimumkan mengikut keperluan pengguna (Rafiza & Maryam, 2013). Justeru, *Fiqhoria* dapat dilihat sebagai hasil pendekatan pembangunan bahan pembelajaran yang berstruktur serta berpaksikan keperluan pengguna sekali gus menyokong transformasi pedagogi digital dalam Pendidikan Islam. Penekanan terhadap reka bentuk *Fiqhoria* berasaskan analisis keperluan pelajar dan pembangunan multimedia yang terancang ini bukan sahaja memperkukuh kedudukan *Fiqhoria* sebagai model PdP digital malah memastikan platform ini relevan dengan dinamika pendidikan abad ke-21.

***Dapatan Ibu Bapa***

**Jadual 5: Persepsi Ibu Bapa Terhadap Laman Web *Fiqhoria***

| Bil | Pernyataan | (1=SS) | (2=S) | (3=TS) |
|---|---|---|---|---|
| **1** | Kaedah ini sesuai untuk generasi anak | 48 (92.3%) | 4 (7.7%) | 0 |
| **2** | *Fiqhoria* meningkatkan keyakinan akademik anak | 44 (84.6%) | 8 (15.4%) | 0 |
| **3** | *Fiqhoria* memudahkan pembelajaran di rumah | 50 (96.2%) | 2 (3.9%) | 0 |
| **4** | Saya berpuas hati dengan platform ini | 48 (92.3%) | 4 (7.7%) | 0 |

Sumber: Soal Selidik 2025

Jadual 5 menunjukkan persepsi ibu bapa terhadap *Fiqhoria* sangat positif dengan purata persetujuan keseluruhan melebihi 80% bagi semua item. 92.3% ibu bapa bersetuju bahawa kaedah ini sesuai untuk generasi anak mereka. Keyakinan akademik anak juga dilihat meningkat melalui persetujuan seramai 84.6%. *Fiqhoria* dapat memudahkan pembelajaran di rumah dengan anggaran melebihi 95% menjadikannya alat sokongan yang membantu ibu bapa memantau pembelajaran anak secara lebih sistematik. Selain itu, tahap kepuasan keseluruhan ibu bapa terhadap platform ini turut mencatatkan persetujuan tinggi 92.3% yang membuktikan bahawa *Fiqhoria* berpotensi besar sebagai medium pembelajaran tambahan yang relevan dan efektif dalam menyokong pembelajaran formal dan kendiri.

Dapatan daripada kumpulan ibu bapa menunjukkan tahap penerimaan dan keyakinan yang sangat tinggi terhadap penggunaan *Fiqhoria* sebagai platform pembelajaran digital, menandakan kesesuaian pendekatan ini dengan pola pembelajaran generasi semasa yang lebih memberi responsif terhadap teknologi, visual dan pembelajaran interaktif. Sokongan ibu bapa amatlah penting untuk memperkukuh kedudukan rumah sebagai ekosistem pembelajaran yang signifikan selari dengan teori *Situated Learning Theory* yang menekankan bahawa pembelajaran berkesan berlaku melalui interaksi sosial dalam komuniti yang lebih luas, bukan terbatas pada bilik darjah sahaja (Jean Lave & Etienne Wenger, 1991). Peningkatan keyakinan akademik anak yang diakui ibu bapa juga konsisten dengan *Self-Efficacy Theory*, di mana pengalaman kejayaan kecil melalui aktiviti digital seperti latihan kendiri, kuiz interaktif dan demonstrasi visual mampu memupuk keupayaan kendiri pelajar (Bandura, 1997). Fenomena ini turut disokong oleh kajian Melayu yang membuktikan bahawa kaedah digital interaktif dalam Pendidikan Islam meningkatkan motivasi dan keupayaan pelajar menguasai konsep abstrak (Mohd Maziz et al., 2021).

Di samping itu, dapatan ini dirangka dalam konteks realiti pendidikan Malaysia, di mana ibu bapa berdepan cabaran seperti kekangan masa, kekurangan sumber pengukuhan berkualiti dan kebergantungan kepada kelas tuisyen agama yang tidak dapat diakses oleh semua keluarga. Terdapat kajian yang menunjukkan bahawa ibu bapa memerlukan pendekatan pembelajaran agama yang lebih fleksibel, mudah diakses dan mampu menyokong pembelajaran di rumah tanpa bergantung sepenuhnya kepada guru atau kelas tambahan (Norhayati et al., 2024). Kajian tersebut turut mendapati bahawa model pembelajaran berasaskan teknologi dapat membantu meringankan beban ibu bapa serta meningkatkan keberkesanan pengukuhan pembelajaran anak melalui sumber digital yang terancang dan mesra pengguna. Secara keseluruhannya, dapatan ibu bapa mengesahkan bahawa *Fiqhoria* bukan sahaja memudahkan penguasaan Fiqah secara kendiri tetapi juga memperkukuh penglibatan keluarga dan memperluas ruang pembelajaran daripada bilik darjah ke ekosistem rumah. Gabungan asas teori, penyertaan aktif keluarga dan reka bentuk digital yang terarah kurikulum mengukuhkan kedudukan *Fiqhoria* sebagai model pembelajaran Islam digital yang mampan dan berskala serta relevan dengan tuntutan pedagogi global masa kini.

## Kesimpulan

Kajian ini mengesahkan bahawa Laman Web *Fiqhoria* berfungsi sebagai platform digital interaktif yang berkesan dalam meningkatkan kualiti PdP Pendidikan Islam, khususnya bagi topik Fiqah melalui pendekatan Pembelajaran Berpusatkan Pelajar (SCL). Pelaksanaan analisis pra dan pasca ujian yang melibatkan seramai 120 orang pelajar menunjukkan peningkatan penguasaan kandungan yang signifikan. Peningkatan ini dibuktikan melalui skor min yang meningkat secara menyeluruh serta penghapusan jurang pencapaian skor rendah dalam ujian pasca sekali gus membuktikan impak pedagogi positif penggunaan *Fiqhoria*. Selain itu, dapatan kajian turut disokong oleh persepsi positif daripada pelajar, guru dan ibu bapa. Pelajar melaporkan peningkatan tahap kefahaman terhadap konsep Fiqah serta minat yang lebih tinggi dalam pembelajaran. Guru pula mengesahkan keberkesanan *Fiqhoria* sebagai medium pembelajaran kendiri yang menyokong PdP di dalam dan luar bilik darjah manakala ibu bapa bersetuju bahawa platform ini memudahkan proses pembelajaran di rumah secara lebih sistematik dan kolaboratif. Secara keseluruhannya, dapatan ini menunjukkan bahawa *Fiqhoria*

bukan sahaja memperkukuh penguasaan konsep Fiqah malah meningkatkan autonomi pembelajaran pelajar serta memperluas penglibatan keluarga dalam ekosistem pembelajaran digital. Berdasarkan dapatan tersebut, kajian ini mencadangkan agar latihan profesional guru diperkukuhkan khususnya dalam aspek pedagogi digital dan kemahiran menganalisis data pembelajaran murid melalui analitik pembelajaran. Pihak kerajaan juga disarankan untuk meningkatkan lagi pelaburan dalam infrastruktur digital dan kemudahan internet sebagai akses pembelajaran yang adil dan saksama kepada semua pelajar termasuk mereka yang berada di kawasan luar bandar. Akhir sekali, bagi memperluas sumbangan ilmiah kajian ini penyelidikan lanjutan dicadangkan menggunakan reka bentuk kuasi-eksperimen dua kumpulan bagi membolehkan perbandingan yang lebih mantap antara intervensi pembelajaran digital dan kaedah pengajaran tradisional. Kajian seterusnya juga boleh menilai perkembangan literasi digital kerohanian pelajar dengan meneliti aspek nilai, adab serta pengamalan agama hasil interaksi digital dengan kandungan Fiqah.

## Penghargaan

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# KEBERKESANAN LAMAN WEB E-FAITH JOURNEY TERHADAP PEMBELAJARAN PENDIDIKAN ISLAM ABAD KE-21 BAGI PELAJAR TINGKATAN 1

## *THE EFFECTIVENESS OF THE E-FAITH JOURNEY WEBSITE ON 21ST-CENTURY ISLAMIC EDUCATION LEARNING FOR FORM 1 STUDENTS*

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***Abstrak:*** *Kajian ini bertujuan untuk menilai keberkesanan laman web "E-Faith Journey" sebagai platform pembelajaran digital Pendidikan Islam abad ke-21 bagi pelajar Tingkatan 1. Fokus utama pembangunan laman web ini adalah bagi memudahkan pemahaman topik Sirah, merangkumi Riwayat Hidup Rasulullah SAW, Era Masyarakat Jahiliah dan Perjuangan Khulafa' ar-Rasyidin melalui elemen interaktif seperti nota digital, e-buku, video, permainan dan kuiz. Kajian ini menggunakan reka bentuk tinjauan kuantitatif dengan melibatkan sampel seramai 242 orang pelajar Tingkatan 1 di sebuah sekolah menengah harian di Kuala Terengganu. Data dikumpul melalui borang soal selidik berstruktur menggunakan Google Form dan dianalisis secara statistik. Pendekatan pembelajaran yang diterapkan dalam laman web ini adalah berasaskan gaya VARK (Visual, Auditori, Membaca dan Kinestetik) bagi memenuhi pelbagai keperluan pembelajaran pelajar. Dapatan kajian menunjukkan tahap keberkesanan yang sangat tinggi, di mana hampir 97% responden melaporkan tahap kefahaman yang memuaskan terhadap kandungan Sirah. Selain itu, lebih 93% pelajar menyatakan bahawa pembelajaran melalui laman web ini jauh lebih menarik berbanding penggunaan buku teks tradisional. Elemen permainan digital dan kuiz interaktif juga terbukti membantu meningkatkan fokus serta daya ingatan pelajar terhadap fakta sejarah. Secara*

*keseluruhan, kajian ini membuktikan bahawa integrasi teknologi digital seperti "E-Faith Journey" mampu meningkatkan motivasi, penglibatan aktif dan pemahaman pelajar dalam subjek Pendidikan Islam. Inovasi ini wajar dikembangkan sebagai bahan bantu mengajar digital yang efektif untuk mendepani cabaran pendidikan era Revolusi Industri 4.0.*

***Kata kunci:*** *Pembelajaran Digital, Pendidikan Islam, Sirah, Penglibatan Pelajar, Teknologi Pendidikan.*

***Abstract:*** *This study aims to evaluate the effectiveness of the "E-Faith Journey" website as a 21st-century digital learning platform for Islamic Education among Form 1 students. The primary focus of the website's development is to facilitate the understanding of Sirah (Islamic History) topics, including the Life of Prophet Muhammad SAW, the Era of Jahiliyyah Society, and the Struggle of the Khulafa' ar-Rasyidin, through interactive elements such as digital notes, e-books, videos, games, and quizzes. This study employed a quantitative survey design involving a sample of 242 Form 1 students at a daily secondary school in Kuala Terengganu. Data were collected via structured questionnaires using Google Forms and analyzed statistically. The learning approach implemented on the website is based on the VARK model (Visual, Auditory, Reading, and Kinesthetic) to cater to diverse student learning needs. The findings indicate a very high level of effectiveness, with nearly 97% of respondents reporting a satisfactory level of understanding of the Sirah content. Furthermore, over 93% of students stated that learning through this website is significantly more engaging compared to using traditional textbooks. Digital game elements and interactive quizzes were also proven to help enhance students' focus and memory of historical facts. Overall, this study demonstrates that the integration of digital technology such as "E-Faith Journey" can increase motivation, active engagement, and student understanding in Islamic Education. This innovation deserves further development as an effective digital teaching aid to meet the educational challenges of the Industrial Revolution 4.0 era.*

***Keywords:*** *Digital Learning, Islamic Education, Sirah, Student Engagement, Educational Technology*

## Pengenalan

Perkembangan teknologi abad ke-21 telah mengubah cara penyampaian ilmu, khususnya dalam Pendidikan Islam. Penyelidikan dalam bidang Pendidikan Islam kini semakin berkembang pesat dengan pengintegrasian elemen teknologi bagi memenuhi keperluan pendidikan masa kini (Wan Ali Akbar Wan Abdullah & Fairuzzah Harun, 2024). Pembelajaran digital semakin menjadi pilihan utama kerana ia bukan sahaja menarik perhatian pelajar, tetapi juga membantu mereka memahami kandungan pelajaran dengan lebih baik. Penggunaan teknologi maklumat dalam pendidikan adalah sangat penting bagi memastikan bidang pengajian agama terus relevan dalam mendepani cabaran Revolusi Industri 4.0 (Suriani Sudi et al., 2023). Penyelidikan menunjukkan bahawa permainan digital dalam pembelajaran Sirah dapat meningkatkan minat dan penglibatan pelajar (Salleh & Wan Abdullah, 2024). Penggunaan teknologi maklumat yang teratur dan bijak dalam bilik darjah mampu meningkatkan motivasi pelajar untuk belajar dan fokus terhadap topik tertentu. Cabaran pendidikan abad ke-21 menuntut persediaan yang rapi daripada guru Pendidikan Islam dalam melaksanakan kurikulum sedia ada secara lebih efektif (Rosnani Hashim et al., 2022).

Keberkesanan teknologi ini dalam Pendidikan Islam turut bergantung kepada pengalaman guru menggunakan alat digital sebagai medium pengajaran (Saili et al., 2025). Justeru itu, laman web E-Faith Journey berpotensi menjadi inovasi penting dalam memenuhi keperluan pembelajaran abad ke-21. Laman web ini bukan sahaja menggalakkan pembelajaran kendiri, tetapi juga membantu pelajar Tingkatan 1 memahami topik Pendidikan Islam melalui elemen interaktif, multimedia dan aktiviti digital yang lebih menarik.

***Pernyataan Masalah***

Penggunaan teknologi dalam pendidikan kini semakin meluas, namun pembelajaran Pendidikan Islam di sekolah masih banyak bergantung kepada pendekatan tradisional seperti syarahan dan pembacaan buku teks. Guru Pendidikan Islam sering menghadapi kekangan dalam menarik minat pelajar terhadap bidang Sirah sekiranya hanya bergantung kepada kaedah syarahan tradisional semata-mata (Muhammad Talhah Ajmain @ Jima'ain et al., 2024). Kaedah pengajaran yang bersifat konvensional ini menyebabkan sebahagian pelajar kurang berminat, pasif dan tidak terlibat secara aktif dalam proses pembelajaran. Kajian lepas turut menunjukkan bahawa pendekatan digital, khususnya yang menggabungkan multimedia dan elemen interaktif berupaya meningkatkan minat serta penglibatan pelajar dalam pembelajaran Sirah. Meskipun demikian, pelaksanaan teknologi secara menyeluruh di bilik darjah masih terhad (Salleh & Wan Abdullah, 2024), sekali gus menggambarkan jurang yang ketara antara potensi teknologi pendidikan dengan amalan sebenar di sekolah.

Motivasi pelajar untuk belajar melalui laman web pendidikan pula sangat bergantung kepada reka bentuk teknologi yang interaktif, mesra pengguna dan relevan dengan keperluan pembelajaran. Namun, cabaran seperti kemahiran, kesediaan dan pengalaman guru dalam mengintegrasikan teknologi digital masih menjadi isu utama dalam konteks Pendidikan Islam (Saili et al., 2025). Nur Adibah Liyana Awi dan Hafizhah Zulkifli (2021) menjelaskan bahawa amalan kreativiti merupakan elemen penting bagi guru Pendidikan Islam dalam melaksanakan pembelajaran abad ke-21. Walaupun Kementerian Pendidikan Malaysia telah menggariskan kepentingan penggunaan teknologi melalui Pelan Pembangunan Pendidikan Malaysia 2013–2025, pelaksanaannya dalam mata pelajaran Pendidikan Islam masih belum menyeluruh. Kekangan guru dalam menguasai peralatan digital turut membataskan penggunaan bahan pembelajaran interaktif dalam pengajaran harian.

Tambahan pula, beberapa sekolah berdepan kekangan seperti ketiadaan bahan digital berkualiti bagi Pendidikan Islam, capaian internet yang tidak konsisten serta peluang latihan ICT kepada guru yang masih terhad (Taat et al., 2022). Kekurangan sumber digital ini menyebabkan pelajar tidak mendapat pengalaman pembelajaran interaktif yang menyeluruh, seterusnya menjejaskan minat dan kemampuan mereka memahami kandungan Sirah. Laman web sedia ada juga jarang memberikan fokus komprehensif terhadap topik Sirah (Fatin Izati & Farah Hanan, 2021), malah kebanyakannya sekadar menawarkan nota ringkas tanpa sokongan multimedia, animasi, atau permainan pembelajaran. Ketiadaan elemen visual dan simulasi sejarah ini menyukarkan pelajar membayangkan peristiwa penting, sedangkan pendekatan berasaskan visual terbukti dapat meningkatkan ingatan jangka panjang serta pemahaman yang lebih mendalam (Mohd Arubi Ismail et al., 2025). Justeru, terdapat keperluan mendesak untuk menilai keberkesanan laman web E-Faith Journey yang dibangunkan secara khusus bagi memenuhi keperluan pembelajaran Sirah secara lebih interaktif, holistik dan berasaskan teknologi.

### *Tinjauan Literatur*

Kajian lepas menekankan kepentingan elemen digital dalam meningkatkan minat pelajar terhadap pembelajaran Pendidikan Islam. Pembelajaran abad ke-21 menuntut integrasi bahan bantu mengajar yang menyokong kemahiran berfikir aras tinggi (Siti Fatihah Osman, 2023). Salleh dan Wan Abdullah (2024) mendapati permainan digital meningkatkan penglibatan aktif pelajar dalam pembelajaran Sirah melalui elemen interaktif yang bermakna dan menyeronokkan. Selain itu, penggunaan teknologi maklumat yang disokong pedagogi berkesan dapat meningkatkan motivasi pelajar serta memudahkan akses kepada sumber ilmu (Taat et al., 2022). Transformasi digital turut memberi impak signifikan terhadap kebolehcapaian ilmu dan amalan kerohanian melalui aplikasi mudah alih (Tajul Asmawee et al., 2024). Namun, keberkesanan teknologi banyak dipengaruhi faktor guru, khususnya pengalaman dan kemahiran dalam mengintegrasikan teknologi dalam pengajaran Sirah dan Tamadun Islam (Jahidih Saili & Muhamad Suhaimi Taat, 2024). Oleh itu, kajian ini menilai sejauh mana laman web E-Faith Journey dapat menyokong keperluan pembelajaran abad ke-21.

Kajian oleh Siti Mariam Abdul Razak & Mardzelah Makhsin (2024) menunjukkan bahawa inovasi dalam bilik darjah mampu merangsang aspek kognitif, psikomotor dan afektif murid selaras dengan ciri-ciri Pembelajaran Abad Ke-21 (PAK-21). Dalam konteks Pendidikan Islam, penerapan teknologi dengan kurikulum dapat membantu pelajar memahami konsep abstrak secara lebih konkrit. Selain itu, teori konstruktivisme menyatakan bahawa pembelajaran lebih berkesan apabila pelajar terlibat secara aktif dalam membina kefahaman melalui pengalaman sendiri (Piaget, 1976). Laman web E-Faith Journey menyediakan ruang kepada pelajar meneroka kandungan mengikut kelajuan mereka sendiri, sekaligus menyokong pembelajaran kendiri. Penggunaan laman web telah terbukti membantu proses pembelajaran pelajar (Suriani Sudi et al., 2023). Pelaksanaan elemen PAK-21 terbukti mampu meningkatkan keberkesanan proses pengajaran dan pembelajaran dalam subjek Pendidikan Islam (Abu Bakar Yusof et al., 2022). Hal ini selari dengan pembelajaran abad ke-21 yang menekankan kemahiran kolaborasi, komunikasi, kreativiti dan pemikiran kritis.

Kajian terkini oleh Muhamad Faizzuddin dan Zulkifli (2024) mendapati bahawa pembelajaran digital meningkatkan keupayaan refleksi pelajar terhadap nilai-nilai akhlak Islam apabila dipersembahkan melalui cerita, grafik sejarah dan simulasi interaktif. Pendigitalan pendidikan semakin menjadi keperluan dalam konteks pembelajaran abad ke-21 (Aminamul Saidah et al., 2021). Tan Bee Piang & Shazlin Abdullah (2025) mendapati bahawa penggunaan laman web interaktif yang mengintegrasikan elemen multimedia dan kecerdasan buatan (AI) berkesan dalam meningkatkan pemahaman serta penaakulan moral pelajar. Ini menunjukkan bahawa laman web E-Faith Journey mampu melahirkan bukan sahaja pelajar yang celik teknologi, tetapi juga mempunyai penghayatan moral yang lebih mendalam. Namun, kajian turut menegaskan bahawa kejayaan laman web E-Faith Journey bergantung kepada reka bentuk pedagogi yang sistematik dan mesra pengguna.

### *Objektif Kajian*

Antara objektif yang hendak dicapai adalah: i. Menilai tahap keberkesanan laman web E-Faith

Journey terhadap peningkatan pemahaman Pendidikan Islam Abad Ke-21 bagi pelajar Tingkatan 1. ii. Mengenal pasti kesan elemen interaktif laman web E-Faith Journey terhadap motivasi dan penglibatan pelajar dalam pelajaran Sirah, terutamanya topik Riwayat Hidup Rasulullah SAW, Era Masyarakat Jahiliah dan Keunggulan Perjuangan Khulafa' ar-Rasyidin. iii. Menggalakkan penggunaan teknologi digital sebagai alat bantu pembelajaran yang menyeronokkan dan inovatif dalam kalangan pelajar dan guru sekolah menengah.

## Metodologi Kajian

Bab ini membincangkan metodologi yang digunakan dalam kajian ini bagi mencapai objektif yang telah ditetapkan, sekali gus memastikan data yang dikumpulkan adalah tepat dan memenuhi standard penyelidikan semasa (Asrulla et al. (2023). Perbincangan dalam bab ini merangkumi aspek utama seperti reka bentuk kajian, populasi dan sampel, instrumen kajian, prosedur pengumpulan data serta teknik analisis data yang digunakan oleh penyelidik. Penjelasan terperinci mengenai setiap komponen bertujuan memberikan gambaran jelas tentang bagaimana kajian dijalankan secara sistematik, teratur, dan berpandukan kaedah saintifik yang diiktiraf dalam bidang penyelidikan pendidikan.

Selain itu, metodologi yang dirangka adalah selaras dengan pendekatan penyelidikan kontemporari dalam bidang pendidikan yang menekankan keperluan penggunaan kaedah pengumpulan data yang sahih, boleh dipercayai serta sesuai dengan konteks kajian (Shaari, 2022). Pendekatan ini penting bagi memastikan dapatan kajian bukan sahaja tepat, malah mampu menyumbang kepada pembangunan pengetahuan baharu dan boleh digeneralisasikan kepada populasi yang lebih besar. Hal ini menjadi lebih penting apabila kajian melibatkan elemen teknologi pendidikan dan pembelajaran digital yang memerlukan justifikasi metodologi yang kukuh untuk menyokong kesahan hasil penyelidikan.

Tambahan pula, penggunaan metodologi kuantitatif melalui reka bentuk kajian tinjauan membolehkan penyelidik memperoleh maklumat yang lebih komprehensif mengenai persepsi dan tahap penerimaan pelajar terhadap laman web pembelajaran E-Faith Journey, selaras dengan keperluan kajian pendidikan masa kini yang menekankan elemen interaktiviti dan inovasi digital. Kaedah penyelidikan kuantitatif membantu penyelidik memahami proses pengumpulan dan analisis data secara sistematik melalui penggunaan instrumen yang berstruktur, sekali gus memastikan bahawa prosedur kajian dijalankan dengan teratur dan mematuhi standard penyelidikan yang telah ditetapkan (Shaari, 2022). Pendekatan ini turut memberi peluang kepada penyelidik menilai pola dan kecenderungan pelajar terhadap penggunaan laman web E-Faith Journey dalam pembelajaran Sirah.

Dengan prosedur yang tersusun, pemilihan sampel secara rawak serta penggunaan alat pengumpulan data yang melalui proses kesahan dan kebolehpercayaan, kajian ini memastikan bahawa data yang dikumpulkan benar-benar mencerminkan realiti pembelajaran pelajar dalam konteks pembelajaran Sirah secara digital. Selain itu, proses pengumpulan dan analisis data mengikuti garis panduan penyelidikan semasa yang menekankan aspek kejelasan, etika dan ketepatan dalam pelaporan kajian. Oleh itu, pendekatan ini penting bagi menjamin ketelitian, kredibiliti serta keutuhan hasil penyelidikan, seterusnya memastikan dapatan yang diperoleh dapat dijadikan rujukan yang sah dan bernilai untuk penyelidikan masa akan datang dalam bidang teknologi pendidikan.

### *Reka Bentuk Kajian*

Reka bentuk kajian ini adalah kajian kuantitatif (Kamarul Azmi Jasmi, 2021) jenis tinjauan (survey) yang bertujuan untuk mengumpul data tentang maklum balas pelajar terhadap penggunaan laman web E-Faith Journey bagi subjek Pendidikan Islam Tingkatan 1 dalam bidang Sirah. Pelajar diberi peluang untuk meneroka dan menggunakan laman web tersebut yang mengandungi nota, e-buku, permainan dan kuiz terlebih dahulu sebelum menjawab soal selidik yang disediakan dalam Google Form. Reka bentuk ini membolehkan penyelidik mengumpul data secara sistematik dan objektif bagi menilai tahap penerimaan dan keberkesanan laman web tersebut sebagai alat pembelajaran. Selain itu, pendekatan ini juga membolehkan penilaian secara langsung terhadap interaksi pelajar dengan kandungan digital, termasuk tahap pemahaman, minat, dan kepuasan pelajar terhadap penggunaan laman web. Menurut Ishak et al. (2021), penggunaan reka bentuk kajian kuantitatif berasaskan soal selidik dan interaksi digital adalah sesuai untuk mengumpul data yang boleh dianalisis secara statistik, sekaligus memberikan gambaran jelas tentang keberkesanan intervensi pendidikan.

### *Sampel dan Populasi*

Populasi kajian ini terdiri daripada semua pelajar Tingkatan 1 di Sekolah Menengah Harian di Kuala Terengganu. Menurut Krejcie & Morgan (1970), sampel kajian pula melibatkan seramai 242 pelajar yang dipilih secara rawak daripada populasi 650 pelajar. Pemilihan sampel secara rawak dapat meningkatkan ketepatan data dalam kajian pendidikan kerana ia memastikan sampel mewakili populasi secara menyeluruh. Hal ini selaras dengan kajian Asrulla et al. (2023) yang menekankan bahawa penggunaan populasi dan persampelan yang sistematik dapat meningkatkan kebolehpercayaan data yang dikumpulkan. Seperti yang dinyatakan oleh Nurul Hidayana Mohd Noor & Amirah Mohamad Fuzi (2024), penggunaan kaedah persampelan yang terancang dan sistematik membantu memastikan keputusan kajian dapat digeneralisasikan kepada populasi sebenar dengan lebih tepat. Pendekatan ini penting dalam menilai keberkesanan laman web pembelajaran E-Faith Journey kerana data yang diperoleh membolehkan analisis menyeluruh terhadap pengalaman dan penerimaan pelajar terhadap kandungan digital.

### *Instrumen Kajian*

Instrumen kajian adalah alat atau cara yang digunakan untuk mengumpul data dalam satu kajian penyelidikan. Ia boleh berbentuk soal selidik, ujian, temubual, pemerhatian, atau dokumen yang membantu penyelidik mendapatkan maklumat yang diperlukan untuk dianalisis secara sistematik. Instrumen kajian memainkan peranan penting bagi memastikan data yang diperoleh tepat, boleh dipercayai dan selaras dengan objektif serta tujuan kajian yang telah ditetapkan. Contohnya, dalam kajian kuantitatif Pendidikan Islam, instrumen yang sering digunakan adalah soal selidik yang mengandungi soalan-soalan berkaitan topik kajian dan diisi oleh responden secara sukarela dan teliti. Menurut Ishak et al. (2021), soal selidik merupakan instrumen yang kerap digunakan dalam kajian Pendidikan Islam kerana ia membolehkan pengumpulan maklumat dilakukan secara sistematik, berstruktur dan mudah dianalisis.

Instrumen kajian yang digunakan dalam kajian ini ialah borang soal selidik berstruktur yang

dibangunkan menggunakan Google Form. Soal selidik ini direka khas bagi mengumpul maklumat mengenai maklum balas pelajar terhadap penggunaan laman web E-Faith Journey, iaitu laman web pembelajaran Pendidikan Islam yang dibangunkan untuk menyokong pembelajaran interaktif dan mendalam. Item-item dalam soal selidik merangkumi beberapa aspek utama, termasuk pengetahuan, kefahaman serta tahap kepuasan pelajar terhadap kandungan dan keberkesanan laman web E-Faith Journey sebagai medium pembelajaran. Dengan penggunaan instrumen yang berstruktur dan berfokus kepada objektif kajian, penyelidik dapat memastikan bahawa data yang dikumpulkan mencerminkan pengalaman sebenar pelajar, sekaligus membolehkan analisis yang sahih dan tepat bagi menilai keberkesanan laman web E-Faith Journey dalam konteks pembelajaran abad ke-21.

***Prosedur Pengumpulan Data***

Prosedur pengumpulan data pula adalah langkah atau cara bagaimana data dikumpulkan menggunakan instrumen tersebut. Contohnya, menggunakan Google Form untuk menyebarkan soal selidik kepada responden atau menjalankan temubual secara bersemuka. Prosedur ini merangkumi tatacara menjalankan pengisian instrumen kajian supaya data dapat diperoleh dengan betul dan teratur. Prosedur pengumpulan data melibatkan pelajar Tingkatan 1 di sekolah tersebut diberi peluang untuk meneroka dan bermain dengan website yang dibangunkan. Selepas itu, mereka diminta mengisi borang soal selidik dalam Google Form sebagai respons terhadap pengalaman mereka menggunakan website tersebut. Pengumpulan data dijalankan secara dalam talian dengan penyebaran pautan Google Form kepada 242 pelajar sebagai sampel kajian. Data yang dikumpul kemudiannya dianalisis secara kuantitatif bagi menilai tahap maklum balas dan keberkesanan website pembelajaran.

## Dapatan Kajian

Dapatan kajian menunjukkan bahawa laman web E-Faith Journey terbukti berkesan sebagai medium pembelajaran Pendidikan Islam bagi pelajar Tingkatan 1 di Sekolah Menengah Harian di Kuala Terengganu dapat memberikan kesan positif dan bermanfaat terhadap pengalaman pembelajaran mereka. Melalui soal selidik Google Form, pelbagai maklum balas diperoleh berkaitan tahap kefahaman, minat, motivasi serta pengalaman pelajar ketika menggunakan laman web tersebut. Data ini membolehkan penilaian keberkesanan laman web dari perspektif kognitif, afektif dan psikomotor pelajar. Zulkifli et al. (2025) menyatakan bahawa terdapat perbezaan yang signifikan antara keberkesanan kaedah PAK-21 berbanding kaedah tradisional dalam subjek Pendidikan Islam.

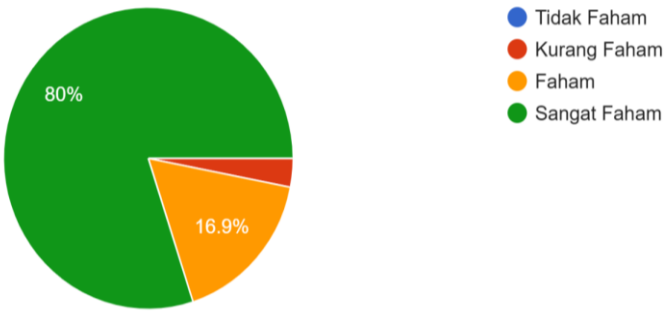
Dalam pembangunan E-Faith Journey, elemen gaya pembelajaran VARK (Visual, Auditori, Membaca dan Kinestetik) diterapkan secara sistematik melalui pelbagai medium interaktif seperti video instruksional, nota digital yang padat, e-buku serta aplikasi kuiz dan permainan digital. Penggunaan pelbagai bahan multimedia ini bukan sahaja menjadikan kandungan pembelajaran lebih dinamik dan mudah diikuti, malah ia bertindak sebagai pemangkin yang membantu pelajar mengekalkan tumpuan serta fokus yang tinggi sepanjang proses pengajaran dan pemudahcaraan (PdPC) topik Sirah. Perpaduan elemen-elemen ini berjaya mewujudkan persekitaran pembelajaran yang lebih santai, jelas, dan menyeronokkan, sekaligus merangsang penglibatan aktif pelajar untuk memahami serta mengingati fakta sejarah dengan lebih berkesan. Selaras dengan itu, integrasi teknologi instruksional yang canggih dalam subjek

agama bukan sahaja memudahkan pemahaman konsep yang abstrak, malah mampu merapatkan jurang antara kaedah tradisional dan moden demi meningkatkan motivasi murid secara holistik (Muhamad Faizzuddin Zainol Aman & Hafizhah Zulkifli, 2024). Inovasi ini secara tidak langsung menyokong aspirasi Pembelajaran Abad Ke-21 (PAK-21) yang menekankan elemen komunikasi, kolaboratif dan pemikiran kritis dalam kalangan generasi digital masa kini.

Kajian ini menggunakan pendekatan kaedah campuran (mixed-methods), di mana soal selidik tertutup dijadikan sebagai data utama bagi memperoleh gambaran kuantitatif mengenai persepsi pelajar terhadap laman web, manakala data kualitatif diperoleh melalui tiga soalan terbuka yang memberi peluang kepada pelajar menyampaikan pandangan serta cadangan penambahbaikan. Seramai 242 pelajar memberikan maklum balas lengkap, membolehkan analisis yang lebih menyeluruh dan mendalam tentang keberkesanan laman web dalam konteks pembelajaran Pendidikan Islam Tingkatan 1.

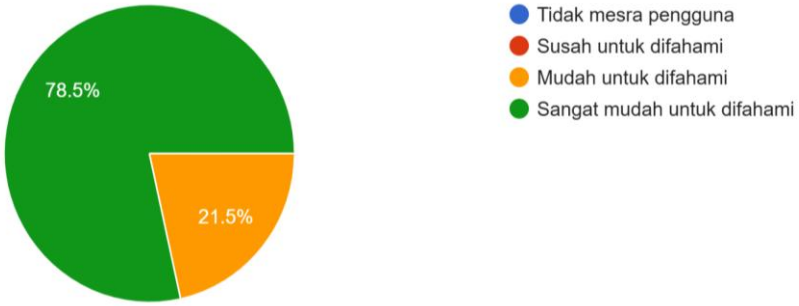
Susun atur kandungan dalam laman web memudahkan pelajar menelusuri topik Sirah mengikut urutan kronologi, sekaligus membantu mereka mendapatkan gambaran yang lebih jelas tentang konteks sejarah Islam. Laman web ini juga terbukti meningkatkan motivasi pelajar untuk terus belajar melalui medium digital, kerana penyampaian kandungan yang lebih moden, interaktif dan bersesuaian dengan gaya pembelajaran generasi kini. Secara keseluruhan, dapatan kajian menyokong bahawa E-Faith Journey merupakan laman web pembelajaran yang berkesan bagi topik Sirah Tingkatan 1, bukan sahaja dari aspek peningkatan pemahaman, tetapi juga dalam menggalakkan minat, motivasi serta penglibatan aktif pelajar dalam pembelajaran Pendidikan Islam. Suhaida Mohd Sukis et al. (2023) menjelaskan bahawa penggunaan aplikasi dan platform digital seperti gamifikasi dan e-portfolio mewujudkan impak positif dalam amalan pentaksiran guru Pendidikan Islam.

Tambahan pula, keberkesanan laman web ini menekankan peranan media digital dalam menyokong pembelajaran kendiri dan pembelajaran berasaskan pengalaman. Dengan kombinasi bahan interaktif dan kandungan yang tersusun mengikut prinsip pedagogi yang sistematik, pelajar dapat membina kefahaman secara aktif, mengaplikasikan pengetahuan dalam konteks praktikal dan meningkatkan kemahiran berfikir aras tinggi (KBAT) ketika menilai dan menganalisis peristiwa sejarah Islam. Oleh itu, E-Faith Journey bukan sahaja berfungsi sebagai medium pembelajaran, tetapi juga sebagai alat untuk membentuk pelajar yang lebih berfikir secara kritis, berdisiplin dan berdaya saing dalam pembelajaran Pendidikan Islam secara holistik.



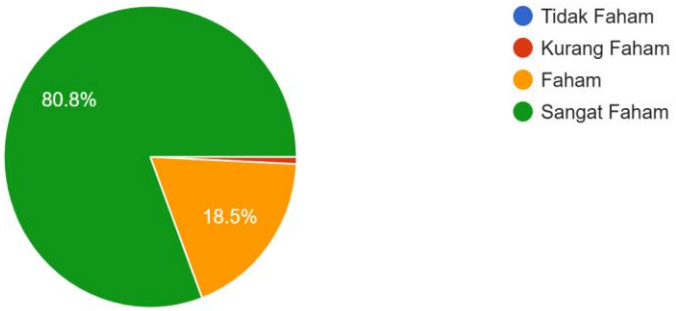

**Rajah 1: Tahap Kefahaman Pelajar Selepas Menggunakan Laman Web**
Sumber: Soal Selidik 2025

Rajah 1 Menunjukkan Tahap Kefahaman 242 Responden Terhadap Kandungan Sirah Selepas Menggunakan Laman Web E-Faith Journey. Dapatan Kajian Menunjukkan Majoriti Pelajar Mencapai Tahap Kefahaman Yang Tinggi Dengan 80% Menyatakan Sangat Faham Dan 16.9% Faham. Secara Keseluruhan, Sebanyak 96.9% Responden Berada Pada Tahap Kefahaman Memuaskan Atau Cemerlang, Manakala Hanya 3.1% Berada Pada Tahap Kurang Faham Dan Tiada Responden Melaporkan Tidak Faham. Dapatan Ini Menunjukkan Bahawa Penggunaan Laman Web E-Faith Journey Berpotensi Meningkatkan Kefahaman Pelajar Dalam Pembelajaran Sirah.



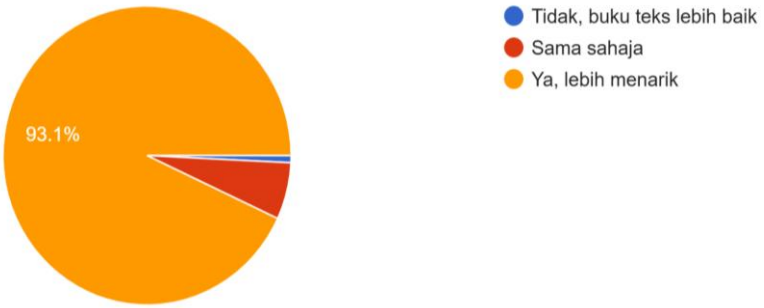

**Rajah 2: Tahap Kemudahan Dan Mesra Pengguna Tentang Laman Web**
Sumber: Soal Selidik 2025

Rajah 2 Menunjukkan Persepsi 242 Responden Terhadap Tahap Kemudahan Penggunaan Dan Kemesraan Pengguna Laman Web E-Faith Journey. Dapatan Kajian Menunjukkan Bahawa Semua Responden Mendapati Laman Web Ini Mudah Digunakan Dengan 78.5% Menyatakan Sangat Mudah Dan 21.5% Menyatakan Mudah. Tiada Responden Melaporkan Kesukaran Atau Masalah Kebolehgunaan. Secara Keseluruhan, Dapatan Ini Menunjukkan Bahawa Laman Web E-Faith Journey Mempunyai Tahap Kebolehgunaan Yang Tinggi Serta Memenuhi Prinsip Reka Bentuk Mesra Pengguna.



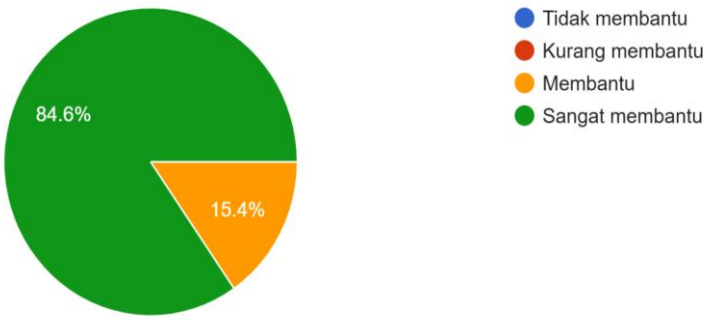

**Rajah 3: Persepsi Terhadap Susunan Isi Kandungan Sirah Dalam Laman Web**
Sumber: Soal Selidik 2025

Rajah 3 Menunjukkan Tahap Kefahaman 242 Responden Terhadap Susunan Isi Kandungan Sirah Dalam Laman Web E-Faith Journey. Seramai 80.8% Responden Menyatakan Mereka Sangat Faham, Manakala 18.5% Lagi Berada Pada Tahap Faham. Hanya Kurang Daripada 0.8% Melaporkan Kurang Faham Dan Tiada Responden Yang Menyatakan Tidak Faham.Secara Keseluruhan, Dapatan Ini Membuktikan Bahawa Reka Bentuk Serta Susunan Kandungan Yang Disediakan Adalah Jelas, Teratur Dan Berkesan Dalam Menyokong Pemahaman Pelajar Terhadap Topik Sirah.




**Rajah 4: Tahap Minat Pelajar Terhadap Pembelajaran Sirah Melalui Laman Web Berbanding Buku Teks**
Sumber: Soal Selidik 2025

Rajah 4 Menunjukkan Tahap Penerimaan 242 Responden Yang Sangat Positif Terhadap Pembelajaran Sirah Melalui Laman Web. Sebanyak 93.1% Responden Menyatakan Bahawa Pembelajaran Melalui Laman Web Adalah Lebih Menarik Berbanding Buku Teks, Manakala 6.2% Menyatakan Ia Sama Sahaja Dan 0.8% Iaitu Seorang Sahaja Yang Menyatakan Bahawa Buku Teks Lebih Baik. Dapatan Ini Membuktikan Bahawa Laman Web Yang Dibangunkan Berjaya Meningkatkan Minat Dan Pengalaman Pembelajaran Pengguna.




**Rajah 5: Keberkesanan Kuiz Dan Aktiviti Interaktif Dalam Membantu Pelajar Mengingati Fakta Penting Sirah**
Sumber: Soal Selidik 2025

Rajah 5 Menunjukkan Bahawa Majoriti 242 Responden Iaitu 84.6% Menyatakan Kuiz Dan Aktiviti Interaktif Dalam Laman Web Sangat Membantu Mereka Mengingati Fakta-Fakta Penting Dalam Sirah. Selain Itu, 15.4% Responden Melaporkan Bahawa Elemen Interaktif Tersebut Membantu, Manakala Tiada Responden Yang Menyatakan Ia Kurang Membantu Atau Tidak Membantu. Dapatan Ini Menunjukkan Bahawa Penggunaan Aktiviti Interaktif Berpotensi Meningkatkan Kefahaman Pelajar Dalam Pembelajaran Sirah.

Analisis kuantitatif menunjukkan bahawa 92% pelajar bersetuju bahawa platform E-Faith Journey membantu mereka memahami peristiwa Sirah dengan lebih jelas. Ini selari dengan kajian Salleh dan Wan Abdullah (2024) yang menunjukkan bahawa visualisasi mampu meningkatkan daya ingatan pelajar. Selain itu, 87% pelajar melaporkan bahawa permainan interaktif dan kuiz membantu meningkatkan fokus semasa belajar. Mereka menyatakan bahawa pembelajaran terasa seperti aktiviti hiburan tetapi tetap memberi manfaat akademik. Pelajar juga menunjukkan peningkatan motivasi dalaman apabila mereka dapat mengawal tempo pembelajaran sendiri. Selain itu, analisis kualitatif melalui soalan terbuka menunjukkan tiga tema utama, iaitu pembelajaran yang lebih menyeronokkan, pemahaman fakta sejarah yang lebih mudah, serta keinginan untuk mendapatkan lebih banyak kandungan digital. Dapatan ini membuktikan bahawa pelajar menerima baik pendekatan pembelajaran digital dan bersedia beralih daripada kaedah tradisional.

## Sumbangan Kajian

Kajian ini memberikan sumbangan yang sangat berharga dalam bidang pendidikan Islam, khususnya melalui peningkatan kefahaman pelajar terhadap nilai keagamaan dan sejarah Islam secara holistik dan bermakna. Dengan mempelajari sirah, pelajar tidak hanya diajar untuk mengetahui fakta sejarah semata-mata, malah dididik untuk memahami nilai-nilai keagamaan yang mendalam yang terkandung dalam perjalanan hidup Nabi Muhammad SAW dan para

Khulafa Ar-Rasyidin sebagai teladan unggul. Kajian ini juga menekankan kepentingan mengintegrasikan kemahiran berfikir aras tinggi (KBAT) secara sistematik dalam proses pembelajaran sirah yang membolehkan pelajar menjadi lebih aktif, kritis dan reflektif dalam mendalami sejarah Islam secara menyeluruh dan berfokus. Dengan pendekatan ini, pelajar

berpeluang memahami konteks, hikmah dan pengajaran di sebalik peristiwa sirah, sekali gus memperkukuh penghayatan serta aplikasinya dalam kehidupan harian. Tambahan pula, penggunaan laman web E-Faith Journey sebagai medium digital turut memperkayakan pengalaman pembelajaran pelajar dengan menyediakan bahan interaktif, simulasi dan aktiviti yang merangsang pemikiran, sekali gus menyokong pelajar untuk mengaitkan pengetahuan yang dipelajari dengan nilai praktikal dalam kehidupan seharian mereka.

## Implikasi Kajian

Impak kajian E-Faith Journey adalah sangat besar dalam membentuk pelajar yang berakhlak mulia, taat kepada ajaran Islam dan bersedia berkorban demi agama dan negara. Melalui pembelajaran sirah yang berkesan, pelajar bukan sahaja memperoleh pengetahuan sejarah, tetapi juga dididik untuk meneladani nilai-nilai murni yang terkandung dalam kehidupan Nabi Muhammad SAW dan para Khulafa Ar-Rasyidin. Kajian ini menunjukkan bahawa penghayatan sirah dapat membantu pelajar menanam sifat-sifat mulia seperti kejujuran, tanggungjawab, disiplin, amanah dan sifat kepimpinan yang penting dalam membina karakter individu yang seimbang. Dengan pemahaman yang mendalam terhadap sirah, pelajar dapat membentuk jati diri yang kukuh, meningkatkan nilai keagamaan dan memupuk karakter moralyang tinggi sebagai seorang individu Islam yang cerdas, berbudi pekerti dan berdaya saing dalam kehidupan seharian.

## Cadangan Kajian Masa Hadapan

Berdasarkan dapatan kajian ini, laman web *E-Faith Journey* menunjukkan potensi yang besar dalam meningkatkan kefahaman pelajar terhadap nilai keagamaan dan sejarah Islam, di samping menyokong penerapan kemahiran berfikir aras tinggi (KBAT) dalam pembelajaran Sirah bagi pelajar Tingkatan 1. Kajian ini juga membuktikan bahawa penggunaan platform digital yang terancang mampu memberi kesan positif terhadap pembentukan sahsiah pelajar, termasuk penghayatan akhlak mulia, ketaatan kepada ajaran Islam serta semangat pengorbanan demi agama, bangsa dan negara. Sehubungan itu, kajian masa hadapan dicadangkan untuk memberi penekanan yang lebih mendalam terhadap aplikasi KBAT dalam pengajaran Sirah melalui penggunaan teknologi digital dan media interaktif yang lebih pelbagai serta inovatif bagi menarik minat generasi muda secara lebih berkesan. Selain itu, penyelidikan lanjutan boleh menilai keberkesanan integrasi elemen multimedia dan permainan interaktif yang lebih kompleks, termasuk pendekatan pembelajaran berasaskan pengalaman dan kolaboratif, dalam meningkatkan penglibatan aktif pelajar serta penguasaan konsep Sirah secara menyeluruh. Pendekatan ini diyakini dapat memperkukuh peranan laman web *E-Faith Journey* sebagai medium pembelajaran Sirah yang bersepadu, berimpak dan relevan dengan tuntutan Pendidikan Islam abad ke-21 serta pembangunan modal insan secara holistik.

## Kesimpulan

Kajian E-Faith Journey meneliti dengan mendalam aspek-aspek utama dalam bidang Sirah Tingkatan 1, khususnya berkaitan kehidupan Nabi Muhammad SAW, era masyarakat Jahiliyah dan para Khulafa Ar Rasyidin. Kajian ini bertujuan memberikan pemahaman yang jelas dan terperinci tentang sejarah kehidupan tokoh Islam dengan matlamat memperkukuh pengetahuan pelajar mengenai Sirah. Dalam konteks ini, kajian bukan sahaja menekankan aspek sejarah

semata-mata, tetapi juga memaparkan hikmah dan nilai-nilai yang terkandung dalam kehidupan mereka yang boleh dijadikan contoh dan panduan kepada pelajar dalam menjalani kehidupan harian. Selain itu, kajian ini menekankan bahawa pemahaman Sirah amat penting untuk membina jati diri agama Islam yang kuat dalam kalangan pelajar. Dengan mempelajari Sirah, pelajar lebih mudah memahami nilai-nilai Islam seperti keikhlasan, kesabaran dan keberanian serta dapat menjadikan Nabi Muhammad SAW dan para Khulafa Ar Rasyidin sebagai contoh teladan. Nilai-nilai ini bukan sahaja memberi pengajaran sejarah, tetapi juga membantu pelajar mengaplikasikan sikap dan amalan mulia dalam kehidupan seharian mereka.

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# PENGARUH PERSEKITARAN LUARAN KE ATAS HUBUNGAN ANTARA STRATEGI ORIENTASI KEUSAHAWANAN DENGAN PRESTASI PERNIAGAAN

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***Abstrak:*** *Perusahaan Kecil dan Sederhana (PKS) memainkan peranan penting sebagai pemangkin utama ekonomi Malaysia, namun sumbangannya kepada KDNK negara masih di bawah prestasi sebenar berbanding dengan negara serantau dan negara maju. Ketidaktentuan persekitaran luaran global seperti persekitaran luaran dinamik, persaingan sengit, dan krisis ekonomi, yang memberi kesan negatif kepada prestasi firma PKS di Malaysia. Sehubungan itu, kajian ini cuba mencari jawapan yang kukuh mengenai hubungan di antara strategi orientasi keusahawanan dengan prestasi perniagaan serta pengaruh persekitaran luaran dinamik, persaingan sengit dan munifcence ke atas firma PKS di Malaysia. Pembolehubah strategi orientasi keusahawanan terdiri dari inovasi, proaktif, dan pengambilan risiko. Populasi kajian terdiri daripada firma PKS dalam sektor perkilangan dan perkhidmatan berkaitan perkilangan yang berdaftar dengan SME Corp. Malaysia. Teknik persampelan berstrata (stratified random sampling) akan digunakan dalam pemilihan responden. Data akan dikumpulkan melalui kaedah borang soal selidik dalam talian serta bersemuka, di mana pembolehubah strategi orientasi keusahawanan, persekitaran luaran, dan prestasi perniagaan diukur menggunakan skala Likert. Analisis regresi berhierarki akan digunakan untuk menguji hipotesis-hipotesis kajian. Kajian ini dijangka akan memberikan jawapan empirikal yang kukuh mengenai keberkesanan strategi keusahawanan dalam pelbagai keadaan persekitaran. Dapatan kajian ini diharap dapat dimanfaatkan oleh pihak kerajaan, usahawan, pengkaji-pengkaji lain, dan pihak-pihak berkepentingan dalam pembangunan PKS di Malaysia untuk meningkatkan daya saing dan kelangsungan perniagaan mereka.*

***Kata Kunci:*** *Strategi Orientasi Keusahawanan; Persekitaran Luaran; Prestasi Perniagaan*

## Pengenalan

Perusahaan Kecil dan Sederhana (PKS) memainkan peranan penting dalam memacu pertumbuhan ekonomi dan meningkatkan daya saing dalam pasaran global (Juminawati et al., 2021). PKS turut memainkan peranan penting dalam penciptaan peluang pekerjaan, inovasi dan pembangunan ekonomi serantau, menjadikannya komponen penting bagi ekonomi sesebuah negara (Fauziah et al., 2024). Pengaruh ini diperkuatkan lagi oleh keupayaan PKS untuk menyesuaikan diri dengan perubahan pasaran global melalui strategi seperti pendigitalan, penggunaan kecerdasan buatan (AI) dan globalisasi, yang meningkatkan

kecekapan operasi dan jangkauan pasaran (Silitonga, 2023) terutama selepas pasca Covid-19. Menurut laporan terkini World Bank (2025) dan ICSB (2025), PKS mewakili sekitar 90% daripada perniagaan global, menyumbang lebih 50% pekerjaan dan antara 40% hingga 60% KDNK di kebanyakan negara. Di negara berpendapatan rendah dan sederhana, sumbangan PKS boleh mencecah 70% KDNK dan sehingga 95% guna tenaga. Menurut laporan terkini OECD (2025), di negara berpendapatan tinggi seperti US dan negara-negara Eropah, PKS menyumbang sekitar 43% hingga 60% kepada KDNK dan menyediakan antara 46% hingga 70% daripada jumlah tenaga kerja.

Di Malaysia, PKS turut memainkan peranan utama dan menjadi pemangkin kepada pembangunan ekonomi negara. Statistik daripada Laporan Tahunan PKS Malaysia 2023 (SME Corp. Malaysia, 2025) menunjukkan PKS mewakili sebanyak 99% atau 1.17 juta firma daripada jumlah keseluruhan pertubuhan perniagaan di Malaysia. Daripada jumlah tersebut, sekitar 47,000 firma PKS terlibat dalam aktiviti perkilangan yang kekal sebagai antara sektor terpenting yang penyumbang kepada ekonomi negara. Namun, didapati sumbangan PKS kepada KDNK Malaysia adalah rendah jika dibandingkan dengan negara-negara serantau serta negara-negara maju. Statistik menunjukkan jumlah sumbangan PKS kepada KDNK negara sebanyak 39.5 peratus (SME Corp. Malaysia, 2025), jauh lebih rendah berbanding negara China (60%), Jerman (57%), Jepun (55%) dan Amerika Syarikat (43.5%) (OECD, 2025).

Sumbangan PKS kepada KDNK Malaysia juga masih lagi rendah jika dibandingkan dengan negara-negara jiran seperti Indonesia (61%), Thailand (45%) dan Vietnam (40%) (ERIA/OECD, 2024). Sumbangan yang rendah ini mungkin disebabkan oleh kesan daripada pandemik Covid-19 serta persekitaran ekonomi global yang tidak menentu. Dasar tarif yang diperkenalkan oleh US dalam beberapa tahun kebelakangan ini, khususnya melalui peningkatan tarif terhadap barangan import dari negara tertentu, turut memberi kesan yang signifikan kepada perdagangan global (Conteduca et al., 2025; World Bank, 2025). Di samping itu, World Bank (2025) menyatakan antara faktor lain seperti turun naik harga minyak yang sukar dikawal, krisis makanan sedunia, krisis politik serta bencana alam turut memperlahankan aktiviti perniagaan di seluruh dunia termasuk Malaysia. Senario yang dibincangkan ini secara tidak langsung telah memberi kesan kepada prestasi firma PKS di Malaysia (SME Corp. Malaysia, 2025). Kajian terkini oleh SME Corp Malaysia (2025) mendapati lebih 60 peratus PKS berdepan cabaran aliran tunai dan kenaikan kos operasi akibat ketidaktentuan ekonomi global, gangguan rantaian bekalan serta inflasi, sejajar dengan trend yang pernah direkodkan pada 2009 apabila lebih 70 peratus PKS terjejas akibat kegawatan ekonomi (SME Corp. Malaysia, 2025).

Sehubungan dengan itu, banyak kajian telah dijalankan bagi mengenal pasti faktor-faktor yang boleh mempengaruhi prestasi perniagaan terutama di Malaysia (Husain et al., 2023). Menurut Lumpkin dan Dess (1996) dan Covin dan Slevin (1989, 1991), salah satu faktor penting yang mempengaruhi prestasi yang perlu dikaji ialah strategi keusahawanan peringkat firma iaitu strategi orientasi keusahawanan (Rao et al., 2023). Menurut Miller (1983), strategi orientasi keusahawanan merujuk kepada tindakan berinovasi, sikap proaktif dan kesanggupan firma untuk mengambil risiko yang menjadi pengukuran penting kepada firma apabila melaksanakan strategi untuk bersaing dengan pesaing-pesaingnya bagi meningkatkan prestasi (Covin & Wales, 2019).

Seterusnya bagi mengukuhkan lagi kajian berkaitan strategi orientasi keusahawanan, Rauch et al. (2009) dan Wiklund dan Shepherd (2005) telah mencadangkan pemeriksaan ke atas pengaruh faktor luaran firma yang berkemungkinan turut mempengaruhi prestasi firma PKS (ICSB, 2025). Hasil daripada kajian lepas telah mendapati faktor persekitaran luaran turut mempengaruhi operasi sesebuah firma perniagaan (World Bank, 2025; IMF, 2025). Firma keusahawanan yang beroperasi dalam persekitaran yang tidak pasti sentiasa terdedah kepada risiko kegagalan. Oleh itu, kajian berterusan mengenai pengaruh persekitaran perniagaan khususnya persekitaran luaran dinamik, persaingan sengit (*hostile*)dan *munificence* (mesra perniagan) ke atas firma keusahawanan perlulah dilaksanakan bagi melihat pengaruhnya ke atas prestasi perniagaan (World Bank, 2025; Davis, 2007). Oleh itu, dengan mengambil kira cadangan dari pengkaji lepas maka satu kajian secara empirikal mengenai pengaruh pembolehubah penyederhana persekitaran luaran dinamik, persaingan sengit dan *munificence* ke atas hubungan antara pembolehubah strategi orientasi keusahawanan (proaktif, inovasi dan pengambilan risiko) dengan prestasi perniagaan firma PKS di Malaysia perlu dilakukan. Secara spesifiknya, objektif kajian ini adalah:

i) Untuk menentukan hubungan antara strategi orientasi keusahawanan dengan prestasi perniagaan.
ii) Untuk menilai pengaruh pembolehubah penyederhana persekitaran luaran ke atas hubungan antara pembolehubah strategi orientasi keusahawanan dengan prestasi perniagaan.

## Ulasan Literatur

### *Strategi Orientasi Keusahawanan*

Hubungan antara strategi orientasi keusahawanan dengan prestasi firma telah menjadi keutamaan dalam literatur bidang keusahawanan (Husain et al., 2023; Covin & Wales, 2019). Bermula daripada kajian Mintzberg (1973) dan Khandwalla (1977) yang memeriksa peranan strategi orientasi keusahawanan terhadap prestasi firma keusahawanan telah menarik minat ramai pengkaji lain untuk terus mengkaji hubungan antara keduanya. Berdasarkan kepada kajian tersebut, Miller (1983) telah merumuskan proses strategi keusahawanan peringkat firma melibatkan elemen inovasi, proaktif dan pengambilan risiko. Manakala Lumpkin dan Dess (1996) merujuk strategi orientasi keusahawanan sebagai proses, amalan dan aktiviti pembuatan keputusan yang membawa kepada kemasukan baru yang turut melibatkan proses inovasi, proaktif dan pengambilan risiko. Kemasukan baru dapat dirumuskan sebagai memasuki pasaran baru atau pasaran yang telah kukuh dengan produk atau perkhidmatan baru atau yang sedia ada dengan memulakan perniagaan baru, menubuhkan anak syarikat baru atau melalui perniagaan sedia ada.

Covin dan Slevin (1989, 1991) menekankan bahawa inovasi, proaktif dan pengambilan risiko adalah dimensi utama kepada strategi orientasi keusahawanan yang akan menentukan kejayaan sesebuah firma. Kajian terkini mengesahkan bahawa dimensi ini kekal relevan, malah diperluas dengan elemen autonomi dan persaingan yang agresif serta factor adaptasi digital bagi meningkatkan prestasi firma dalam persekitaran yang dinamik (Choi & Tan, 2024). Bagi mengukuhkan lagi hujah mereka, Covin dan Slevin (1991) telah membangunkan satu model teoritikal yang mengambarkan pentingnya hubungan antara strategi orientasi keusahawanan yang terdiri daripada dimensi inovasi, proaktif dan pengambilan risiko dengan prestasi firma

serta pengaruh pembolehubah persekitaran luaran, strategi perniagaan dan struktur organisasi (Kreiser & Davis, 2010).

Kajian oleh Franz (2019) dan Jogaratnam dan Tse (2006) yang memeriksa strategi orientasi keusahawanan sebagai konstruk unidimensi mendapati wujud hubungan yang signifikan positif dengan prestasi. Franz (2019) dalam kajiannya ke atas kesan orientasi keusahawanan terhadap prestasi syarikat US, mendapati strategi orientasi keusahawanan mampu meningkatkan prestasi firma dengan baik. Manakala kajian yang dilakukan oleh Jogaratnam dan Tse (2006) yang melibatkan 187 buah hotel di tiga buah negara (China, Malaysia dan Singapura) mendapati strategi orientasi keusahawanan berhubungan secara positif dengan prestasi yang diukur dengan menggunakan pendekatan objektif. Walaupun hasil dapatan lepas telah mengesahkan hubungan yang signifikan positif antara strategi orientasi keusahawanan dengan prestasi, terdapat juga beberapa kajian lepas yang menunjukkan hasil dapatan kajian yang bercampur-campur seperti kajian oleh D'Souza dan Fan (2022) dan Husain et al. (2023). Oleh itu, berdasarkan kepada dapatan yang dibincangkan di atas, adalah dijangka terdapat perhubungan yang signifikan antara kedua-dua pembolehubah ini. Maka,

**Hipotesis 1: Strategi orientasi keusahawanan mempunyai hubungan yang signifikan dengan prestasi perniagaan.**

**Inovasi dan Prestasi Perniagaan**

Inovasi merujuk kepada kecenderungan firma untuk menyokong dan melaksanakan idea baharu, proses kreatif, dan penyelidikan yang menghasilkan produk, perkhidmatan atau proses baharu (Lumpkin & Dess, 1996). Kajian empirikal dan terkini mengesahkan bahawa inovasi merupakan faktor penting dalam konstruk orientasi keusahawanan melalui hubungannya dengan prestasi firma termasuk pertumbuhan jualan dan kelebihan daya saing (Pusparini et al., 2024).

Terdapat sejumlah besar literatur dari hasil kajian lepas menyokong hubungan yang signifikan antara inovasi dengan prestasi firma seperti kajian oleh Billi dan Bernardo (2025), Qiang dan Yang (2023), Bogetoft et al. (2024), serta Quintero dan Zúñiga Collazos (2025). Hasil analisis meta dalam kajian yang dijalankan oleh Billi dan Bernardo (2025) ke atas data firma global menunjukkan bahawa amalan inovasi mempunyai hubungan yang signifikan positif dengan prestasi perniagaan. Dapatan ini selari dengan kajian Qiang dan Yang (2023) yang menekankan bahawa inovasi hijau dan proaktif memberi kesan positif terhadap prestasi organisasi. Selain itu, Bogetoft et al. (2024) mendapati strategi inovasi yang menggabungkan inovasi produk, proses dan organisasi memberikan impak yang lebih besar terhadap prestasi firma. Penemuan ini turut disokong oleh kajian Quintero dan Zúñiga Collazos (2025) yang mengesahkan kebolehan berinovasi dan strategi inovasi mempunyai hubungan yang signifikan positif dengan prestasi kewangan PKS. Justeru itu, dijangka akan wujud satu hubungan yang signifikan antara inovasi dengan prestasi perniagaan firma PKS di Malaysia. Maka,

Hipotesis 1a: Inovasi mempunyai hubungan yang signifikan positif dengan prestasi perniagaan.

***Proaktif dan Prestasi Perniagaan***

Kajian awal dalam bidang keusahawanan mendapati pembolehubah proaktif telah memberi sumbangan penting kepada keusahawanan sesebuah firma (Zheng, 2018). Penemuan ini turut disokong oleh kajian terkini oleh Billi dan Bernardo (2025) yang menekankan peranan proaktif dalam memanfaatkan peluang baharu melalui transformasi digital, serta Qiang dan Yang (2023) yang mengaitkan proaktif dengan keberkesanan inovasi hijau (Liu, 2023). Miller (1983) merujuk proaktif kepada keupayaan sesebuah firma untuk meneroka dan mengeksploitasi perspektif berorientasikan masa depan bagi membolehkan firma bertindak ke atas peluang yang dikenal pasti untuk produk, pasaran atau usaha teroka baharu. Dengan kata lain, proaktif merupakan elemen penting yang dapat mengoptimumkan keupayaan inovasi sesebuah firma keusahawanan (Billi & Bernardo, 2025). Kajian terkini turut menekankan bahawa proaktif adalah pembolehubah kritikal dalam meningkatkan prestasi firma melalui penerokaan peluang baharu dan pengembangan pasaran (Qiang & Yang, 2023).

Hasil kajian Zhang dan Li (2022) menunjukkan tindakan proaktif mampu meningkatkan pertumbuhan jualan dan mengembangkan pasaran kepada usahawan. Selain itu, kajian Lumpkin dan Dess (2001) ke atas 124 eksekutif dari 94 firma turut mendapati pembolehubah proaktif mempunyai hubungan signifikan positif dengan semua pengukuran prestasi iaitu pertumbuhan jualan, pulangan jualan dan keuntungan. Hasil Keputusan ini turut disokong oleh dapatan Billi dan Bernardo (2025) serta Qiang dan Yang (2023) yang menekankan peranan proaktif dalam mengoptimumkan inovasi dan meningkatkan prestasi firma. Sehubungan dengan itu, dijangka terdapat perhubungan yang signifikan antara kedua-dua pembolehubah ini. Maka,

Hipotesis 1b: Proaktif mempunyai hubungan yang signifikan positif dengan prestasi perniagaan.

***Pengambilan Risiko dan Prestasi Perniagaan***

Lumpkin dan Dess (1996) merujuk pengambilan risiko kepada tahap kesediaan firma untuk melibatkan komitmen sumber yang besar dalam usaha memanfaatkan peluang pasaran. Kenyataan tersebut disokong oleh kajian Billi dan Bernardo (2025) yang menegaskan firma yang berorientasikan keusahawanan sanggup membuat pelaburan yang signifikan dan menanggung risiko tinggi demi mencapai pulangan yang lebih besar. Sikap ini melibatkan pendedahan aset dan tanggungan yang besar dengan harapan memperoleh keuntungan yang sepadan dengan tahap risiko yang diambil (Qiang & Yang, 2023).

Hasil kajian lepas mendapati hubungan antara pengambilan risiko dan prestasi adalah kompleks, tidak linear dan bercampur-campur (Pham & Dao, 2022). Dapatan dari kajian meta-analisis oleh Pham dan Dao (2022) mendapati pembolehubah seperti leverage, R&D dan saiz firma memberi kesan signifikan terhadap pulangan korporat, sekali gus menunjukkan hubungan yang kompleks antara pengambilan risiko dan prestasi seperti ROA dan ROE. Kajian berasaskan teori prospek oleh Diez-Esteban et al. (2017) pula mendapati wujud hubungan berbentuk U antara pengambilan risiko dan pulangan firma, di mana firma cenderung mengambil lebih banyak risiko apabila prestasi berada di bawah sasaran dan kurang risiko apabila melebihi sasaran. Seterusnya, kajian mengenai strategi orientasi keusahawanan mendapati pengambilan risiko mempunyai hubungan negatif berbentuk U dengan prestasi

PKS, yang menunjukkan tahap pengambilan risiko yang sederhana lebih bermanfaat berbanding tahap yang terlalu rendah atau terlalu tinggi (Morić, 2022).

Walau bagaimanapun, terdapat kajian lepas yang menunjukkan pengambilan risiko mempunyai hubungan yang positif dengan prestasi firma, terutamanya disebabkan oleh prinsip *risk-return tradeoff* di mana tahap risiko yang lebih tinggi berpotensi menghasilkan pulangan yang lebih besar (Putniņš et al., 2020). Dalam konteks PKS, pengambilan risiko dikaitkan dengan peningkatan keuntungan dan pertumbuhan, seperti yang dibuktikan oleh kajian Wanjau et al. (2015) ke atas PKS pemprosesan agro di Kenya. Begitu jugak kajian oleh Wang dan Poutziouris (2010) yang mendapati wujud kesan positif pengambilan risiko terhadap prestasi firma keluarga, di mana faktor individu dan kekeluargaan mempengaruhi kecenderungan mengambil risiko, sekali gus memberi kesan kepada hasil perniagaan. Justeru itu, berdasarkan kepada perbincangan ini, maka,

Hipotesis 1c: Pengambilan risiko mempunyai hubungan yang signifikan positif dengan prestasi perniagaan.

***Persekitaran Luaran***

Persekitaran perniagaan memainkan peranan penting dalam menentukan kejayaan atau kegagalan firma PKS dengan mempengaruhi proses pembuatan keputusan dan prestasi keseluruhan. Menurut Duncan (1972), persekitaran merujuk kepada faktor fizikal dan sosial yang berlaku di luar organisasi yang mempunyai kaitan dengan proses pembuatan keputusan seseorang usahawan. Manakala Robbins dan Coulter (2021) mentakrifkan persekitaran luaran sebagai kuasa-kuasa dan institusi di luar organisasi yang akan memberi tekanan secara langsung atau tidak langsung kepada firma dan seterusnya akan mempengaruhi prestasi firma.

Kajian semasa menunjukkan kesan persekitaran luaran terhadap prestasi perniagaan adalah pelbagai dan tidak konsisten, terutamanya apabila bertindak sebagai pembolehubah penyederhana dalam hubungan antara strategi orientasi keusahawanan dan prestasi firma (Pereira & Rini, 2022). Sebahagian kajian mendapati faktor luaran seperti persekitaran dinamik dan ketersediaan sumber boleh meningkatkan prestasi melalui inovasi dan perancangan strategik (Pérez-de-Lema et al., 2019), manakala kajian lain menekankan cabaran seperti kekurangan infrastruktur, persaingan sengit dan kekangan kewangan sebagai penyumbang kepada kegagalan PKS (Abubakar & Junaidu, 2019). Sehubungan itu, literatur semasa mencadangkan pemeriksaan berterusan terhadap pembolehubah persekitaran luaran kerana ia berpotensi mempengaruhi keberkesanan strategi keusahawanan dan prestasi firma (Pereira & Rini, 2022).

***Pengaruh Penyederhana Persekitaran Luaran Dinamik***

Persekitaran luaran dinamik merujuk kepada kadar perubahan dan inovasi dalam industri yang menjadikan firma sukar meramal atau menjangka tindakan pesaing dan pelanggan (Arıcı & Gok, 2023). Kajian menunjukkan bahawa ciri utama persekitaran ini ialah ketidakpastian dan kadar perubahan yang pantas, yang mewujudkan cabaran besar terhadap operasi firma dalam sesuatu industri (Marichova, 2019). Selain itu, persekitaran dinamik sering dikaitkan dengan tahap inovasi yang tinggi untuk memenuhi keperluan pelanggan, menjadikan elemen dalam

strategi orientasi keusahawanan seperti inovasi dan sikap proaktif sangat penting bagi kelangsungan daya saing (Al Dhaheri, 2024).

Kajian mengenai pengaruh persekitaran dinamik terhadap amalan strategi orientasi keusahawanan dalam firma telah banyak dilakukan. Penyelidikan terkini menunjukkan bahawa firma yang beroperasi dalam persekitaran dinamik berpotensi meningkatkan hubungan antara strategi orientasi keusahawanan dan prestasi (Arıcı & Gok, 2023). Dalam konteks ini, amalan inovasi firma didapati lebih menonjol apabila beroperasi dalam persekitaran dinamik berbanding persekitaran yang stabil (Al Dhaheri, 2024). Selain itu, aktiviti perintis dan penggunaan teknologi dalam pengeluaran produk dilihat lebih berkesan dalam persekitaran yang dinamik berbanding persekitaran *munificence* (mesra perniagaan) (Marichova, 2019). Kajian lain turut menekankan pengaruh persekitaran dinamik terhadap hubungan antara sikap proaktif firma keusahawanan dengan prestasi, di mana wujud hubungan positif yang signifikan terhadap pertumbuhan jualan dan keuntungan, walaupun pulangan atas jualan tidak menunjukkan kesan yang signifikan (Weaver et al., 1998).

Walau bagaimanapun, terdapat kajian yang menunjukkan hasil berbeza apabila mendapati persekitaran luaran dinamik tidak menyederhanakan hubungan antara dimensi strategi orientasi keusahawanan, khususnya sikap proaktif, dengan prestasi perniagaan (Morales et al., 2016). Begitu juga, kajian lain melaporkan bahawa pengaruh persekitaran dinamik tidak dapat menyederhanakan hubungan antara strategi orientasi keusahawanan dengan prestasi jualan dan keuntungan kerana keputusan yang tidak signifikan (Al Dhaheri, 2024).

Berdasarkan kepada perbincangan di atas, pengkaji berhasrat untuk menguji hipotesis berikut:

Hipotesis 2: Hubungan antara strategi orientasi keusahawanan dengan prestasi perniagaan disederhanakan oleh persekitaran dinamik secara signifikan.

Hipotesis 2a: Hubungan antara inovasi dengan prestasi perniagaan disederhanakan oleh persekitaran persekitaran dinamik secara signifikan.

Hipotesis 2b: Hubungan antara proaktif dengan prestasi perniagaan disederhanakan oleh persekitaran persekitaran dinamik secara signifikan.

Hipotesis 2c: Hubungan antara pengambilan risiko dengan prestasi perniagaan disederhanakan oleh persekitaran dinamik secara signifikan.

### *Pengaruh Penyederhana Persekitaran Luaran Persaingan Sengit*

Pembolehubah persekitaran persaingan sengit merujuk kepada tahap ancaman serius yang dihadapi oleh firma keusahawanan akibat dari beberapa faktor seperti intensiti persaingan, turun naik prestasi industri, tahap kesetiaan pelanggan yang rendah serta kemungkinan campur tangan pihak berkuasa (Arıcı & Gok, 2023). Kesannya firma perlu bertindakbalas dengan mewujudkan strategi penurunan harga dan pemasaran agresif. Tahap persaingan yang tinggi ini telah mendorong inovasi dan meningkatkan kualiti produk, memberi manfaat kepada pengguna, namun ia juga berpotensi mengurangkan keuntungan dan menghalang kemasukan pemain (firma) baharu (Giachetti, 2023).

Giachetti (2023) dan Morales et al. (2016) mengambarkan persekitaran persaingan sengit berpotensi menyokong kejayaan firma melalui dimensi strategi orientasi keusahawanan seperti inovasi, proaktif, dan pengambilan risiko. Walau bagaimanapun, dapatan kajian lepas menunjukkan keputusan yang bercampur-campur, di mana sesetengah kajian mendapati pengaruh persaingan sengit terhadap hubungan antara strategi orientasi keusahawanan dan prestasi adalah signifikan positif, manakala kajian lain melaporkan kesan negatif atau tidak signifikan (Zhaishylyk et al., 2024; Amankwah-Amoah et al., 2018). Perbezaan ini menekankan bahawa kesan persaingan sengit terhadap prestasi firma mungkin bergantung kepada faktor kontekstual dan keupayaan firma untuk menyesuaikan strategi mereka dengan keadaan persekitaran.

Kajian menunjukkan kesan orientasi keusahawanan berbeza mengikut konteks negara dan persekitaran. Di Kanada, kejayaan firma didapati mempunyai hubungan yang negatif dengan dimensi proaktiviti dan pengambilan risiko, manakala inovasi produk baharu dan inovasi teknologi tidak menunjukkan kesan signifikan, mencadangkan bahawa strategi ini mungkin tidak sejajar dengan keadaan pasaran atau budaya perniagaan tempatan (Martins & Rialp, 2023). Sebaliknya, firma di U.S yang mengamalkan strategi inovatif dan proaktif mencatatkan hasil positif, khususnya dalam persekitaran yang sangat kompetitif, sejajar dengan pandangan bahawa pasaran U.S. lebih menghargai amalan inovasi dan bersikap proaktif (Wales et al., 2021). Perbezaan ini jelas menekankan pengaruh faktor seperti pasaran yang dinamik, intensiti persaingan, dan jenis industri terhadap keberkesanan strategi orientasi keusahawanan, di mana pasaran maju cenderung menunjukkan kesan positif orientasi keusahawanan terhadap prestasi, manakala pasaran sedang membangun mungkin mengalami kesan yang bercampur (Covin & Wales, 2019; Martins & Rialp, 2023).

Seterusnya, Covin dan Slevin (1991) dalam model gelagat keusahawanan telah mencadangkan bahawa persekitaran persaingan sengit akan menyederhanakan perhubungan antara strategi orientasi keusahawanan dengan prestasi firma. Model tersebut dibangunkan berdasarkan kepada hasil kajian yang dilakukan ke atas firma pengilangan yang mendapati firma yang beroperasi dalam persekitaran persaingan sengit menunjukkan prestasi yang memberangsangkan apabila dikaitkan dengan strategi keusahawanan. Kajian secara longitudinal turut mendapati persekitaran sengit mempengaruhi secara positif hubungan antara pembolehubah orientasi keusahawanan dengan prestasi firma, dan keputusan kajian menunjukkan hubungan tersebut meningkat dari semasa ke semasa (Covin & Wales, 2019; Martins & Rialp, 2023; Wales et al., 2021). Berdasarkan kepada perbincangan di atas, pengkaji menjangkakan firma keusahawanan yang beroperasi dalam persekitaran persaingan sengit akan mempengaruhi hubungan antara strategi orientasi keusahawanan dengan prestasi perniagaan secara signifikan. Maka:

Hipotesis 3: Hubungan antara strategi orientasi keusahawanan dengan prestasi perniagaan disederhanakan oleh persekitaran persaingan sengit secara signifikan.

Hipotesis 3a: Hubungan antara inovasi dengan prestasi perniagaan disederhanakan oleh persekitaran persaingan sengit secara signifikan.

Hipotesis 3b: Hubungan antara proaktif dengan prestasi perniagaan disederhanakan oleh persekitaran persaingan sengit secara signifikan.

Hipotesis 3c: Hubungan antara pengambilan risiko dengan prestasi perniagaan disederhanakan oleh persekitaran persaingan sengit secara signifikan.

***Pengaruh Penyederhana Persekitaran Luaran Munificence***

Persekitaran luaran munificence atau mesra perniagaan mempunyai ciri dan sifat yang bertentangan dengan persekitaran persaingan sengit (Covin & Wales, 2019; Martins & Rialp, 2023; Wales et al., 2021). Persekitaran mesra merujuk kepada sumber-sumber dan jumlah peluang yang tersedia di dalam persekitaran luaran yang khusus dan dijangka akan menggalakkan aktiviti orientasi keusahawanan dalam firma (Martins & Rialp, 2023; Wales et al., 2021). Peranan persekitaran mesra sebagai pembolehubah penyederhana antara orientasi keusahawanan dengan prestasi perniagaan telah pun dikaji oleh beberapa pengkaji seperti Wales et al. (2021), Covin dan Wales (2019) dan Shirokova et al. (2016). Kajian mereka mendapati faktor persekitaran seperti kelimpahan sumber dan peluang pasaran boleh memperkukuh hubungan antara orientasi keusahawanan dan prestasi firma.

Kajian lepas menunjukkan persekitaran luaran *munificence* berperanan penting sebagai pembolehubah penyederhana dalam hubungan antara strategi orientasi keusahawanan dengan prestasi firma. Kreiser et al. (2002) mendapati firma yang beroperasi dalam persekitaran mesra mampu meningkatkan hubungan antara inovasi dengan prestasi pertumbuhan jualan, walaupun hubungan inovasi dengan prestasi untung kasar adalah tidak signifikan. Dapatan ini disokong oleh kajian terkini yang menekankan bahawa kelimpahan sumber dan peluang pasaran boleh memperkukuh kesan inovasi terhadap prestasi, khususnya dalam industri berteknologi tinggi (Martins & Rialp, 2023). Walau bagaimanapun, beberapa kajian juga menunjukkan bahawa persekitaran mesra tidak semestinya menyederhanakan semua hubungan inovasi dengan prestasi, malah dalam sesetengah kes, hubungan tersebut boleh menjadi negatif kerana firma mungkin terlalu bergantung kepada sumber yang tersedia tanpa mengoptimumkan inovasi (Gul, 2019).

Selain inovasi, persekitaran mesra turut menggalakkan firma untuk bertindak secara proaktif. Kajian terdahulu dan semasa mendapati sikap proaktif mempunyai hubungan yang lebih kuat dengan prestasi firma dalam persekitaran yang kaya dengan sumber (Covin & Wales, 2019; Shirokova et al., 2016). Ini selari dengan hujah bahawa pasaran yang mempunyai peluang besar, membolehkan firma memanfaatkan tindakan proaktif untuk meningkatkan pulangan jualan dan pertumbuhan (Martins & Rialp, 2023). Sebaliknya, dalam persekitaran yang kurang mesra, firma mungkin lebih berhati-hati dan mengurangkan pengambilan risiko kerana kekangan sumber (Wales et al., 2021). Namun, kajian juga menunjukkan bahawa dalam persekitaran mesra, pengambilan risiko boleh memberi kesan positif terhadap prestasi kerana kadar kegagalan adalah rendah berikutan kelimpahan sumber (Covin & Wales, 2019), walaupun hubungan ini tidak selalu signifikan untuk semua indikator prestasi (Shirokova et al., 2016).

Secara keseluruhan, peranan persekitaran *munificence* sebagai moderator adalah kompleks dan bergantung kepada dimensi orientasi keuisahawanan yang dikaji. Walaupun kebanyakan kajian menyokong kesan positif persekitaran *munificence* terhadap hubungan antara inovasi, proaktif, dan pengambilan risiko dengan prestasi, terdapat bukti bahawa kesan ini boleh berubah mengikut jenis industri, tahap persaingan, dan strategi firma (Martins & Rialp, 2023; Wales et al., 2021). Berdasarkan hujahan ini, pengkaji mencadangkan persekitaran *munificence* akan mempengaruhi secara signifikan hubungan antara setiap dimensi orientasi keusahawanan dengan prestasi perniagaan.

Hipotesis 4: Hubungan antara strategi orientasi keusahawanan dengan prestasi perniagaan disederhanakan oleh persekitaran *munificence* secara signifikan.

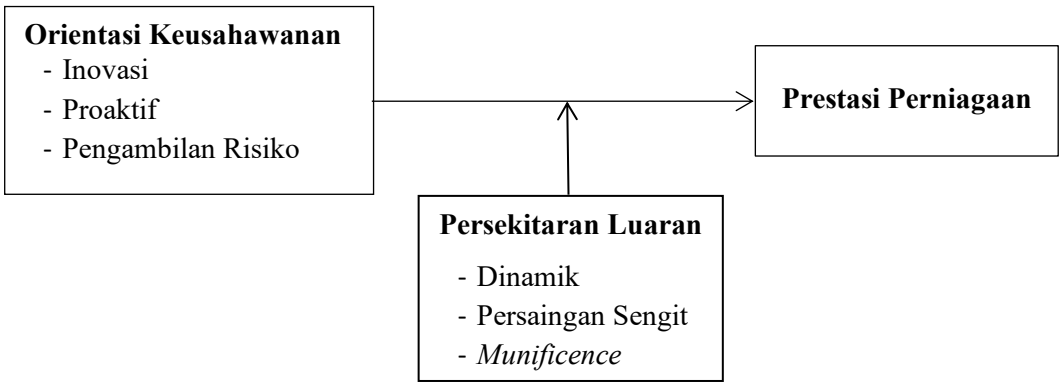
Hipotesis 4a: Hubungan antara inovasi dengan prestasi perniagaan disederhanakan oleh persekitaran *munificence* secara signifikan.

Hipotesis 4b: Hubungan antara proaktif dengan prestasi perniagaan disederhanakan oleh persekitaran *munificence* secara signifikan.

Hipotesis 4c: Hubungan antara pengambilan risiko dengan prestasi perniagaan disederhanakan oleh persekitaran *munificence* secara signifikan.

## Kerangka Konseptual

Berdasarkan kepada ulasan literatur serta hipotesis yang dibangunkan, satu kerangka konseptual kajian dapat ditunjukkan seperti dalam rajah 1.




**Rajah 1: Kerangka Konseptual Kajian**

Model dalam kajian ini menunjukkan keseluruhan cadangan kerangka untuk diperiksa dan dianalisis. Rajah 1 menunjukkan hubungan antara setiap pembolehubah orientasi keusahawanan (inovasi, proaktif dan pengambilan risiko) dengan prestasi perniagaan serta pengaruh pembolehubah penyederhana persekitaran luaran dinamik, persaingan sengit dan *munificence* ke atas hubungan tersebut.

## Metodologi Kajian

Populasi bagi kajian ini merujuk kepada semua firma perkilangan (termasuk asas tani) dan perkhidmatan berkaitan perkilangan yang beroperasi di Malaysia dan telah mendaftar dengan Perbadanan Perusahaan Kecil dan Sederhana Malaysia (SME Corp. Malaysia). Senarai firma-firma tersebut diperolehi dari SME Corp. Malaysia yang boleh disemak melalui laman web https://smecorp.gov.my. Pemilihan responden menggunakan pendekatan teknik persampelan berstrata (*stratified random sampling*). Pendekatan ini penting bagi memastikan setiap sampel kajian diwakili dari pelbagai kategori, negeri dan sektor perniagaan serta meningkatkan kesahan dan kebolehpercayaan kajian. Pengumpulan data akan menggunakan kaedah dalam talian dan bersemuka. Kaedah ini perlu bagi memastikan pengumpulan data yang komprehensif.

Pembolehubah strategi orientasi keusahawanan akan menggunakan skala pengukuran yang telah dibangunkan oleh Lumpkin dan Dess (1996). Sebanyak empat belas item soal selidik diukur dengan menggunakan skala Likert 7 mata. Masing-masing lima item mengukur pembolehubah inovasi dan pengambilan risiko dan empat item untuk mengukur proaktif. Seterusnya pembolehubah persekitaran luaran dinamik dan persaingan sengit serta *munificence* akan menggunakan skala pengukuran yang telah dibangunkan oleh Green et al. (2008). Sebanyak sebelas item digunakan untuk mengukur persekitaran luaran dinamik (5 item) dan persaingan sengit serta *munificence* (6 item). Format skala Likert 7 mata akan digunakan bermula dengan 1 (sangat tidak bersetuju) hingga 7 (sangat setuju). Manakala item pengukuran bagi prestasi perniagaan adalah sebanyak lapan item berbentuk subjektif yang mengukur pertumbuhan perniagaan dan prestasi kewangan (Wiklund, 1999). Didapati kajian lepas telah membuktikan pendekatan pengukuran kewangan secara subjektif atau laporan sendiri adalah boleh dipercayai (Schulze et al., 2001).

## Kesimpulan

Cadangan kajian empirikal ini bertujuan untuk memeriksa hubungan antara strategi orientasi keusahawanan dengan prestasi perniagaan PKS di Malaysia. Kajian terdahulu telah melaporkan penemuan hubungan yang pelbagai serta tidak konsisten. Hubungan yang tidak menentu ini juga melibatkan ketiga-tiga dimensi (inovasi, proaktif dan pengambilan risiko) dengan prestasi perniagaan PKS. Variasi ini mungkin berpunca daripada perbezaan dalam konteks kajian, masa dan metodologi. Selain itu, faktor pandemik COVID-19 serta persekitaran luaran perniagaan yang tidak menentu turut memberi kesan ketara kepada prestasi perniagaan di peringkat tempatan dan global. Oleh itu, pengaruh persekitaran luaran (dinamik, persaingan sengit dan munificence) ke atas hubungan antara strategi keusahawanan dengan prestasi turut akan diperiksa. Pengkaji ingin melihat adakah pengaruh setiap pembolehubah persekitaran luaran mampu mempengaruhi hubungan tersebut.

Hasil kajian ini diharap mampu membantu agensi kerajaan serta pihak-pihak yang berkepentingan membantu usahawan di Malaysia. Dapatan ini juga boleh digunakan untuk proses membantu usahawan menerusi khidmat bantuan dan sokongan serta khidmat nasihat kepada usahawan di Malaysia. Dengan memanfaatkan penemuan kajian ini, pemilik perniagaan boleh mengenal pasti peluang dan ancaman dengan lebih baik apabila membangunkan pelan strategik dan melaksanakan mekanisme kawalan. Kajian ini juga akan berfungsi sebagai asas untuk penyelidikan masa depan yang mengkaji sama ada faktor dalaman atau luaran dalam firma keusahawanan mempengaruhi prestasi perniagaan PKS.

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# PENGARUH ETIKA PENGEDARAN PRODUK TERHADAP PRESTASI PERNIAGAAN USAHAWAN WANITA MUSLIM DI KELANTAN

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***Abstrak:*** *Etika pengedaran produk merupakan komponen penting dalam memastikan kelestarian dan daya saing perniagaan dalam kalangan usahawan wanita Muslim. Berteraskan prinsip Syariah seperti keadilan, ketelusan dan tanggungjawab sosial, amalan etika yang baik diyakini mampu mempengaruhi tahap prestasi perniagaan secara signifikan. Kajian ini dijalankan bagi menilai tahap amalan etika pengedaran produk serta menganalisis hubungannya dengan prestasi perniagaan usahawan wanita Muslim. Menggunakan pendekatan kuantitatif deskriptif, soal selidik diedarkan kepada usahawan wanita Muslim yang menjalankan perniagaan kecil dan sederhana di negeri Kelantan. Analisis kajian mendapati bahawa pematuhan terhadap etika pengedaran produk berasaskan Syariah dapat meningkatkan kepercayaan pelanggan, mengukuhkan reputasi perniagaan serta menyumbang kepada pertumbuhan prestasi perniagaan. Kajian ini mencadangkan agar pembangunan modul latihan etika pengedaran produk berteraskan prinsip Islam diperkukuhkan bagi meningkatkan profesionalisme usahawan wanita serta memastikan amalan pengedaran yang lebih berintegriti dan mampan.*

***Kata kunci:*** *Etika pengedaran produk, prestasi perniagaan, usahawan wanita muslim, etika perniagaan Islam, Syariah.*

## Pengenalan

Etika perniagaan merupakan aspek penting dalam keberhasilan dan kelestarian sesebuah organisasi, terutamanya dalam perniagaan kecil dan sederhana (PKS) yang semakin berkembang di peringkat global (Khan et al., 2024). Dalam konteks keusahawanan Muslim, prinsip etika bukan sahaja merangkumi kepatuhan pada undang-undang, tetapi juga dipandu oleh nilai-nilai Syariah seperti keadilan, keikhlasan, ketelusan dan tanggungjawab sosial (Ahmad & Omar, 2025). Amalan etika dalam pengedaran produk merupakan salah satu elemen kritikal dalam memastikan produk diurus dan disampaikan kepada pelanggan secara telus dan adil, yang seterusnya dapat mempengaruhi persepsi pelanggan terhadap perniagaan tersebut (Hasan et al., 2023).

Usahawan wanita Muslim memainkan peranan penting dalam pembangunan ekonomi Malaysia, termasuk di negeri Kelantan di mana sektor perniagaan kecil dan sederhana

didominasi oleh penyertaan wanita (Zainal & Rahman, 2025). Walau bagaimanapun, kajian terdahulu menunjukkan bahawa cabaran seperti kekangan modal, kurangnya pengetahuan pemasaran dan kurangnya amalan etika perniagaan memberi kesan negatif terhadap prestasi perniagaan usahawan wanita (Siti & Faridah, 2024). Dalam pasaran yang semakin kompetitif, etika pengedaran produk bukan sahaja memberi impak kepada hubungan perniagaan tetapi juga memainkan peranan penting dalam membina kepercayaan pelanggan dan memupuk reputasi yang positif (Saleh & Ibrahim, 2024).

Beberapa kajian terdahulu telah mengaitkan amalan etika perniagaan dengan prestasi perniagaan secara umum (Noor & Aziz, 2023; Lee & Ahmad, 2025). Namun begitu, masih terdapat kekosongan literatur yang khusus meneliti hubungan antara etika pengedaran produk dan prestasi perniagaan dalam kalangan usahawan wanita Muslim di Malaysia, khususnya di Kelantan. Justeru itu, kajian ini bertujuan untuk menilai tahap amalan etika pengedaran produk serta menganalisis pengaruhnya terhadap prestasi perniagaan usahawan wanita Muslim di negeri tersebut.

Kajian ini dijangka dapat menyumbang kepada pemahaman yang lebih mendalam tentang bagaimana amalan etika dalam pengedaran produk dapat memperkukuh prestasi perniagaan, seterusnya membantu pembuat dasar, institusi latihan keusahawanan, serta usahawan itu sendiri untuk merangka strategi pembangunan perniagaan yang lebih efektif.

**Penyataan Masalah**

Perniagaan usahawan wanita Muslim di Kelantan dilihat menghadapi pelbagai cabaran berkaitan pengedaran produk yang memberi kesan terhadap prestasi perniagaan mereka. Kajian terdahulu menunjukkan bahawa kelemahan dalam aspek pemasaran, perancangan pengedaran, dan pengurusan produk boleh menjejaskan pertumbuhan dan daya saing perniagaan usahawan wanita (Kalthom & Ahmad, 2010; Sharifah & Suzana, 2014). Selain itu, kurangnya pematuhan terhadap etika perniagaan Islam, seperti ketelusan dalam penyampaian maklumat produk, turut menjejaskan kepercayaan pelanggan serta prestasi jualan (Mohd Syahrir et al., 2017; Mohd Rosli & Rosman, 2014).

Kajian terkini dalam konteks Kelantan juga mendapati terdapat hubungan positif yang signifikan antara etika pengedaran produk dengan prestasi perniagaan usahawan wanita Muslim, di mana amalan pengedaran yang beretika dapat meningkatkan prestasi jualan dan kepercayaan pelanggan (Sha'ari et al., 2025). Tambahan pula, penyelidikan terbaru menunjukkan bahawa strategi pemasaran yang efektif, termasuk pengurusan saluran pengedaran yang baik, memberi impak positif kepada prestasi perniagaan usahawan wanita luar bandar (Kamarul Zaman & Zainol, 2024), dan trend kajian keusahawanan wanita menunjukkan peningkatan fokus terhadap faktor-faktor yang mempengaruhi kejayaan dan keberhasilan perniagaan wanita di pelbagai konteks (Prabha et al., 2025).

Walau bagaimanapun, masih wujud kekangan dalam pelaksanaan strategi pengedaran yang konsisten dan beretika di kalangan usahawan wanita, sekali gus menunjukkan keperluan untuk mengkaji hubungan antara aspek pengedaran produk dan prestasi perniagaan secara lebih mendalam di kalangan usahawan wanita Muslim di Kelantan.

## Kajian Literatur

Kajian ini akan membincangkan tiga topik utama, iaitu keusahawanan wanita muslim, pengedaran produk, etika perniagaan Islam dalam konteks pengedaran produk dan prestasi perniagaan usahawan muslim.

### *Keusahawanan Wanita Muslim*

Keusahawanan wanita Muslim merupakan satu segmen penting yang semakin mendapat perhatian dalam konteks pembangunan ekonomi negara. Golongan ini dikenal pasti sebagai penyumbang aktif kepada pertumbuhan ekonomi melalui penglibatan langsung dalam aktiviti perniagaan, sama ada pada peringkat mikro, kecil mahupun sederhana (Nurul Fazlina, Hallieyana & Wan Khalijah, 2024). Selain berupaya memulakan perniagaan, usahawan wanita juga menunjukkan potensi besar untuk memperluas operasi dan menembusi pasaran yang lebih luas. Selaras dengan pandangan ini, Mucollari et al. (2024) mentakrifkan usahawan wanita sebagai individu wanita yang mengasaskan, memiliki dan mengurus perniagaan, serta memainkan peranan signifikan dalam inovasi dan pembangunan sosioekonomi di peringkat global.

Penglibatan wanita Muslim dalam bidang keusahawanan didorong oleh pelbagai faktor, antaranya keinginan untuk meningkatkan pendapatan keluarga, memperoleh fleksibiliti masa kerja serta memenuhi tanggungjawab sosial dalam komuniti (Nawi et al., 2020). Aktiviti keusahawanan mereka lazimnya tertumpu dalam sektor-sektor seperti makanan halal, kraftangan, tekstil, perkhidmatan serta perniagaan berasaskan platform dalam talian. Namun demikian, penglibatan wanita dalam dunia perniagaan turut berhadapan dengan pelbagai cabaran tersendiri, termasuk diskriminasi jantina, keterbatasan akses kepada sumber kewangan serta tuntutan untuk mengimbangi peranan sebagai usahawan dan tanggungjawab keluarga. Sehubungan itu, Mucollari et al. (2024) menegaskan bahawa kewujudan ekosistem sokongan yang mantap, dasar yang bersesuaian serta bimbingan berterusan amat diperlukan bagi memperkasa dan memperkukuh keusahawanan wanita.

Dalam konteks tempatan, kajian yang dijalankan oleh Anis Solehin dan Sharifah Rohayah (2020) mengenal pasti beberapa kekangan utama yang dihadapi oleh usahawan wanita, khususnya dari aspek fizikal, pengurusan masa, pengurusan sumber manusia serta faktor sosial. Walaupun berdepan dengan pelbagai cabaran tersebut, usahawan wanita di Kelantan didapati memiliki tahap daya tahan dan keupayaan penyesuaian yang tinggi. Sebagai contoh, apabila menghadapi kekurangan pelanggan, mereka cenderung mengambil inisiatif untuk menggunakan kaedah promosi secara dalam talian sebagai strategi bagi menarik pelanggan baharu dan mengekalkan kelangsungan perniagaan.

Penemuan ini turut disokong oleh kajian Niels Bosma dan Donna Kelley (2018) yang melaporkan bahawa usahawan di beberapa wilayah dunia, termasuk Amerika Latin serta Timur Tengah dan Afrika, menunjukkan tahap ketakutan terhadap kegagalan yang berbeza-beza. Kajian tersebut mendapati bahawa hanya 17 peratus usahawan di Angola melaporkan kebimbangan terhadap kegagalan, manakala Maghribi mencatatkan kadar tertinggi iaitu 64 peratus. Variasi ini mencerminkan perbezaan tahap keberanian dan ketahanan dalam kalangan

usahawan, namun secara keseluruhannya menunjukkan bahawa sikap berani mengambil risiko dan keupayaan menghadapi kegagalan merupakan elemen penting dalam mencapai kejayaan perniagaan (Anis Solehin & Sharifah Rohayah, 2020).

Selain faktor individu, kejayaan usahawan wanita juga banyak dipengaruhi oleh ketersediaan sokongan luaran yang bersifat konstruktif, terutamanya melalui pembentukan jaringan perniagaan yang kukuh. Sokongan ini merangkumi bimbingan dan khidmat nasihat perniagaan, akses kepada pembiayaan yang selamat, pengambilan tenaga kerja berkemahiran serta pembinaan hubungan strategik dalam rantaian nilai perniagaan (Anis Solehin & Sharifah Rohayah, 2020). Dengan sokongan yang menyeluruh dan berterusan, usahawan wanita berpotensi untuk berkembang secara mampan serta kekal berdaya saing dalam persekitaran keusahawanan yang semakin kompleks dan mencabar.

***Pengedaran Produk***

Pengedaran produk merupakan elemen utama dalam rantaian bekalan sesebuah perniagaan kerana ia berfungsi memastikan produk dapat disampaikan kepada pelanggan dengan cekap dan sistematik. Keberkesanan proses pengedaran bukan sahaja mempengaruhi tahap kepuasan pelanggan, malah turut memberi kesan langsung terhadap prestasi dan kelangsungan perniagaan. Secara umumnya, pengedaran produk merangkumi pelbagai aktiviti seperti pengangkutan, penyimpanan, pemprosesan pesanan serta pengurusan saluran pengedaran sehingga produk diterima oleh pengguna akhir.

Sehubungan itu, strategi pengedaran yang dirancang secara teliti amat diperlukan bagi memastikan produk tersedia pada masa yang tepat, dalam kuantiti yang mencukupi dan di lokasi yang bersesuaian. Sazelin (2009) menegaskan bahawa selain keperluan modal, kejayaan perniagaan turut bergantung kepada kebijaksanaan dalam merebut peluang pasaran, pembinaan rangkaian perniagaan yang kukuh serta keupayaan memasarkan, mempromosikan dan mengiklankan produk secara berkesan.

Pengedaran produk juga mempunyai hubungan yang rapat dengan pasaran, memandangkan pasaran merupakan medium yang membolehkan interaksi dan pertukaran nilai berlaku antara penjual dan pembeli. Proses ini melibatkan aktiviti seperti jualan, promosi serta usaha menarik minat pelanggan terhadap produk atau perkhidmatan yang ditawarkan (Sharifah & Suzana, 2014). Dari perspektif Islam, aktiviti pemasaran dan pengedaran perlu berlandaskan nilai murni serta etika perniagaan yang menekankan keadilan, ketelusan dan keseimbangan. Prinsip ini termasuklah penetapan harga yang adil berdasarkan kos sebenar, mengelakkan keuntungan yang berlebihan, memenuhi keperluan pelanggan serta berusaha meningkatkan kualiti produk secara berterusan. Kajian oleh Rossidi Usop, Siti Fariha dan Fakhrul Anwar (2017) mendapati bahawa pematuhan terhadap amalan pengedaran yang beretika mampu menyumbang kepada kejayaan perniagaan dalam jangka panjang.

Kajian ini menumpukan perhatian kepada pengedaran produk sebagai sebahagian daripada strategi pemasaran yang diamalkan oleh usahawan wanita. Menurut Nasib et al. (2019), pemasaran merupakan satu proses sosial dan pengurusan yang melibatkan individu atau organisasi dalam usaha mencipta, menawarkan dan menyampaikan produk bernilai bagi memenuhi keperluan serta kehendak pelanggan. Selain itu, Azyyati et al. (2021) menyatakan

bahawa pelaksanaan strategi pemasaran yang berkesan berupaya membantu sesebuah organisasi mencapai matlamat perniagaan dan meningkatkan prestasi jualan secara keseluruhan.

Bagi memastikan strategi pemasaran dan pengedaran dapat dilaksanakan dengan berkesan, pendekatan yang berstruktur melalui latihan serta pembangunan sumber manusia adalah amat penting. Danda dan Endale (2020) mencadangkan agar program latihan perniagaan memberi penekanan kepada aspek utama seperti strategi pemasaran, pengurusan operasi dan perancangan perniagaan. Di samping itu, penguasaan teknologi dalam pengendalian operasi serta usaha berterusan untuk meningkatkan kualiti produk turut dikenal pasti sebagai faktor penting dalam memperkukuh daya saing perniagaan di peringkat global. Melalui latihan dan pendedahan yang sistematik, usahawan bukan sahaja dapat meningkatkan keupayaan pemasaran, malah dapat menyokong kelestarian dan pertumbuhan perniagaan dalam jangka masa panjang.

Secara keseluruhannya, pengedaran produk memainkan peranan penting dalam memastikan keberkesanan rantaian bekalan serta tahap kepuasan pelanggan. Strategi pengedaran yang dilaksanakan dengan baik bukan sahaja menjamin ketersediaan produk dari segi kuantiti, masa dan lokasi, malah turut membantu membina hubungan yang lebih kukuh antara pelanggan dan pemilik perniagaan melalui nilai tambah yang ditawarkan. Kajian-kajian terdahulu jelas menunjukkan bahawa pembentukan nilai bersama, aktiviti promosi yang berkesan serta kebijaksanaan dalam strategi pemasaran merupakan komponen penting dalam meningkatkan prestasi perniagaan.

### *Amalan Etika Perniagaan Islam dalam Saluran Pengedaran Produk*

Pengedaran produk merujuk kepada rangka kerja strategi pemasaran yang merangkumi aktiviti promosi, pengiklanan serta penetapan harga bagi sesuatu produk atau perkhidmatan yang ditawarkan kepada pengguna, sama ada berbentuk fizikal, perkhidmatan mahupun idea. Pasaran pula berfungsi sebagai medium perhubungan antara peniaga dan pengguna dalam proses penyampaian barangan dan perkhidmatan (Rossidi Usop, Fakhrul & Nadhirah, 2018). Dalam konteks ini, pengiklanan memainkan peranan penting sebagai alat komunikasi pemasaran yang bertujuan menarik perhatian, mempengaruhi persepsi serta mendorong keputusan pembelian pelanggan.

Dari perspektif Islam, pengedaran produk tidak hanya tertumpu kepada aspek keuntungan semata-mata, malah perlu berlandaskan prinsip syariah yang menekankan keadilan, kejujuran dan ketelusan. Amalan seperti penetapan harga yang munasabah tanpa unsur eksploitasi, penyampaian maklumat produk yang tepat, serta penghindaran penipuan adalah antara elemen utama yang perlu dipatuhi. Pematuhan kepada prinsip ini memastikan pengguna memperoleh produk atau perkhidmatan secara sah dan beretika. Walaupun sesuatu produk mempunyai kualiti yang baik, ia berpotensi gagal di pasaran sekiranya tidak disokong oleh usaha pemasaran, promosi dan pengiklanan yang berkesan, memandangkan pengguna lazimnya lebih cenderung kepada perniagaan yang aktif memasarkan produk mereka.

Kajian oleh Sharifah Yuhayu dan Suzana (2014) serta Safura dan Ahmad Syafiq (2021) mendapati bahawa hasil jualan produk merupakan sumber pendapatan utama bagi perniagaan,

sama ada bagi memenuhi keperluan harian atau mencapai objektif kewangan tertentu. Oleh itu, pemilihan saluran pengedaran yang sesuai dan cekap adalah penting bagi memastikan produk sampai kepada pengguna mengikut kehendak, permintaan dan piawaian kualiti yang ditetapkan. Produk yang dipasarkan juga perlu berada di lokasi yang strategik serta memenuhi spesifikasi kuantiti dan kualiti bagi menjamin kepuasan pelanggan.

Selain itu, tahap margin dalam pengedaran boleh berubah bergantung kepada kaedah pengedaran yang dipilih oleh perniagaan. Keupayaan untuk mengawal dan mengurangkan kos pengedaran membolehkan usahawan mengekalkan daya saing dengan menawarkan harga yang lebih kompetitif berbanding pesaing. Dalam usaha mencapai matlamat tersebut, usahawan perlu bersikap proaktif dalam meningkatkan inovasi dan kualiti produk, termasuk aspek pembungkusan yang menarik dan berkualiti. Dapatan kajian oleh Farahdillah Iqmar Omar (2020) menunjukkan bahawa keberkesanan strategi pengiklanan, pendekatan pemasaran yang sistematik serta reputasi produk merupakan antara faktor utama yang mempengaruhi prestasi perniagaan dalam kalangan Perusahaan Kecil dan Sederhana (PKS).

Di samping itu, nilai kejujuran dan ketelusan turut memainkan peranan penting dalam proses penetapan harga. Usahawan bertanggungjawab memastikan harga yang dikenakan adalah selaras dengan kualiti produk yang ditawarkan agar pengguna dapat membuat keputusan pembelian yang tepat tanpa unsur penipuan. Pematuhan kepada etika perniagaan Islam, khususnya dalam urusan jual beli dan penentuan harga yang adil, merupakan asas penting dalam membina kepercayaan pelanggan serta kelangsungan perniagaan (Rossidi Usop et al., 2018).

Kesimpulannya, pengedaran produk merupakan elemen strategik yang mempengaruhi kejayaan sesebuah perniagaan. Ia merangkumi aspek penetapan harga, promosi dan pelaksanaan strategi pemasaran yang berkesan bagi memenuhi keperluan pasaran. Dalam kerangka Islam, amalan pengedaran yang berteraskan etika menitikberatkan prinsip keadilan, kejujuran dan ketelusan bagi memastikan pengguna menerima produk secara sah dan beretika. Saluran pengedaran yang cekap, strategi pemasaran yang mantap serta reputasi produk yang baik terbukti memberi kesan signifikan terhadap prestasi perniagaan, khususnya dalam kalangan PKS. Oleh itu, usahawan disaran agar terus berinovasi, meningkatkan mutu produk serta mengekalkan pematuhan kepada prinsip syariah bagi menjamin daya saing, kepercayaan pelanggan dan kelestarian perniagaan dalam jangka panjang.

***Prestasi Kejayaan Usahawan Muslim***

Kajian berkaitan prestasi perniagaan kini menjadi tumpuan utama dalam penyelidikan keusahawanan, terutamanya bagi sektor Perusahaan Kecil dan Sederhana (PKS) serta mikroushawan. Prestasi perniagaan berfungsi sebagai
indikator kritikal yang mencerminkan tahap kejayaan sesebuah entiti melalui pelbagai dimensi seperti pengurusan, strategi pemasaran, sistem pengedaran, kedudukan kewangan, tahap inovasi, rangkaian perniagaan, serta kelestarian operasi.

Menurut Wiklund dan Shepherd (2005), prestasi perniagaan merujuk kepada kemajuan dan pencapaian yang diraih oleh sesebuah perniagaan. Norashidah Hashim et al. (2020) pula menegaskan bahawa pemantauan prestasi adalah penting bagi menjamin kelangsungan

perniagaan. Dalam konteks ini, fokus diberikan kepada usahawan mikro, iaitu perniagaan berskala kecil yang diuruskan secara peribadi atau dengan sokongan ahli keluarga terdekat.

Norashidah Hashim et al. (2020) menyatakan bahawa penilaian prestasi tradisional sering menggunakan pendekatan subjektif berasaskan perspektif kewangan. Ini merangkumi elemen seperti pengurusan inventori dan kualiti perkhidmatan, kos operasi dan penguasaan pasaran serta keuntungan dan pengurusan sumber manusia. Selain itu, Keelson et al. (2024) mendapati bahawa persaingan pasaran mempunyai impak ketara terhadap prestasi PKS, di mana inovasi proses bertindak sebagai pemangkin (moderasi) dalam memperkukuh kedudukan perniagaan.

Dalam aspek keuntungan, kajian Mohd Maliki Kamarul Zaman dan Norasmah Othman (2018) terhadap usahawan wanita FELCRA Berhad menunjukkan trend peningkatan keuntungan tahunan yang positif. Hal ini membuktikan produk mereka mempunyai daya saing yang kuat. Tahap keuntungan ini merupakan kayu ukur universal untuk menentukan sama ada prestasi usahawan berada di bawah, setara, atau melebihi purata industri. Manakala, kajian oleh Ishak Yusof et al. (2011) di Pulau Langkawi mengenal pasti bahawa pertumbuhan kewangan dan keuntungan adalah indikator utama kejayaan usahawan Melayu di sana. Selain kewangan, faktor lain yang turut menyumbang termasuklah kadar pusing ganti pekerja, penerimaan produk di pasaran antarabangsa, serta imej perniagaan.

Dalam kajian yang berbeza, Norashidah Hashim et al. (2020) telah memperincikan profil usahawan asnaf di Kedah yang mendapat sokongan melalui Program Bantuan Jayadiri. Hasil kajian tersebut menunjukkan bahawa elemen prestasi perniagaan, bantuan zakat, motivasi, serta rangkaian perniagaan berada pada tahap yang memuaskan, manakala aspek latihan yang diterima dan amalan simpanan pula berada pada tahap sederhana. Secara keseluruhannya, peningkatan prestasi perniagaan dalam kalangan usahawan asnaf ini bukan sahaja mampu menaik taraf kualiti hidup mereka, malah mempunyai impak jangka panjang yang signifikan untuk mengubah status mereka daripada golongan penerima zakat (asnaf) kepada pembayar zakat pada masa hadapan.

Kepentingan elemen pemasaran moden terhadap prestasi perniagaan telah disokong oleh pelbagai dapatan kajian mutakhir. Menurut Omar et al. (2020), penggunaan media digital, aktiviti pengiklanan, dan pengukuhan reputasi jenama mempunyai hubungan yang sangat signifikan dengan prestasi PKS, khususnya di kawasan Lembah Klang. Selari dengan itu, Norasmah Othman (2020) serta Norhauzan dan Norasmah (2023) menekankan bahawa kemahiran pemasaran mempunyai korelasi positif terhadap prestasi eksport syarikat di Malaysia. Hal ini menunjukkan bahawa keupayaan usahawan dalam mengenal pasti serta bertindak pantas terhadap peluang pasaran baharu merupakan kunci utama kepada peningkatan prestasi. Dapatan ini turut diperkukuhkan lagi oleh kajian Rabitah dan Shuhymee (2020) yang merumuskan bahawa kemahiran dalam elemen pemasaran secara keseluruhannya adalah faktor kritikal yang memacu kecemerlangan sesebuah perniagaan.

## Metodologi Kajian

Kajian ini dilaksanakan dengan menggunakan pendekatan kuantitatif melalui reka bentuk deskriptif atau tinjauan. Menurut Creswell (2005), kaedah ini membolehkan penyelidik meninjau populasi atau sampel secara sistematik bagi menentukan serta menghubungkaitkan

tahap pemahaman usahawan wanita Muslim di Bazar Tok Guru, Kota Bharu, Kelantan secara empirikal. Fokus utama kajian ini tertumpu kepada populasi seramai 180 usahawan wanita di lokasi tersebut. Memandangkan saiz populasi yang agak kecil, penyelidik menetapkan saiz sampel sebanyak 50 orang berdasarkan formula penentuan saiz sampel oleh Krejie dan Morgan (1970). Tindakan mengambil hampir separuh daripada populasi ini disokong oleh Sidek (2002), yang menyatakan bahawa pemilihan sebahagian atau keseluruhan populasi yang kecil tidak akan menjejaskan ketepatan hasil kajian.

Bagi tujuan pengumpulan data, instrumen soal selidik telah digunakan dan diedarkan melalui kaedah bersemuka serta tinjauan dalam talian. Soal selidik ini menggunakan skala *Likert* lima (5) pilihan, bermula daripada sangat tidak bersetuju sehingga sangat bersetuju, bagi mengukur tahap kesedaran serta pemahaman responden terhadap prestasi perniagaan mereka. Instrumen kajian ini telah direka bentuk dan diubah suai berdasarkan kajian-kajian lepas, yang mana ia merangkumi enam (6) item berkaitan etika perniagaan Islam dalam aspek pengedaran produk dan lima (5) item bagi mengukur prestasi perniagaan usahawan wanita Muslim di Kelantan.

Dalam kajian ini, terdapat dua kategori pemboleh ubah utama iaitu pengedaran produk sebagai pemboleh ubah bebas dan prestasi perniagaan sebagai pemboleh ubah bersandar. Penggunaan borang soal selidik ini membolehkan penyelidik memperoleh data numerik yang kemudiannya dianalisis menggunakan teknik statistik seperti yang dicadangkan oleh Creswell (2003). Melalui kaedah ini, perkaitan antara etika pengedaran produk dan prestasi perniagaan dapat diukur secara tepat bagi mencapai objektif kajian yang telah ditetapkan.

**Jadual 1: Item Pengedaran Produk (Pemboleh Ubah Bebas)**

| Pemboleh Ubah Bebas | Item | Penulis |
|---|---|---|
| Pengedaran produk (Etika perniagaan Islam) | 1. Saya banyak menggunakan media sosial sebagai medium promosi dan pengiklanan.<br>2. Strategi harga produk saya mesti mengambil kos-kos pengeluaran.<br>3. Saya merasa cukup dengan keuntungan yang sedikit.<br>4. Networking merupakan perkara penting untuk membantu mengembangkan produk.<br>5. Saya mengambil tindakan proaktif dengan memenuhi segala tuntutan dan permintaan pelanggan.<br>6. Saya sentiasa menjalankan kajian terhadap pasaran dan memperbaiki mutu perkhidmatan perniagaan saya. | Siti Fariha Muhamad (2017) |

**Jadual 2: Prestasi Perniagaan (Pemboleh Ubah Bersandar)**

| Pemboleh Ubah Bersandar | Item | Penulis |
|---|---|---|
| Prestasi Perniagaan | 1. Perniagaan saya lebih maju daripada yang lepas.<br>2. Untung bersih perniagaan saya meningkat.<br>3. Pelanggan saya semakin bertambah<br>4. Pelangaan berpuas hati dengan produk jualan saya.<br>5. Wang tunai saya semakin bertambah. | Norashidah Hashim (2020) |

## Dapatan Kajian

Dalam skop statistik inferens, analisis korelasi diaplikasikan bagi mengenal pasti bentuk interaksi antara pemboleh ubah bebas dan pemboleh ubah bersandar. Melalui kaedah ini, pemboleh ubah bebas bertindak sebagai faktor yang mempengaruhi, manakala pemboleh ubah bersandar merupakan kesan atau hasil yang boleh diukur secara saintifik. Bagi menilai kekuatan hubungan antara kedua-dua pemboleh ubah tersebut, ujian korelasi *Pearson* telah dijalankan. Kekuatan hubungan ini ditentukan melalui nilai pekali korelasi (r) yang berada dalam julat antara (-1.00 hingga +1.00). Secara teknikal, nilai r yang negatif mencerminkan hubungan songsang antara pemboleh ubah, manakala nilai r yang positif menandakan wujudnya hubungan sehala. Sebagai panduan interpretasi, tahap kekuatan nilai pekali korelasi dalam kajian ini dirujuk berdasarkan kriteria yang telah dicadangkan oleh Cohen dan Holliday (1982).

**Jadual 3: Nilai Pekali Korelasi**

| Nilai Indeks Korelasi (r) | Petunjuk |
|---|---|
| 0.90 – 1.00 | Sangat Kuat |
| 0.70 – 0.89 | Kuat |
| 0.40 – 0.69 | Sederhana |
| 0.20 – 0.39 | Lemah |
| Kurang dari 0.19 | Sangat Lemah |
| 0.00 | Tiada Korelasi |

**Sumber : Cohen & Holliday (1982)**

Hasil analisis korelasi antara pengedaran produk dan prestasi perniagaan adalah sebagaimana dinyatakan dalam jadual 4 dan 5 di bawah.

**Jadual 4: Pekali Korelasi Pearson Hubungan Antara Pengedaran Produk Terhadap Prestasi Perniagaan**

| *Variables* | Pengedaran produk | Prestasi perniagaan |
|---|---|---|
| Pengedaran produk | 1 | .485 |
| Prestasi perniagaan | .485 | 1 |

**Jadual 5: Nilai-P (Pearson) Bagi Hubungan Antara Pengedaran Produk Terhadap Prestasi Perniagaan**

| | **Pengedaran produk** | **Prestasi perniagaan** |
|---|---|---|
| Pengedaran produk | 0 | < .000 |
| Prestasi perniagaan | < .000 | 0 |

Dapatan kajian menunujukkan wujudnya korelasi positif pada tahap sederhana yang signifikan antara aspek pengedaran produk dengan prestasi perniagaan dalam kalangan usahawan wanita Muslim di Kelantan ($r = 0.485$, $p < 0.01$). Hal ini menunjukkan bahawa kecekapan usahawan dalam menguruskan pengedaran merupakan faktor penting yang mempengaruhi kemajuan, inovasi, serta prestasi keseluruhan perniagaan mereka. Walaupun usahawan dikesan mempunyai jaringan hubungan yang kukuh dengan pelbagai pihak, kajian mendapati hubungan bagi tindakan proaktif dalam memenuhi keperluan pelanggan di Bazar Tok Guru adalah sangat negatif. Sentimen negatif ini berpunca daripada kecenderungan majoriti responden yang lebih mengutamakan penerapan nilai-nilai murni dan etika perniagaan Islam berbanding strategi keuntungan semata-mata. Selain itu, platform digital seperti *Instagram*, *Facebook*, dan *TikTok* kini menjadi saluran utama pengiklanan, manakala aplikasi e-dagang seperti *Shopee* digunakan secara meluas sebagai platform pemasaran produk dalam talian.

## Cadangan Kajian Masa Hadapan

Kajian ini mencadangkan agar penyelidik akan datang menggunakan kaedah kualitatif, seperti temubual mendalam, bagi memahami punca sebenar "sentimen negatif" responden terhadap tindakan proaktif dalam memenuhi keperluan pelanggan. Melalui pendekatan ini, faktor-faktor seperti pegangan agama, budaya setempat, dan psikologi usahawan wanita Muslim dapat diterokai dengan lebih terperinci berbanding data angka semata-mata. Selain itu, kajian lanjutan dicadangkan untuk memperluas skop kajian ke negeri-negeri lain bagi membandingkan kesan lokasi terhadap etika pengedaran dan prestasi perniagaan. Hasil kajian yang lebih menyeluruh ini sangat penting untuk membantu merangka modul latihan keusahawanan yang lebih berkesan dan berteraskan nilai integriti Islam

## Kesimpulan

Secara keseluruhannya, amalan etika dalam perniagaan Islam yang berpandukan Al-Quran dan Al-Sunnah merupakan kunci utama kepada kelestarian perniagaan, di mana prinsip kejujuran, keadilan, dan tanggungjawab sosial menjadi teras operasi yang mendatangkan manfaat kepada pemilik serta masyarakat umum. Walau bagaimanapun, usahawan masa kini tetap berdepan cabaran besar dalam mendepani dunia perniagaan moden, terutamanya untuk menjauhi amalan tidak beretika seperti rasuah dan penipuan yang boleh merosakkan ekosistem perniagaan. Kajian menunjukkan masih terdapat segelintir usahawan wanita Muslim yang belum mengamalkan prinsip Islam sepenuhnya dalam pengurusan demi mengejar keuntungan jangka pendek. Oleh itu, pendedahan yang lebih mendalam mengenai etika perniagaan Islam amat diperlukan bagi membantu mereka mengimbangi kejayaan material dengan tuntutan moral. Kejayaan hakiki sesebuah perniagaan bergantung kepada gabungan pengurusan yang bijak serta integriti yang tinggi bagi mencapai keberkatan dan kejayaan yang diredhai Allah.

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# HALA TUJU PEMBANGUNAN NUKLEAR IRAN PASCA PERANG ISRAEL 13-24 JUNE 2025: ANALISA PEMBANGUNAN NUKLEAR SECARA STRATEGI PEMEROLEHAN SENJATA NUKLEAR SIAP GUNA

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***Abstrak:*** *Konflik bersenjata antara Iran dan Israel pada Jun 2025, khususnya serangan ketenteraan Amerika Syarikat dan Israel terhadap kemudahan nuklear utama Iran, telah mencetuskan perubahan signifikan dalam landskap keselamatan serantau dan perbahasan global mengenai proliferasi nuklear. Artikel ini menganalisis hala tuju pembangunan nuklear Iran pasca konflik tersebut dengan memberi tumpuan kepada strategi pemerolehan senjata nuklear siap guna sebagai tindak balas terhadap tekanan ketenteraan dan diplomatik yang semakin meningkat. Menggunakan pendekatan kualitatif berasaskan analisis dokumen, laporan agensi antarabangsa dan liputan media global, kajian ini menilai keberkesanan serangan pencegahan (preventive strikes) dalam mengekang keupayaan nuklear Iran serta implikasi strategik terhadap pilihan keselamatan Tehran. Dapatan kajian menunjukkan bahawa walaupun serangan ketenteraan telah menyebabkan kerosakan ketara terhadap infrastruktur nuklear Iran, keupayaan teknikal dan niat strategiknya tidak dapat dihapuskan sepenuhnya. Sebaliknya, tekanan keselamatan pasca serangan berpotensi mendorong Iran menilai alternatif strategik di luar pembangunan domestik, termasuk kemungkinan pemerolehan keupayaan nuklear dari luar sempadan negara sebagai bentuk externalized deterrence. Artikel ini seterusnya menggunakan Cuban Missile Crisis 1962 sebagai model perbandingan sejarah bagi menjelaskan logik pemilikan senjata nuklear melalui pihak ketiga dalam persekitaran geopolitik yang berintensiti tinggi. Secara teoritikal, kajian ini menyumbang kepada literatur deterrence dan proliferasi nuklear dengan mencabar andaian bahawa penggunaan kekuatan ketenteraan dapat mencegah proliferasi secara berkesan. Sebaliknya, ia berhujah bahawa pendekatan sedemikian berisiko mempercepatkan adaptasi strategik negara sasaran dan melemahkan rejim non-proliferasi antarabangsa sedia ada. Artikel ini menegaskan keperluan pendekatan keselamatan yang lebih menyeluruh, berasaskan diplomasi, jaminan keselamatan dan pengurusan konflik jangka panjang.*

***Kata Kunci :*** *Iran, Nuclear Program, Deterrence, Nuclear Proliferation, Cuban Missile Crisis, Strategi Pemerolehan Senjata*

## 1.0 Pengenalan

Perang berskala besar yang tercetus antara Iran dan Israel dari 13 hingga 24 Jun 2025, yang melibatkan serangan udara Israel dan Amerika Syarikat terhadap beberapa fasiliti nuklear utama Iran, menandakan satu titik perubahan penting dalam trajektori pembangunan nuklear Tehran. Serangan ini dilaksanakan atas justifikasi untuk menghalang Iran daripada mencapai keupayaan senjata nuklear, khususnya selepas laporan bahawa Iran telah meningkatkan tahap

pengayaan uranium sehingga hampir 60 peratus, satu tahap yang dianggap hampir dengan keupayaan senjata nuklear sekiranya diperkaya lebih lanjut (International Atomic Energy Agency [IAEA], 2025; Reuters, 2025a). Walaupun kemudahan seperti Natanz dan Fordow mengalami kerosakan ketara, penilaian pasca konflik oleh pemerhati antarabangsa menunjukkan bahawa kesan serangan tersebut lebih bersifat sementara, dan tidak sepenuhnya memusnahkan kapasiti teknikal nuklear Iran (The Guardian, 2025).

Pasca gencatan senjata pada 24 Jun 2025, Iran berhadapan dengan dilema strategik yang kompleks antara mempertahankan kedaulatan dan keupayaan teknologi nuklearnya dengan tekanan antarabangsa yang semakin meningkat untuk ketelusan dan pematuhan rejim bukan proliferasi. Sebagai tindak balas terhadap serangan dan apa yang dianggap sebagai pencabulan kedaulatan, Iran menggantung sebahagian kerjasama dengan IAEA dan menegaskan haknya di bawah Perjanjian Non-Proliferation Treaty (NPT) untuk meneruskan pembangunan nuklear bagi tujuan damai (TRT Global, 2025). Pada masa yang sama, rundingan diplomatik dengan Amerika Syarikat dan kuasa-kuasa Barat kekal tegang, dengan sekatan ekonomi dan tekanan di peringkat Pertubuhan Bangsa-Bangsa Bersatu terus membentuk persekitaran strategik Iran pasca perang (Reuters, 2025b). Dinamika ini menunjukkan bahawa konflik ketenteraan bukan sahaja gagal menyelesaikan isu nuklear Iran secara menyeluruh, malah berpotensi mempercepatkan penilaian semula strategi keselamatan negara tersebut.

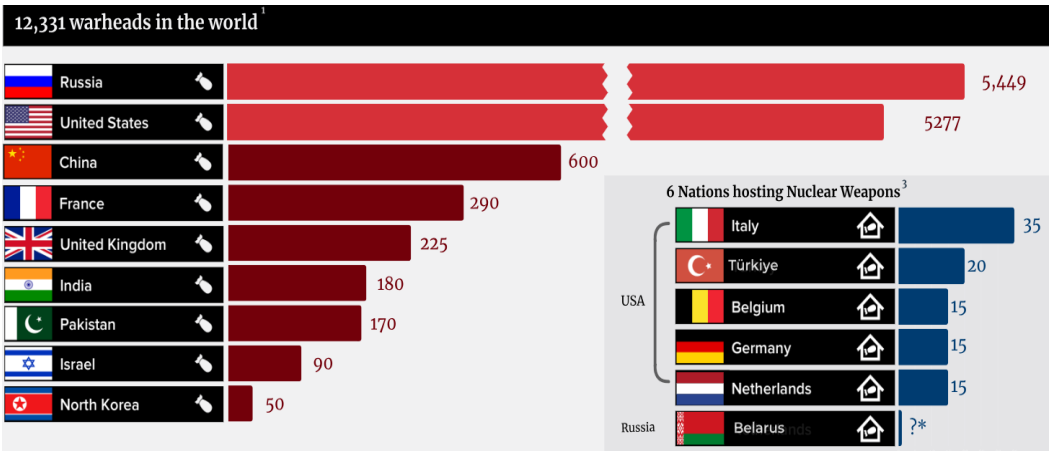
Sehubungan itu, kertas pembentangan ini bertujuan menganalisis hala tuju pembangunan nuklear Iran pasca perang, khususnya dari sudut strategi pemerolehan senjata nuklear siap guna sama ada melalui pembangunan domestik atau alternatif strategik lain. Dalam konteks ini, perbincangan akan diperluaskan kepada teori pemilikan senjata dari luar sempadan sesebuah negara, dengan merujuk model sejarah seperti *Cuban Missile Crisis* 1962, di mana Kesatuan Soviet menempatkan senjata nuklear di Cuba sebagai instrumen deterrence terhadap Amerika Syarikat (Allison & Zelikow, 1999). Pendekatan teori ini, yang turut dibahaskan dalam literatur proliferasi nuklear klasik (Sagan & Waltz, 2013; Waltz, 1981), menyediakan kerangka analisis penting untuk memahami kemungkinan Iran menilai pilihan strategik di luar pembangunan dalaman sebagai respons terhadap ancaman keselamatan dan tekanan geopolitik pasca konflik.

## 2.0 Teori 'Mendapatkan Nuklear Dari Negara Luar' Seperti Model Cuban Missile Crisis 1962

'Teori pemilikan senjata dari luar sempadan sesebuah negara' adalah penyediaan senjata nuklear daripada negara kuasa nuklear kepada sesebuah negara pernah berlaku seperti tawaran dan cadangan penempatan senjata nuklear Great Britain kepada Malaya pada 1956 bagi menghadapi ancaman komunis (Jones, 2023). Malah idea dan proses pemilikan senjata nuklear dari luar sempadan ini boleh dilihat dalam Krisis Peluru Berpandu Cuba yang berlaku pada Oktober 1962 apabila AS menemui pangkalan peluru berpandu nuklear Soviet di Cuba, yang membawa kepada konfrontasi antara AS dan Kesatuan Soviet (USSR) yang hampir mencetuskan perang nuklear (Hersberg, 2004). Krisis itu adalah puncak persaingan Perang Dingin antara AS dan USSR. Selepas revolusi komunis oleh Fidel Castro pada tahun 1959, AS berhenti berdagang dengan Cuba, dan USSR menjadi penyokong utama Cuba, termasuk menjanjikan untuk mempertahankan Cuba daripada AS. Pemilikan sejata nuklear "ready made" dari luar sempadan ini dapat dilihat dengan tindakan Khrushchev menghantar peluru berpandu

balistik dan juruteknik ke Cuba dengan meletakkan peluru berpandu nuklear yang berpotensi mengancam bandar-bandar utama AS pada Mei 1962 (Benjamin-Alvarado & Belkin, 1994).

Teori 'pemilikan senjata dari luar sempadan sesebuah negara' ini dapat dilihat apabila terdapat sekurang-kurang 6 buah negara iaitu Itali, Netherlands, Turkiye, Belgium, Jerman dan Belarus yang memiliki senjata nuklear dari luar dan tidak dibangunkan dari dalam negara. Ini bermaksud senjata nuklear "ready made" disediakan atau diperolehi dari sumber luar sempadan negara. Malah ini belum membabitkan Cuba, South Africa dan negara Timur Tengah yang berpotensi menjadi ingin memiliki senjata nuklear. Menurut laporan The International Campaign to Abolish Nuklear Weapons (ICAN, 2023) menyatakan Beberapa negara seperti Belgium, Jerman, Itali, Belanda dan Türkiye menjadi tuan rumah bagi senjata nuklear Amerika Syarikat, di mana AS mengekalkan kawalan operasi tetapi penempatan ini menyokong perancangan strategik mereka. Pada 2023, Belarus turut mengumumkan menjadi tuan rumah senjata nuklear taktikal Rusia. Selain itu, 28 negara lagi menyokong penggunaan senjata nuklear melalui pakatan pertahanan seperti NATO dan CSTO, menjadikan jumlah keseluruhan 34 negara yang secara langsung atau tidak langsung terlibat dalam kepemilikan atau penggunaan senjata nuklear.




Source: ICAN, 2023

Senario ini menunjukan Iran juga boleh memiliki senjata nuklear "ready made" seperti mana negara di atas tanpa membangunkan program nuklear sendiri. Malah beberapa negara Timur Tengah seperti Arab Saudi turut pernah menyatakan hasrat untuk membangunkan nuklear. Malah dengan adanya negara nuklear seperti Russia, China, Pakistan, Korea Utara, India dan bekas negara komunis Soviet ia boleh menjadi saluran kepada Iran untuk mendapatkan senjata dan kemudahan nuklear sama ada secara langsung atau rahsia. Malah dengan kemampuan Iran yang telah memiliki teknologi peluru berpandu yang terbukti berkesan dalam beberapa siri serangan ke atas Israel, ia menjadikan Iran hanya memerlukan nuklear warhead sahaja dan leih memudahakan kepada Iran membina senjata nuklear. Teori ini dapat dilihat dalam kes penyediaan senjata nuklear oleh Soviet Union kepada Cuba dalam Cuban Missile Crisis (Cederlöf, 2020).

Selaras dengan agenda keselamatan merupakan aspek yang tidak dapat diabaikan oleh sesebuah negara (Sulaiman & Keling, 2022). Ancaman keselamatan dari luar terhadap sesebuah negara boleh hadir daripada negara jiran terdekat, serantau dan antarabangsa (Keling

et.al, 2011). Dalam konteks ini, Iran turut menghadapi ancaman dari dalam rantau Timur Tengah dan antarabangsa khususnya Israel dan AS. Kaedah kedua Iran untuk mendapatkan nuklear adalah melalui pembelian produk yang telah siap (*ready made*). Pembelian ini tidak memerlukan jumlah yang besar, hanya sekadar bagi mewujudkan deterrence kepada musuh agar tidak melakukan kekerasan ke atas Iran (Davenport, 2024). Pembelian ini akan membolehkan ia menjadi kekuatan dan jaminan keselamatan, disamping dapat menyambung program pembangunan nuklear yang telah terjejas. Adakah kaedah ini boleh dilaksanakan? Kaedah ini pernah dilakukan dalam kes krisis peluru berpandu Cuba yang menunjukan kesediaan sesebuah negara berkuasa nuklear menghantar nuklear kepada negara lain seperti mana yang berlaku Soviet Union (SU) menghantar peluru berpandu nuklear ke Cuba pada tahun 1962.

## 3.0 Iran Mendapatkan Nuklear 'Siap-Sedia' Melalui Model Cuban Missile Crisis 1962

Krisis ini merupakan satu krisis melibatkan pertentangan antara AS dan SU yang dianggap sebagai peristiwa yang hampir membawa kepada "Perang Dunia ke-III" atau "perang nuklear" (Baylis & Smith, 2009). Secara ringkasnya, sejarah penglibatan AS di Cuba adalah sebelum 1945 lagi dan ia merupakan pembabitan AS dalam membentuk dan memberi sokongan kepada kerajaan Cuba (Yacob, 2005). Fidel Castro telah dilantik sebagai Perdana Menteri Cuba pada 1 Januari 1959 dan telah melaksanakan dasar memiliknegarakan aktiviti ekonomi termasuk syarikat yang dimiliki oleh AS di Cuba. AS telah mengambil pendekatan untuk memutuskan hubungan diplomatik dengan Cuba dan dalam masa yang sama Cuba telah menjalinkan hubungan yang baik dengan pihak SU. Pada 7 Februari 1962, AS telah menggesa dunia untuk mengenakan sekatan ekonomi dan perdagangan dengan Cuba. Hubungan baik Cuba dan SU telah membawa kepada perancangan penempatan peluru berpandu nuklear bagi menjamin keselamatan dan pertahanan Cuba. Peristiwa ini bermula apabila Julai 1962, John McCone, Pengarah CIA diberitahu oleh Perancis bahawa terdapat 60 buah kapal SU sedang membuat perjalanan ke Cuba. Beliau kemudiannya memberi amaran kepada Presiden Kennedy bahawa sesetengah daripada kapal itu membawa bahan ketenteraan.

Pada 14 Oktober 1962, AS telah mendapat maklumat hasil daripada pengintipan pesawat U-2 yang telah berjaya mendapatkan beberapa gambar yang membuktikan penempatan peluru berpandu SS-4 (MRBM) di Cuba. Namun pada 16 Oktober, gambar-gambar yang diambil menerusi satelit yang membuktikan wujudnya proses pembinaan pengkalan peluru berpandu di Cuba. Keputusan melalui kesepakatan dibuat melalui Majlis Keselamatan Negara seminggu selepas bukti (gambar satelit) diperolehi pada 14 Oktober 1962. Kennedy mengumumkan satu kepungan tentera laut akan dilakukan untuk mencegah ketibaan peluru-peluru berpandu itu ke Cuba pada 24 Oktober 1962. Presiden Kennedy mendesak SU membuka dan membuang senjata-senjata dan Cuba diistiharkan sebagai zon kuarantin. Tentera AS memintas kapal SU dan memeriksanya sama ada membawa bekalan senjata atau tidak. Untuk beberapa hari yang tegang bagi kapal Soviet mengelakkan zon kuarantin di Cuba, akhirnya Khrushchev dan Kennedy berkomunikasi melalui rundingan diplomatik. 27 Oktober 1962, Khrushchev menyatakan beliau menerima rancangan tolak ansur yang menuntut agar SU menarik balik peluru berpandu yang dianggap '*offensive*' itu, dan sebagai balasannya, Amerika berjanji tidak akan menyerang-langgar Cuba. Berdasarkan model krisis peluru berpandu Cuba ini, ia membuktikan bahawa sesebuah negara berkuasa nuklear iaitu SU bersedia menghantar dan menempatkan peluru berpandu nuklear ke negara lain. Ini bermaksud Cuba tidak perlu

membangunkan program nuklearnya sebaliknya mendapatkan produk yang telah siap (ready made). Situasi ini dapat dilakukan oleh Iran memandangkan telah ada perbincangan antara Iran-Rusia secara mendalam selepas serangan AS dan Israel mengenai program nuklearnya. Malah ia mampu dilaksanakan berikutan negara kuasa nuklear Rusia, China, Pakistan dan Korea Utara adalah negara sekutu Iran yang sentiasa menyokong Iran.

## 4.0 Keberkesanan Serangan Terhadap Infrastruktur Nuklear Bawah Tanah Iran

Serangan ketenteraan oleh Amerika Syarikat dan Israel ke atas kemudahan nuklear Iran pada 22 Jun 2025 merupakan antara operasi ketenteraan paling signifikan dalam usaha membendung proliferasi nuklear Iran secara paksaan. Operasi ini melibatkan penggunaan bom bunker-buster GBU-57 Massive Ordnance Penetrator (MOP) seberat kira-kira 13,000 kilogram, yang direka khusus untuk memusnahkan sasaran bawah tanah yang diperkukuh, dan digugurkan oleh pesawat pengebom strategik B-2 Spirit ke atas fasiliti bawah tanah Fordo. Pada masa yang sama, puluhan peluru berpandu jelajah dilancarkan dari kapal selam dan platform laut, menyasarkan tapak nuklear utama lain termasuk Natanz dan Isfahan (Reuters, 2025a; The Guardian, 2025). Serangan ini bukan sahaja bertujuan melumpuhkan infrastruktur fizikal nuklear Iran, tetapi juga berfungsi sebagai mesej strategik pencegahan (deterrence signalling) kepada Tehran dan aktor serantau lain mengenai kesanggupan Barat menggunakan kuasa ketenteraan bagi mengekang ancaman nuklear.

Sebagai tindak balas, Iran melancarkan serangan balas ke-20 terhadap Israel dengan menggunakan peluru berpandu balistik Kheibar Shekan (Khyber), yang digabungkan dengan penggunaan dron pintar dan taktik operasi berlapis bagi meningkatkan ketepatan serta keberkesanan serangan (TRT Global, 2025). Respons ini mencerminkan usaha Iran untuk mengekalkan kredibiliti deterrence konvensionalnya walaupun berada di bawah tekanan ketenteraan langsung. Walaupun pihak Amerika Syarikat dan Israel mengumumkan kejayaan operasi dan mendakwa bahawa program nuklear Iran telah dimusnahkan atau sekurang-kurangnya dilumpuhkan secara menyeluruh, dakwaan tersebut telah dinafikan oleh Tehran. Malah, penilaian awal oleh beberapa pemerhati antarabangsa menunjukkan bahawa kerosakan yang dialami mungkin bersifat separa dan sementara, dan tidak semestinya menamatkan keupayaan nuklear Iran secara total (International Atomic Energy Agency [IAEA], 2025; Reuters, 2025b).

Berdasarkan laporan agensi antarabangsa dan analisis media global, wujud percanggahan maklumat, kesangsian dan perdebatan mengenai tahap sebenar kejayaan serangan tersebut, sekali gus menimbulkan persoalan terhadap naratif rasmi Washington dan Tel Aviv. Dalam konteks ini, terdapat dua kemungkinan hala tuju strategik bagi Iran. Pertama, Iran berupaya meneruskan program nuklear sedia ada, memandangkan kemudahan kritikal, kepakaran teknikal dan stok bahan nuklear dipercayai tidak musnah sepenuhnya. Kedua, Iran berpotensi menilai strategi alternatif iaitu pemerolehan senjata nuklear siap guna dari luar sempadan negara sebagai bentuk deterrence segera, melalui kerjasama atau perlindungan strategik dengan kuasa nuklear seperti Rusia, China, Pakistan atau Korea Utara. Pendekatan ini bukanlah sesuatu yang baharu dalam sejarah hubungan antarabangsa, malah pernah diaplikasikan oleh Kesatuan Soviet melalui penempatan peluru berpandu nuklear di Cuba semasa *Cuban Missile Crisis* 1962, sebagai usaha mengimbangi ancaman keselamatan terhadap Amerika Syarikat (Allison & Zelikow, 1999; Sagan & Waltz, 2013). Oleh itu, perkembangan pasca serangan ini membuka

ruang analisis penting mengenai perubahan strategi nuklear Iran daripada pembangunan domestik kepada pendekatan pemerolehan lintas sempadan dalam persekitaran geopolitik yang semakin tidak stabil.

Dari sudut penilaian teori hubungan antarabangsa, perkembangan ini mencabar andaian utama pendekatan counter-proliferation melalui kekuatan ketenteraan, yang beranggapan bahawa pemusnahan fizikal infrastruktur nuklear mampu menghapuskan niat dan keupayaan sesebuah negara untuk memiliki senjata nuklear. Sebaliknya, seperti yang dihujahkan dalam teori deterrence realis, ancaman ketenteraan yang tinggi sering kali mendorong negara sasaran untuk mencari bentuk keselamatan alternatif yang lebih pantas dan berkesan, termasuk melalui pemerolehan senjata strategik dari luar sempadan negara (Waltz, 1981; Sagan & Waltz, 2013).

Dalam konteks ini, strategi pemilikan senjata nuklear melalui pihak ketiga boleh ditafsirkan sebagai bentuk externalized deterrence, di mana keupayaan nuklear tidak semestinya dimiliki atau dibangunkan secara domestik, tetapi tetap berfungsi sebagai alat pencegahan yang kredibel terhadap musuh. Pendekatan ini selari dengan analisis *Cuban Missile Crisis* 1962, yang menunjukkan bagaimana penempatan senjata nuklear oleh kuasa luar mampu mengubah keseimbangan strategik serantau secara drastik tanpa memerlukan pembangunan nuklear dalaman oleh negara penerima (Allison & Zelikow, 1999). Oleh itu, tingkah laku Iran pasca serangan boleh difahami bukan sebagai kegagalan rasionaliti strategik, tetapi sebagai penyesuaian logik terhadap tekanan keselamatan yang semakin memuncak dalam sistem antarabangsa yang bersifat anarki.

## 5.0 Kesimpulan

Artikel ini menilai hala tuju pembangunan nuklear Iran pasca konflik bersenjata Israel–Iran pada Jun 2025 dengan memberi tumpuan kepada implikasi strategik serangan ketenteraan terhadap pilihan keselamatan dan deterrence Tehran. Analisis menunjukkan bahawa walaupun serangan Amerika Syarikat dan Israel ke atas kemudahan nuklear utama Iran telah menyebabkan kerosakan ketara terhadap infrastruktur fizikal, ia tidak semestinya menamatkan keupayaan atau niat strategik Iran untuk mengekalkan pilihan nuklear sebagai alat pencegahan. Sebaliknya, serangan tersebut memperlihatkan keterbatasan pendekatan counter-proliferation melalui kekuatan ketenteraan, khususnya apabila berhadapan dengan kemudahan nuklear bawah tanah yang diperkukuh serta kepakaran teknikal yang telah lama berakar.

Dapatan kajian ini turut menunjukkan bahawa tindak balas Iran bukan sahaja bersifat ketenteraan konvensional melalui peluru berpandu dan dron, tetapi juga mencerminkan penyesuaian strategik yang lebih luas dalam persekitaran keselamatan yang semakin terancam. Dalam konteks ketidakpastian maklumat pasca serangan dan percanggahan naratif antara pihak yang terlibat, Iran berdepan dua pilihan strategik utama: sama ada meneruskan pemulihan dan pembangunan program nuklear domestik yang sedia ada, atau menilai pendekatan alternatif melalui pemerolehan keupayaan nuklear siap guna dari luar sempadan negara sebagai bentuk deterrence segera. Pilihan kedua ini, walaupun berisiko tinggi dari sudut diplomatik dan rejim bukan proliferasi, muncul sebagai respons rasional terhadap tekanan keselamatan yang berterusan.

Dari sudut teori hubungan antarabangsa, artikel ini menyumbang kepada perbahasan tentang deterrence dan proliferasi nuklear dengan menonjolkan konsep *externalized deterrence* sebagai mekanisme penyesuaian strategik negara yang berada di bawah ancaman langsung. Perbandingan dengan *Cuban Missile Crisis* 1962 menunjukkan bahawa pemilikan senjata nuklear tidak semestinya memerlukan pembangunan domestik, tetapi boleh dicapai melalui penempatan atau perlindungan kuasa luar bagi mengubah keseimbangan strategik serantau. Implikasi daripada dapatan ini mencabar keberkesanan rejim non-proliferasi sedia ada, khususnya dalam situasi konflik bersenjata, dan menimbulkan persoalan sama ada tekanan ketenteraan sebenarnya menghalang atau mempercepatkan logik proliferasi. Secara keseluruhan, kajian ini menegaskan bahawa penyelesaian jangka panjang terhadap isu nuklear Iran tidak boleh bergantung kepada pendekatan ketenteraan semata-mata, sebaliknya memerlukan gabungan strategi diplomasi, jaminan keselamatan dan reformasi struktur dalam tadbir urus keselamatan antarabangsa.

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# PENERAPAN NILAI ISLAM DALAM SAINS TEKNOLOGI DAN KEJURUTERAAN: PERSPEKTIF PELAJAR PSMZA

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***Abstrak:*** *Kajian ini meneliti penerapan nilai Islam dalam bidang Sains, Teknologi dan Kejuruteraan dari perspektif pelajar Politeknik Sultan Mizan Zainal Abidin (PSMZA). Fokus utama adalah mengenal pasti tahap penerapan nilai Islam dalam pembelajaran teknikal, menilai amalan penerapan nilai Islam dalam tugasan dan projek, serta menganalisis hubungan antara kedua-dua aspek tersebut berdasarkan demografi pelajar. Dapatan kajian ini menunjukkan bahawa tahap penerapan dan amalan nilai Islam berada pada aras tinggi secara konsisten, dengan nilai amanah, integriti, disiplin, ihsan dan adab menjadi teras utama dalam pembelajaran teknikal. Analisis Mann-Whitney turut menunjukkan terdapat perbezaan signifikan berdasarkan jantina, yang mana pelajar lelaki mencatat skor yang lebih tinggi dalam penerapan nilai Islam berbanding dengan pelajar perempuan. Korelasi Spearman pula membuktikan adanya hubungan positif yang signifikan antara penerapan dan amalan nilai Islam, menegaskan bahawa kefahaman nilai Islam mendorong pelaksanaan tugasan teknikal secara beretika dan profesional. Kajian ini menyumbang kepada pemahaman tentang bagaimana nilai Islam boleh dibudayakan dalam pendidikan teknikal moden, sekaligus memperkukuh etika profesional pelajar TVET selaras dengan tuntutan industri dan pembangunan insan berteraskan nilai.*

***Kata Kunci:*** *Nilai Islam, Sains, Teknologi, Kejuruteraan*

## Pengenalan

Penerapan nilai Islam dalam ruang lingkup Sains Teknologi dan Kejuruteraan semakin diberi perhatian dalam ekosistem pendidikan teknikal negara, terutama apabila kemajuan teknologi berkembang begitu cepat dan membawa kesan besar kepada masyarakat. Dalam konteks institusi TVET seperti politeknik, kepentingan menyeimbangkan ilmu teknikal dengan nilai Islam menjadi lebih mendesak kerana pelajar bukan sahaja belajar mengendalikan teknologi, tetapi juga berpotensi menjadi pembina, penyelesai masalah dan *inovator* pada masa hadapan. Nilai seperti amanah, integriti, ihsan, disiplin dan tanggungjawab sosial merupakan teras ajaran Islam yang sangat relevan dengan keperluan profesion teknikal hari ini.

Walaupun bidang teknikal sering dipersepsikan sebagai bersifat neutral dan berorientasikan kemahiran, banyak kajian menunjukkan bahawa teknologi tidak pernah terpisah daripada nilai. Penghasilan, penggunaan dan keputusan teknikal sentiasa melibatkan pertimbangan moral dan etika. Dalam konteks pendidikan tinggi, integrasi nilai Islam bukan sekadar menambah elemen keagamaan, tetapi membentuk kerangka pemikiran yang lebih beretika dan seimbang dalam menangani isu keselamatan, pengurusan data, inovasi, penggunaan sumber dan kesejahteraan

manusia. Ini bermaksud penerapan nilai Islam perlu berlaku serentak melalui pengajaran, tugasan, kerja praktikal dan interaksi bilik kuliah.

Walau bagaimanapun, tinjauan terhadap kajian-kajian terdahulu menunjukkan bahawa banyak penyelidikan lebih menumpukan kepada aspek nilai Islam secara umum dalam pendidikan atau menilai tahap kefahaman agama dalam kalangan pelajar. Kajian secara khusus melihat bagaimana nilai Islam diaplikasikan dalam konteks bidang teknikal seperti Sains Teknologi dan Kejuruteraan masih agak terhad, terutama di peringkat politeknik. Kebanyakan kajian juga memberi tumpuan kepada amalan moral pelajar secara umum, tetapi kurang melihat bagaimana nilai Islam diterapkan dalam tugasan teknikal sebenar seperti projek reka bentuk, kerja makmal atau penyelesaian masalah berasaskan teknologi. Ruang kosong inilah yang menunjukkan adanya keperluan penyelidikan lebih mendalam dalam konteks TVET Malaysia.

Dalam masa yang sama, penyelidikan mengenai penerapan nilai Islam dalam pendidikan teknikal sering menggunakan pendekatan kualitatif atau berbentuk naratif. Masih kurang kajian yang mengukur tahap penerapan secara kuantitatif dan menganalisis hubungan antara pembelajaran teknikal dengan nilai-nilai Islam melalui kaedah statistik yang lebih mantap seperti analisis perbezaan antara program atau hubungan antara tahap kefahaman dan amalan nilai Islam. Pendekatan kuantitatif ini penting untuk memberi gambaran lebih jelas tentang sejauh mana nilai Islam benar-benar diamalkan dalam konteks pembelajaran teknikal, bukan sekadar dinyatakan secara konseptual.

Kesimpulannya, kajian ini dijalankan untuk menangani jurang yang dikenal pasti dengan meneliti perspektif pelajar Politeknik Sultan Mizan Zainal Abidin (PSMZA) terhadap penerapan nilai Islam dalam bidang Sains Teknologi dan Kejuruteraan secara lebih sistematik dan berasaskan data empirikal. Penemuan kajian ini diharap dapat memberi pemahaman yang lebih jelas tentang bagaimana nilai Islam boleh dibudayakan dalam pendidikan teknikal moden serta membantu pensyarah merangka strategi pengajaran yang lebih seimbang. Kajian ini juga berpotensi menjadi asas kepada usaha memperkukuh etika profesional pelajar TVET selaras dengan keperluan industri dan tuntutan pembangunan insan yang berteraskan nilai.

## Objektif Kajian

1- Mengenal pasti tahap penerapan nilai Islam dalam pembelajaran Sains Teknologi dan Kejuruteraan dalam kalangan pelajar PSMZA.
2- Menilai tahap amalan penerapan nilai Islam dalam tugasan dan projek oleh pelajar PSMZA.
3- Menentukan hubungan antara tahap penerapan nilai Islam dalam pembelajaran dengan amalan penerapan nilai Islam dalam tugasan dan projek.
4- Menganalisis perbezaan tahap penerapan nilai Islam dalam pembelajaran Sains Teknologi dan Kejuruteraan dan tahap amalan penerapan nilai Islam dalam tugasan dan projek berdasarkan demografi pelajar.

## Tinjauan Literatur

Syed Sahuri (2025) melaporkan bahawa faktor-faktor yang mendorong minat dan usaha saintis Muslim dalam mengembangkan ilmu *Science, Technology, Engineering and Mathematics* (STEM) dapat dikenalpasti melalui analisis sistematik terhadap enam artikel penyelidikan yang diterbitkan antara 2014 hingga 2024 menggunakan model PRISMA. Dapatan kajian menunjukkan bahawa saintis Muslim datang daripada pelbagai negara dan mempunyai latar belakang pendidikan yang pelbagai. Dari segi motivasi, Faktor dalaman dan luaran memainkan peranan penting, termasuk rasa ingin tahu dan minat yang tinggi, kemampuan berfikir secara kritikal dalam penyelesaian masalah, pengiktirafan akademik, kefahaman agama Islam serta proses pembangunan diri berterusan. Kesemua faktor ini secara kolektif mendorong mereka menguasai pelbagai bidang STEM dan memberi sumbangan signifikan dalam disiplin masing-masing, menekankan bahawa perkembangan diri dan nilai Islam saling mempengaruhi pencapaian saintifik dalam konteks STEM.

Anggara dan Lestari (2025) menekankan bahawa integrasi nilai Islam dalam pendidikan STEM bukan sahaja memperkayakan kandungan kurikulum, tetapi juga membentuk model pembelajaran yang menyeluruh dan adaptif. Model ini mampu membangunkan pelajar yang cerdas dari segi akademik serta teguh daripada segi moral dan spiritual. Pendekatan tersebut menjadikan pendidikan Islam relevan dengan tuntutan abad ke-21, sambil mengekalkan asas nilai spiritual sebagai landasan utama dalam proses pembelajaran. Selain itu, integrasi nilai ini membuka ruang bagi pembangunan kaedah pengajaran yang inovatif dan inklusif. Kajian ini memberikan sumbangan konseptual yang penting sebagai asas bagi pengembangan kurikulum yang responsif dan transformatif, sejajar dengan cabaran pendidikan moden dalam konteks global.

Judijanto dan Yusniar (2025) pula mendapati bahawa integrasi nilai Islam ke dalam pengajaran STEM menyumbang secara signifikan kepada penciptaan model pembelajaran yang holistik dan adaptif. Melalui sorotan sistematik terhadap 25 manuskrip daripada pangkalan data Scopus, kajian ini mengenal pasti pendekatan berkesan seperti projek berasaskan pembelajaran, penghayatan nilai etika serta penghargaan terhadap sumbangan sarjana Muslim dalam sejarah. Dapatan menunjukkan bahawa pelajar mengalami peningkatan motivasi, kesedaran etika dan perkembangan menyeluruh dari segi akademik, emosi dan spiritual. Walau bagaimanapun, kajian ini menyoroti cabaran utama seperti keterbatasan sumber dan tahap kesiapsiagaan guru dalam mengintegrasikan nilai-nilai Islam, sekali gus menjadi rujukan strategik kepada pendidik dan pembuat dasar dalam proses pembentukan kurikulum STEM yang relevan secara budaya dan berpandukan nilai moral Islam.

Rahmiati *et al*. (2025) melaporkan bahawa pembangunan model pembelajaran Al-Qur'an-Hadis yang mengintegrasikan pendekatan Sains, Teknologi dan Masyarakat (STM) memberi impak positif yang ketara terhadap pelajar Madrasah Tsanawiyah. Model ini meningkatkan prestasi akademik pelajar sambil mendorong penglibatan aktif mereka dalam bilik darjah. Pelajar menunjukkan peningkatan kreativiti dan pemikiran kritikal yang selari dengan pemupukan kesedaran teknologi dan tanggungjawab sosial. Model yang disahkan oleh pakar bidang ini menunjukkan relevansi pedagogi yang tinggi dan menjadikan pengajaran Al-Qur'an-Hadis lebih kontekstual serta dinamik. Integrasi pendekatan STM membolehkan pelajar menghubungkan kandungan agama dengan isu dunia sebenar, seterusnya meningkatkan pengalaman pembelajaran menyeluruh dan memberi alternatif pendidikan Islam yang

menyelaraskan pengajian agama dengan dimensi saintifik serta sosial, menyokong pembangunan akademik dan sahsiah pelajar secara holistik.

Bahri dan Hamid (2024) pula mendapati bahawa penggabungan STEM dengan pengajaran Al-Qur'an secara signifikan memperkaya pengalaman pembelajaran pelajar. Pendekatan ini menyatukan pengetahuan saintifik moden dengan nilai rohani, bukan sahaja memperkukuh pemahaman akademik pelajar tetapi juga menggalakkan pembangunan sahsiah, pemikiran kritikal dan kemampuan membuat keputusan beretika. Analisis literatur yang dijalankan menekankan bahawa kurikulum bersepadu ini berpotensi melahirkan pelajar yang cekap dari sudut akademik dan peka terhadap nilai moral dan spiritual, menyediakan mereka dengan kemahiran serta nilai yang relevan untuk menghadapi cabaran dunia kontemporari yang kompleks dan saling berkait antara satu sama lain.

Kesimpulannya, kesemua kajian ini menegaskan bahawa integrasi nilai Islam dalam pendidikan STEM bukan sekadar mempertingkat pencapaian akademik, malah memantapkan pembangunan sahsiah, kreativiti, pemikiran kritikal dan tanggungjawab sosial pelajar. Pendekatan bersepadu ini menawarkan panduan berharga bagi pendidik dan pembuat dasar dalam penggubalan kurikulum yang holistik, bersesuaian dengan realiti budaya masyarakat berpandukan nilai moral, seterusnya menyediakan pelajar dengan persediaan yang menyeluruh dalam menghadapi keperluan abad ke-21.

## Metodologi Kajian

### *Reka Bentuk Kajian*

Kajian ini menggunakan reka bentuk penyelidikan kuantitatif melalui kaedah tinjauan berstruktur. Reka bentuk ini dipilih kerana ia sesuai untuk menilai tahap penerapan dan amalan nilai Islam secara sistematik dalam kalangan pelajar PSMZA. Kaedah tinjauan membolehkan pengumpulan data daripada bilangan responden yang besar secara seragam, memudahkan proses perbandingan merentas demografi serta membantu mengenal pasti pola umum dalam populasi sasaran. Pendekatan kuantitatif juga membolehkan hubungan antara pemboleh ubah ditaksir secara empirikal bagi menghasilkan dapatan yang bersifat objektif dan boleh digeneralisasikan terhadap populasi pelajar.

### *Instrumen Kajian dan Sumber*

Instrumen kajian berupa soal selidik berstruktur menggunakan skala Likert 5 mata (1 sangat tidak setuju hingga 5 sangat setuju). Semua item soal selidik ini dibangunkan sendiri oleh penyelidik berdasarkan tinjauan literatur, analisis keperluan konteks politeknik, serta konstruk yang ingin diukur. Pembangunan item merangkumi proses penentuan domain, penulisan item awal, serta semakan oleh dua orang pakar dalam bidang pengajian Islam dan penilaian pendidikan bagi menjamin ketepatan isi kandungan, kejelasan bahasa, dan kesahihan instrumen kajian. Instrumen ini terdiri daripada dua konstruk utama iaitu:

1- Konstruk Penerapan Nilai Islam Item ditulis berdasarkan konsep asas penerapan nilai seperti kefahaman, penghayatan, dan kesediaan pelajar mengaplikasikan prinsip Islam dalam kehidupan kampus.

2- Konstruk Amalan Nilai Islam Item difokuskan kepada tingkah laku yang mencerminkan amalan nilai Islam dalam konteks akademik, sosial, dan disiplin diri.

Kesemua item telah disesuaikan mengikut jargon, budaya, dan persekitaran pelajar PSMZA bagi memastikan soal selidik mudah difahami dan relevan dengan realiti pelajar politeknik.

**Sampel Kajian**

Seramai 200 responden dipilih berpandukan jadual penentuan saiz sampel yang dicadangkan oleh Krejcie dan Morgan (1970). Pemilihan saiz sampel ini bertujuan memastikan kecukupan sampel serta meningkatkan kesahan hasil dapatan.

**Kaedah Pengumpulan Data**

Soal selidik dijalankan secara dalam talian melalui Google Form, dan pautannya dikongsi melalui platform Google Drive serta aplikasi WhatsApp. Kaedah ini dipilih kerana mudah diakses, lebih pantas dan efisien untuk mengumpul data, serta membolehkan capaian merentasi semua jabatan di PSMZA. Penggunaan platform digital juga memudahkan penyelarasan dan penyimpanan data secara automatik.

**Kajian Rintis dan Kebolehpercayaan Instrumen**

Kajian rintis melibatkan 30 pelajar PSMZA. Analisis kebolehpercayaan menunjukkan nilai Cronbach Alpha seperti berikut mengikut konstruk:

1- Konstruk Penerapan Nilai Islam Alpha 0.933 menunjukkan konsistensi dalaman yang sangat tinggi.
2- Konstruk Amalan Nilai Islam Alpha 0.936 yang turut berada pada tahap sangat tinggi.

Nilai ini memenuhi syarat kebolehpercayaan yang tinggi iaitu melebihi 0.70 seperti disyorkan oleh Nunnally (1978). Justeru itu, instrumen ini dianggap stabil dari segi kebolehpercayaan dan layak digunakan dalam analisis data sebenar.

**Kaedah Analisis Data**

Data dianalisis dengan kaedah statistik termasuk deskriptif dan inferensi. Analisis deskriptif melibatkan sisihan piawai, kekerapan, pengiraan min dan peratusan bagi menentukan corak serta tahap kecenderungan pelajar.

Bagi analisis inferensi, beberapa ujian non parametrik digunakan, iaitu:

1- *Mann Whitney U Test* bagi menilai perbezaan dua kumpulan demografi.
2- *Kruskal Wallis H Test* bagi membandingkan tiga kumpulan atau lebih.
3- Korelasi *Spearman* untuk menilai kekuatan dan arah hubungan antara konstruk.

Bagi menafsirkan kekuatan hubungan yang diperoleh melalui korelasi *Spearman*, Jadual 1 digunakan sebagai rujukan. Jadual ini menunjukkan klasifikasi kekuatan korelasi menurut

Chua (2014), yang membolehkan penulis menilai kekuatan hubungan di antara konstruk sama ada sangat lemah, lemah, sederhana, kuat, atau sangat kuat.

**Jadual 1 : Klasifikasi Kekuatan Korelasi**

| Pekali Kolerasi (r) | Kekuatan Kolerasi (Hubungan) |
|---|---|
| ±0.91 hingga ±1.00 | Sangat kuat |
| ±0.71 hingga ±0.90 | Kuat |
| ±0.51 hingga ±0.70 | Sederhana |
| ±0.31 hingga ±0.50 | Lemah |
| ±0.01 hingga ±0.30 | Sangat lemah |
| 0 | Tiada hubungan |

Sumber: Klasifikasi Kekuatan Korelasi (Chua, 2014)

***Skala Interpretasi Min***

Bagi menentukan tahap penerapan dan amalan nilai Islam, interpretasi min berikut digunakan (Rujuk jadual 2).

**Jadual 2 : Interpretasi Skor Min**

| Skor Min | Interpretasi |
|---|---|
| 1.00 – 2.33 | Rendah |
| 2.34 – 3.66 | Sederhana |
| 3.67 – 5.00 | Tinggi |

Sumber: Interpretasi Skor Min Sidek (2005)

Skala ini digunakan untuk tujuan interpretasi tahap kecenderungan responden terhadap setiap konstruk.

## Dapatan Kajian dan Perbincangan

***Demografi Responden***

Daripada Jadual 3, didapati bahawa kebanyakan responden berumur antara 18 hingga 20 tahun, iaitu seramai 162 orang atau 81 peratus. Hanya 19 peratus berada dalam kumpulan umur 21 hingga 23 tahun. Dominasi pelajar lebih muda memberi gambaran bahawa dapatan kajian banyak mewakili pengalaman pelajar awal pengajian yang masih menyesuaikan diri dengan persekitaran akademik. Ketidakseimbangan umur ini juga boleh mempengaruhi corak respon kerana tahap kematangan akademik dan pengalaman pembelajaran biasanya meningkat apabila usia dan semester bertambah.

Daripada aspek jabatan, majoriti responden, dari Jabatan Kejuruteraan Elektrik dan Kejuruteraan Mekanikal dengan masing-masing 42 peratus dan 41 peratus. Kejuruteraan Awam menyumbang 16.5 peratus, manakala Jabatan Teknologi Maklumat dan Komunikasi sangat kecil iaitu 0.5 peratus. Pola ini menunjukkan sampel lebih tertumpu pada pelajar bidang kejuruteraan teknikal, sekali gus menjadikan generalisasi kepada keseluruhan politeknik perlu

dilakukan dengan cermat kerana perbezaan jabatan boleh mempengaruhi sikap dan pengalaman pelajar terhadap topik kajian.

Dari sudut jantina, 78.5 peratus responden ialah pelajar lelaki manakala perempuan hanya 21.5 peratus. Jurang ini selari dengan pola gender di bidang kejuruteraan yang memang cenderung didominasi lelaki. Ketidakseimbangan ini boleh mempengaruhi tafsiran dapatan, terutama jika pemboleh ubah berkait dengan faktor sikap, motivasi atau penggunaan teknologi. Oleh itu, analisis perlu mengambil kira konteks jantina agar kesimpulan kajian lebih tepat.

**Jadual 3 : Statistik Deskriptif Demografi Responden**

| Pemboleh Ubah | Kategori / Nilai | Kekerapan (N) | Peratus (%) |
|---|---|---|---|
| Umur | 18 hingga 20 tahun | 162 | 81.0 |
| | 21 hingga 23 tahun | 38 | 19.0 |
| Jabatan | Jabatan Kejuruteraan Awam (JKA) | 33 | 16.5 |
| | Jabatan Kejuruteraan Mekanikal (JKM) | 82 | 41.0 |
| | Jabatan Kejuruteraan Elektrik (JKE) | 84 | 42.0 |
| | Jabatan Teknologi Maklumat dan Komunikasi (JTMK) | 1 | 0.5 |
| Jantina | Lelaki | 157 | 78.5 |
| | Perempuan | 43 | 21.5 |

***Tahap Penerapan Nilai Islam dalam Pembelajaran Sains Teknologi dan Kejuruteraan***

Jadual 4 menunjukkan analisis deskriptif tahap penerapan nilai Islam dalam pembelajaran sains, teknologi dan kejuruteraan berada pada tahap tinggi dengan min keseluruhan 4.72 dan sisihan piawai 0.449. Skor min keseluruhan yang kukuh dengan sisihan piawai yang kecil mencerminkan persepsi positif yang hampir sama dalam kalangan responden. Dapatan tersebut menunjukkan mereka memahami kepentingan nilai Islam dalam bidang teknikal dan bersedia mengintegrasikannya dalam pembelajaran serta amalan professional.

Penemuan ini selari dengan Asiyah, Febrini, Topano, & Mustamin (2024) yang mendapati bahawa pendekatan STEM berasaskan prinsip Islam memberi kesan signifikan terhadap peningkatan kompetensi saintifik dan literasi saintifik bakal guru madrasah. Analisis *independent samples t-test* yang signifikan rendah membuktikan bahawa integrasi nilai Islam memberi perbezaan jelas dalam keberkesanan pembelajaran. Ini mengukuhkan dapatan semasa bahawa penerapan nilai seperti amanah, integriti dan ihsan berada pada tahap tinggi serta menyumbang kepada pembelajaran teknikal yang lebih berkualiti.

Dapatan menunjukkan item berkaitan keyakinan pelajar bahawa nilai Islam seperti amanah dan integriti sebagai asas penting dalam bidang teknikal mencatat skor tertinggi. Ini menggambarkan pengiktirafan jelas terhadap keperluan nilai moral dalam tugas yang menuntut ketepatan, keselamatan dan kejujuran profesional. Kesedaran pelajar tentang risiko kecuaian

atau ketidakjujuran turut menunjukkan bahawa amanah dan integriti sudah menjadi asas pertimbangan mereka dalam melaksanakan tugasan teknikal.

Keserasian dapatan ini turut diperkuatkan oleh Anas dan Iswantir (2024) yang menekankan bahawa integrasi nilai Islam dalam kurikulum STEM bukan sekadar meningkatkan prestasi akademik, tetapi turut meneguhkan asas nilai moral yang kukuh seperti kejujuran, tanggungjawab, disiplin dan kerjasama. Mereka menjelaskan bahawa pembelajaran yang menggabungkan konsep saintifik dengan prinsip etika Islam memberi kesedaran mendalam kepada pelajar tentang keperluan melaksanakan kerja teknikal secara amanah dan berintegriti. Pandangan ini sejajar dengan dapatan semasa yang menggambarkan bahawa pelajar meletakkan nilai moral sebagai teras dalam bidang teknikal, kerana mereka menyedari bahawa penghayatan nilai Islam dapat mengawal tindak tanduk profesional dan meningkatkan kualiti kerja pada masa yang sama.

Pernyataan kedua tertinggi menunjukkan pelajar memahami bahawa Islam menuntut kerja teknikal dijalankan secara bertanggungjawab dan yakin nilai Islam mampu meningkatkan kualiti kerja teknikal. Ini membuktikan mereka melihat nilai Islam bukan sekadar panduan moral, tetapi sebagai faktor yang menyokong standard kerja dan profesionalisme. Pelajar turut sedar hubungan antara amalan teknikal dan tuntutan etika Islam seterusnya mengamalkan nilai tersebut dalam tugas harian.

Dalam konteks lebih luas, pandangan Desfita, Salminawati & Usiono (2024) juga memperkukuh tafsiran suatu dapatan dengan menegaskan bahawa integrasi ilmu dalam pendidikan Islam menuntut pengalaman pembelajaran yang holistik, merangkumi aspek spiritual, intelektual dan praktis. Mereka menjelaskan bahawa pendidikan yang berteraskan integrasi nilai mampu membentuk individu yang bukan sekadar cemerlang dari segi akademik, malah berakhlak mulia dan nilai moral yang tinggi. Keselarasan hasil kajian ini sejajar dengan dapatan semasa membuktikan bahawa pelajar bukan sahaja memahami tuntutan agama terhadap etika kerja teknikal, tetapi turut yakin bahawa nilai spiritual seperti amanah dan ihsan berupaya meningkatkan kualiti kerja serta memberi impak langsung terhadap prestasi mereka dalam bidang teknikal.

Secara keseluruhan, dapatan menunjukkan penerimaan yang kukuh terhadap integrasi nilai Islam dalam pembelajaran teknikal. Pelajar melihat nilai seperti amanah, tanggungjawab, ihsan dan kepatuhan syariah sebagai relevan dengan perkembangan teknologi semasa. Tahap persefahaman yang tinggi serta skor yang seragam menunjukkan nilai ini sudah menjadi sebahagian daripada etika pelajar. Hal ini menggambarkan bahawa integrasi nilai Islam mampu mengukuh budaya kerja beretika dan menyumbang kepada pembangunan tenaga teknikal yang lebih profesional dan bertanggungjawab, selari dengan tuntutan industri serta nilai agama.

**Jadual 4 : Analisis Deskriptif Tahap Penerapan Nilai Islam dalam Pembelajaran Sains Teknologi dan Kejuruteraan**

| | Item Soalan | Min | Sisihan Piawai | Tahap |
|---|---|---|---|---|
| P1 | Saya percaya nilai Islam seperti amanah dan integriti penting dalam bidang teknikal | 4.76 | .496 | Tinggi |

| | | | | |
|---|---|---|---|---|
| P2 | Saya memahami bahawa Islam menuntut kerja teknikal dijalankan secara bertanggungjawab | 4.74 | .523 | Tinggi |
| P3 | Saya memahami bahawa penggunaan teknologi mesti mengelakkan unsur yang memudaratkan masyarakat. | 4.64 | .618 | Tinggi |
| P4 | Saya yakin nilai Islam membantu meningkatkan kualiti kerja teknikal saya. | 4.74 | .483 | Tinggi |
| P5 | Saya bersetuju bahawa prinsip ihsan relevan dalam menghasilkan tugasan teknikal yang baik. | 4.73 | .518 | Tinggi |
| P6 | Saya percaya etika kerja profesional dalam Islam sesuai diterapkan dalam kursus teknikal moden. | 4.73 | .539 | Tinggi |
| P7 | Saya sedar bahawa inovasi dan teknologi perlu selari dengan prinsip syariah. | 4.73 | .530 | Tinggi |
| Skor Keseluruhan | | 4.72 | .449 | Tinggi |

***Tahap Amalan Penerapan Nilai Islam dalam Tugasan dan Projek***

Jadual 5 menunjukkan analisis keseluruhan tahap pengamalan nilai Islam dalam tugasan dan projek dikategorikan pada tahap tinggi dengan skor min keseluruhan 4.67 dan sisihan piawai 0.469. Tinggi dan konsistennya skor ini mencerminkan bahawa pelajar konsisten menginternalisasi prinsip seperti amanah, integriti, adab, disiplin dan keadilan dalam pelaksanaan tugasan teknikal. Keseragaman sisihan piawai yang rendah menandakan bahawa hampir semua pelajar menunjukkan kecenderungan yang sama, menjadikan nilai Islam amalan praktikal dalam kerja dan interaksi profesional.

Kajian oleh Mohd Nor, Abdul Hamid, & Osman (2021) menegaskan bahawa elemen kerohanian seperti niat, azam, sabar, istiqamah, doa, tawakal serta penjagaan hubungan merupakan asas penting yang membentuk etika kerja dan ketekunan dalam kalangan pelajar TVET, malah terbukti menjadi faktor yang menyokong kejayaan graduan teknikal walaupun mereka bermula daripada tahap akademik sederhana. Penekanan terhadap nilai nilai tersebut menunjukkan bahawa kerohanian mampu memandu kelakuan, membuatkan pelajar lebih berdisiplin dan berprinsip dalam melaksanakan tugasan. Selaras dengan itu, dapatan kajian ini turut mencerminkan kecenderungan yang sama, iaitu pelajar yang dibentuk melalui pendekatan berteraskan nilai Islam memperlihatkan amalan kerja yang beradab, berintegriti dan profesional, sekali gus menegaskan bahawa nilai Islam berfungsi sebagai landasan praktikal yang memperkukuh mutu tugasan teknikal.

Item tertinggi dalam keseluruhan konstruk ialah A7, iaitu menjaga adab ketika berbincang atau bekerja dengan pensyarah dan rakan, dengan skor min 4.77 dan sisihan piawai 0.456. Adab merupakan nilai paling dominan diamalkan oleh pelajar, menandakan kefahaman mereka terhadap kepentingan akhlak dalam hubungan profesional, terutamanya dalam situasi kolaboratif seperti perbincangan projek, kerja kumpulan dan penyeliaan tugasan teknikal.

Amalan beradab menyokong komunikasi harmonis, kerjasama berkesan, penyelesaian masalah, dan suasana pembelajaran yang produktif dalam tugasan teknikal. Wan Zaharudin (2025) pula menekankan bahawa pengintegrasian konsep fiqh dalam pendidikan sains membolehkan pelajar memahami fenomena alam bukan sahaja dari sudut saintifik tetapi juga dari perspektif tanggungjawab mereka sebagai khalifah dalam menjaga keseimbangan alam.

Penerapan prinsip halal dan halalan tayyiban dalam pengajaran sains mampu meningkatkan literasi saintifik sambil menyemai kesedaran nilai Islam dan kefahaman holistik terhadap isu kontemporari seperti bioteknologi dan pemakanan. Dapatan ini selari dengan amalan A7, di mana nilai adab bukan sahaja memperkukuh hubungan profesional tetapi turut meningkatkan keberkesanan kolaborasi, penyelesaian masalah dan suasana pembelajaran yang saling menghormati, membuktikan bahawa nilai Islam memberi kesan nyata terhadap amalan etika dan kualiti kerja teknikal.

Kedudukan kedua tertinggi ialah A2 "Saya mengelakkan penipuan data kerana ia bertentangan dengan nilai Islam" mencatat min 4.69. Skor ini menunjukkan tahap persetujuan yang amat tinggi dalam kalangan responden. Nilai ini menunjukkan bahawa prinsip agama berfungsi sebagai kawalan dalaman yang kuat ketika pelajar berhadapan dengan proses pengumpulan dan pelaporan data, sekali gus mengurangkan kecenderungan melakukan ketidakjujuran akademik. Hasil kajian ini memperlihatkan bahawa majoriti pelajar bukan sahaja memahami implikasi etika penipuan data, tetapi juga mengaitkannya secara langsung dengan tanggungjawab moral sebagai seorang Muslim ketika melaksanakan tugasan dan projek. Secara keseluruhan, skor min yang tinggi ini menegaskan bahawa penerapan nilai Islam menjadi antara faktor utama yang mengukuhkan integriti akademik dalam kalangan pelajar.

Eusope dan Abdul Ghani Azmi (2021) menegaskan bahawa walaupun majoriti pelajar mempunyai pengetahuan yang jelas tentang konsep integriti, sebahagian daripada mereka masih menunjukkan kecenderungan terhadap salah laku akademik apabila nilai nilai etika tidak benar benar dihayati. Kajian mereka turut menyebut bahawa perbezaan pandangan terhadap nilai sosial, termasuk sikap yang bertentangan dengan prinsip murni, boleh menjejaskan pembentukan integriti yang stabil jika tidak disokong oleh kefahaman Islam yang mendalam sebagai asas kehidupan. Hujah ini selari dengan dapatan semasa yang menunjukkan pelajar mengaitkan aspek kejujuran akademik secara langsung dengan prinsip agama, menandakan nilai Islam bertindak sebagai mekanisme kawalan dalaman yang menguatkan integriti ketika melaksanakan tugasan atau membuat keputusan etika. Secara keseluruhan, sokongan kajian tempatan ini memperkukuh interpretasi bahawa penghayatan nilai agama bukan sahaja membentuk sikap, tetapi juga mempengaruhi tindakan pelajar dengan cara yang mengurangkan kecenderungan melakukan salah laku akademik.

Secara keseluruhan, hasil kajian ini menegaskan bahawa penerapan nilai Islam dalam pelaksanaan tugasan dan projek pelajar berada pada tahap tinggi, bukan sekadar teori tetapi diamalkan secara konsisten dalam tindakan harian. Nilai seperti adab, amanah, integriti, disiplin dan keadilan bukan sahaja membentuk sikap profesional, tetapi juga menjadi mekanisme dalaman yang mengawal kelakuan akademik dan menyokong kerjasama yang produktif. Sokongan daripada kajian tempatan menekankan bahawa kefahaman dan penghayatan nilai agama memperkukuh integriti, mengurangkan salah laku akademik, serta meningkatkan kualiti tugasan teknikal dan interaksi profesional.

**Jadual 5 : Analisis Deskriptif Tahap Amalan Penerapan Nilai Islam dalam Tugasan dan Projek**

| Item Soalan | Min | Sisihan Piawai | Tahap |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| A1 | Saya menjaga amanah ketika menjalankan eksperimen dan tugasan | 4.68 | .517 | Tinggi |
| A2 | Saya mengelakkan penipuan data kerana ia bertentangan dengan nilai Islam | 4.69 | .571 | Tinggi |
| A3 | Saya menghindari plagiat dan peniruan kerana ia melanggar integriti Islam | 4.63 | .597 | Tinggi |
| A4 | Saya mengurus masa dengan disiplin ketika menyiapkan tugasan teknikal | 4.59 | .620 | Tinggi |
| A5 | Saya berusaha menghasilkan kerja berkualiti sebagai bentuk ihsan | 4.63 | .580 | Tinggi |
| A6 | Saya bekerjasama dengan rakan secara adil dalam kerja kumpulan | 4.68 | .507 | Tinggi |
| A7 | Saya menjaga adab ketika berbincang atau bekerja dengan pensyarah dan rakan | 4.77 | .456 | Tinggi |
| Skor Keseluruhan | | 4.67 | .469 | Tinggi |

***Analisis Normaliti***

Analisis normaliti bagi dua pembolehubah kajian, iaitu Tahap Penerapan Nilai Islam dalam Pembelajaran Sains, Teknologi dan Kejuruteraan (*Kolmogorov-Smirnov* = 0.322, *Shapiro-Wilk* = 0.673, $p < 0.001$) dan Amalan Penerapan Nilai Islam dalam Tugasan dan Projek (*Kolmogorov-Smirnov* = 0.292, *Shapiro-Wilk* = 0.727, $p < 0.001$), memperlihatkan bahawa data kedua-duanya tidak selaras dengan taburan normal. Nilai p yang rendah (< 0.05) menandakan penyebaran data menyimpang daripada normal, justeru kaedah statistik parametrik seperti *Pearson* atau *t-test* tidak sesuai digunakan. Keputusan ini konsisten dengan dapatan deskriptif sebelum ini, di mana purata skor yang tinggi dan sisihan piawai yang rendah mencerminkan pelajar secara konsisten mengamalkan nilai Islam dalam pembelajaran dan tugasan teknikal, tetapi taburan skor tidak seimbang.

Oleh kerana data tidak normal, analisis hubungan antara pembolehubah berterusan seperti Tahap Penerapan dan Amalan Nilai Islam lebih sesuai menggunakan ujian *non-parametrik*, contohnya *Spearman correlation* untuk menilai kekuatan dan arah hubungan. Selain itu, jika ingin membandingkan amalan nilai antara dua kumpulan, *Mann-Whitney U test* boleh digunakan, manakala untuk lebih daripada dua kumpulan**,** *Kruskal-Wallis H test* sesuai bagi menilai sama ada wujud perbezaan signifikan antara kumpulan. Pendekatan ini memastikan dapatan analisis statistik tepat dan selaras dengan sifat data, sambil mengekalkan interpretasi bahawa nilai Islam bukan sahaja difahami secara teori tetapi diterjemahkan secara konsisten dalam amalan tugasan dan projek, seterusnya memperkukuh budaya etika dan profesionalisme pelajar.

**Jadual 6 : Keputusan Ujian Normaliti Kolmogorov-Smirnov dan Shapiro-Wilk**

**Ujian Normaliti**

| | Kolmogorov-Smirnov | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistik | df | Sig. | Statistik | df | Sig. |
| PENERAPAN | .322 | 200 | .000 | .673 | 200 | .000 |
| AMALAN | .292 | 200 | .000 | .727 | 200 | .000 |

***Hubungan antara Tahap Penerapan Nilai Islam dalam Pembelajaran dengan Amalan Penerapan Nilai Islam dalam Tugasan dan Projek***

Jadual 6 menunjukkan analisis korelasi *Spearman*, Tahap Penerapan Nilai Islam dalam Pembelajaran (PENERAPAN) dan Amalan Penerapan Nilai Islam dalam Tugasan dan Projek (AMALAN) menunjukkan hubungan positif yang signifikan dengan nilai r = 0.696 pada tahap 0.01 ($p < 0.01$). Menurut klasifikasi Chua (2014) jadual 7, nilai ini tergolong dalam kategori sederhana, menunjukkan bahawa kefahaman pelajar terhadap prinsip Islam seperti amanah, integriti, adab, disiplin dan keadilan mempunyai kaitan nyata dengan bagaimana mereka mengamalkan nilai-nilai tersebut dalam tugasan dan projek teknikal. Keputusan ini menegaskan bahawa pelajar yang memahami prinsip Islam secara mendalam cenderung melaksanakan tugasan dan projek dengan sikap profesional dan beretika, sekaligus menjadikan nilai Islam bukan sekadar teori, tetapi diterjemahkan ke dalam amalan praktikal harian.

Handayani (2025) menyokong dapatan ini dengan menekankan bahawa integrasi pendidikan Islam dan literasi sains membolehkan pelajar memahami nilai moral dan etika sambil membimbing mereka mengaplikasikan prinsip tersebut dalam konteks pembelajaran dan kehidupan sebenar. Pendekatan pembelajaran yang *transdisipliner* dan holistik, yang menyeimbangkan aspek kognitif dan afektif, mendorong pelajar untuk menginternalisasi nilai-nilai Islam sekaligus mengasah kemahiran berfikir kritis serta meningkatkan kesedaran sosial dan tanggungjawab terhadap persekitaran. Hal ini menunjukkan bahawa penggabungan nilai spiritual, etika dan saintifik bukan sahaja memperkukuh pemahaman konseptual tetapi turut membentuk sikap dan amalan positif dalam tugasan.

Rosita, Prabowo, & Istiningsih (2025) melaporkan bahawa integrasi nilai Islam dalam proses pembelajaran Ilmu Pengetahuan Alam (IPA) di madrasah meningkatkan pembentukan karakter pelajar, terutamanya aspek syukur, tanggungjawab, kejujuran, kepedulian sosial dan disiplin. Peningkatan ini menunjukkan bahawa pendekatan pembelajaran yang berasaskan nilai Islam dan kontekstual bukan sahaja memperkukuh penguasaan konsep saintifik tetapi juga membentuk budaya etika, profesionalisme dan kerjasama berkesan dalam kalangan pelajar. Penerapan nilai Islam secara konsisten dalam pembelajaran saintifik dapat memperkukuh amalan dalam tugasan dan projek teknikal, memastikan pelajar menunjukkan tanggungjawab, integriti, disiplin dan sikap kerjasama yang tinggi.

Kesemua dapatan ini menegaskan bahawa wujud hubungan positif yang ketara antara kefahaman nilai Islam dalam pembelajaran dengan amalan nilai Islam dalam tugasan dan projek**.** Hubungan ini membolehkan pelajar berkembang menjadi individu yang bukan sahaja cekap secara teknikal malah berakhlak dengan budaya etika, profesionalisme dan kolaborasi yang produktif. Pendekatan menyeluruh yang merangkumi aspek spiritual, etika dan saintifik memperkukuh kefahaman nilai Islam serta mendorong pelaksanaan amalan nilai tersebut secara konsisten dalam aktiviti akademik dan praktikal.

**Jadual 7 : Korelasi Spearman antara Tahap Penerapan Nilai Islam dalam Pembelajaran dengan Amalan Penerapan Nilai Islam dalam Tugasan dan Projek**

Kolerasi

| | PENERAPAN | AMALAN |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| Spearman's rho | PENERAPAN | Pekali Kolerasi | 1.000 | .696** |
| | | Sig. (2-hala) | . | .000 |
| | | N | 200 | 200 |
| | AMALAN | Pekali Kolerasi | .696** | 1.000 |
| | | Sig. (2-hala) | .000 | . |
| | | N | 200 | 200 |

***Perbezaan Tahap Penerapan Nilai Islam dalam Pembelajaran Sains Teknologi dan Kejuruteraan dan Tahap Amalan Penerapan Nilai Islam dalam Tugasan dan Projek Berdasarkan Demografi Pelajar***

**1- Umur**

Jadual 8 menunjukkan analisis menggunakan ujian *Kruskal-Wallis* tentang Tahap Penerapan Nilai Islam dalam Pembelajaran (PENERAPAN) tidak berbeza secara signifikan mengikut umur pelajar (H = 1.616, df = 1, p = 0.204). Walaupun kumpulan pelajar berumur 21–23 tahun mencatatkan *mean rank* lebih tinggi (110.07) berbanding kumpulan lain, perbezaan ini tidak mencukupi untuk dianggap signifikan secara statistik. Hasil dapatan menunjukkan bahawa kefahaman dan penerapan nilai Islam dalam konteks pembelajaran sains, teknologi dan kejuruteraan adalah konsisten merentasi kumpulan umur. Faktor ketidakbezaan signifikan ini boleh dijustifikasikan melalui beberapa aspek, termasuk pendekatan kurikulum dan strategi pedagogi yang seragam bagi semua pelajar, integrasi nilai Islam yang holistik dalam semua modul pembelajaran, serta pengaruh motivasi dalaman dan budaya akademik yang lebih dominan berbanding umur. Oleh itu, perbezaan kecil dalam purata skor lebih mencerminkan variasi individu dan bukannya perbezaan demografi yang ketara.

Kajian oleh Elbashir, Alkhair, & Al Thani (2024) menyokong dapatan ini dengan meneliti integrasi pendekatan *Design Thinking* dalam pendidikan STEM berasaskan nilai Islam bagi pelajar Tingkatan 7 dan 8 di sebuah institusi agama di Qatar. Kajian kuantitatif ini mendapati bahawa tiada perbezaan signifikan antara kumpulan umur daripada segi minat terhadap STEM, kemahiran *Design Thinking*, atau penguasaan subjek. Walaupun terdapat sedikit variasi dalam korelasi antara konstruk bagi setiap kumpulan, dapatan keseluruhan menunjukkan bahawa penerapan nilai Islam dalam pembelajaran STEM berlaku secara konsisten merentas peringkat umur. Ini menegaskan bahawa faktor umur bukanlah penentu utama dalam penghayatan nilai Islam; sebaliknya, pendekatan kurikulum yang seragam, integrasi nilai yang holistik, serta budaya akademik yang kukuh lebih mempengaruhi tahap kefahaman dan penginternalan pelajar.

Bagi Tahap Amalan Nilai Islam dalam Tugasan dan Projek (AMALAN), keputusan *Kruskal-Wallis* juga menunjukkan tiada perbezaan signifikan mengikut umur (H = 2.251, df = 1, p = 0.133). Kumpulan pelajar 21–23 tahun mencatat *mean rank* tertinggi (112.17) berbanding kumpulan lain, menunjukkan kecenderungan sedikit lebih tinggi dalam pengamalan nilai Islam, namun perbezaan ini masih di bawah paras signifikan. Kekonsistenan ini boleh dijustifikasikan melalui integrasi nilai Islam dalam semua tugasan dan projek, di mana semua pelajar diberi peluang yang sama untuk mengamalkan nilai seperti amanah, integriti, adab, disiplin dan keadilan. Faktor lain termasuk saiz kumpulan yang tidak seimbang dan skop umur yang terhad, yang menyebabkan perbezaan umur menjadi kurang relevan dalam menentukan

amalan nilai Islam, sementara pengaruh pedagogi, budaya akademik dan motivasi dalaman lebih dominan.

Amaliah, Ridwan, & Putra (2025) juga menyokong dapatan ini, di mana walaupun pelajar menggunakan kurikulum yang berbeza mengikut kelas, amalan nilai Islam seperti iman, taqwa, akhlak mulia, serta keterampilan abad ke-21 tetap diamalkan secara konsisten merentas kumpulan umur. Pendekatan kurikulum yang menekankan nilai Islam sebagai asas utama dalam tugasan dan projek memberi peluang yang saksama kepada semua pelajar untuk mengamalkan nilai-nilai etika dan profesionalisme.

Secara keseluruhan, kedua-dua analisis *Kruskal-Wallis* menegaskan bahawa umur tidak memberi kesan signifikan terhadap tahap penerapan dan amalan nilai Islam dalam kalangan pelajar. Walaupun terdapat trend purata yang sedikit lebih tinggi bagi kumpulan 21–23 tahun, perbezaan tersebut tidak mencukupi untuk dianggap signifikan secara statistik. Hasil kajian ini menegaskan bahawa faktor kurikulum, strategi pedagogi yang konsisten, budaya akademik yang menyokong, serta motivasi dalaman pelajar memainkan peranan lebih kritikal dalam pengamalan nilai Islam berbanding faktor demografi seperti umur. Kesinambungan antara penerapan dalam pembelajaran dan amalan dalam tugasan serta projek menunjukkan bahawa integrasi nilai Islam yang holistik mampu memastikan penghayatan nilai berlaku secara konsisten merentas semua pelajar, sekaligus menekankan bahawa faktor pembelajaran dan budaya akademik lebih menentukan daripada faktor umur.

**Jadual 8: Perbezaan Tahap Penerapan dan Amalan Nilai Islam Berdasarkan Umur Pelajar**

| Pemboleh Ubah | Nilai H (*Kruskal-Wallis*) | df | Sig. (p) | Keputusan Umum | Kumpulan dengan *Mean Rank* Tertinggi | Interpretasi Ringkas |
|---|---|---|---|---|---|---|
| Tahap Penerapan Nilai Islam (PENERAPAN) | 1.616 | 1 | 0.204 | Tidak signifikan | 21-23 tahun (110.07) | Tahap penerapan nilai Islam dalam pembelajaran tidak berbeza secara signifikan mengikut umur, namun kumpulan 21-23 tahun menunjukkan purata skor sedikit lebih tinggi. |
| Tahap Amalan Nilai Islam dalam Tugasan | 2.251 | 1 | 0.133 | Tidak signifikan | 21-23 tahun (112.17) | Tahap amalan nilai Islam dalam tugasan dan projek tidak |

| Pemboleh Ubah | Nilai H (*Kruskal-Wallis*) | df | Sig. (p) | Keputusan Umum | Kumpulan dengan *Mean Rank* Tertinggi | Interpretasi Ringkas |
|---|---|---|---|---|---|---|
| dan Projek (AMALAN) | | | | | | berbeza secara signifikan mengikut umur, tetapi kumpulan 21-23 tahun menunjukkan purata skor sedikit lebih tinggi. |

**2- Jabatan**

Jadual 9 menunjukkan analisis menggunakan ujian *Kruskal-Wallis* menunjukkan bahawa kedua-dua pemboleh ubah, iaitu Tahap Penerapan Nilai Islam (PENERAPAN) dan *Tahap* Amalan Nilai Islam dalam Tugasan dan Projek (AMALAN), tidak menunjukkan perbezaan yang signifikan apabila dibandingkan mengikut jabatan pengajian. Untuk PENERAPAN, nilai H = 2.697, df = 3, p = 0.441 manakala bagi AMALAN, nilai H = 2.656, df = 3, p = 0.448. Dari segi *mean rank*, Jabatan Kejuruteraan Awam (JKA) mencatat nilai tertinggi bagi PENERAPAN iaitu 103.92, manakala Jabatan Kejuruteraan Mekanikal (JKM) mencatat nilai tertinggi bagi AMALAN iaitu 102.88. Walaupun terdapat sedikit variasi antara jabatan, perbezaan purata ini tidak cukup besar untuk mengatasi *varians* dalam data dan mencapai signifikan statistik, menunjukkan bahawa secara umum pelajar di semua jabatan menghayati dan mengamalkan nilai Islam secara homogen.

Beberapa faktor pedagogi dan konteks akademik dapat menjelaskan mengapa perbezaan itu tidak signifikan. Pertama, kurikulum, sukatan dan standard penilaian yang digunakan cenderung seragam dalam institusi politeknik atau institut teknikal; modul, tugasan projek dan rubrik penilaian biasanya distandardkan antara jabatan bagi memastikan kesepadanan keluarannya. Kedua, amalan pengajaran dan budaya akademik juga konsisten kerana pensyarah mengikuti garis panduan fakulti dan program yang sama, selain latihan profesional dan bengkel merentasi jabatan turut memupuk keseragaman pengalaman akademik. Ketiga, pengaruh rakan sebaya dan persekitaran pembelajaran, menghasilkan pengalaman pembelajaran yang serupa bagi pelajar daripada jabatan berlainan. Keempat, saringan masuk dan kriteria pemilihan pelajar berpotensi menghasilkan kohort yang relatif homogen dari segi nilai asas, sikap terhadap etika kerja dan motivasi akademik, seterusnya mengurangkan perbezaan yang boleh dikesan antara jabatan.

Kajian Abdul Khalil, Othman, & Saidon (2020) menekankan bahawa pensyarah dan pelajar di institusi pengajian tinggi sentiasa bersikap proaktif dalam menghadapi perubahan teknologi dengan mengikuti perkembangan semasa dan penggunaan teknologi ini turut membentuk sikap pelajar ke arah penghayatan nilai yang lebih positif. Dalam konteks ini, penerapan nilai tidak dipisahkan daripada aplikasi teknologi kerana pensyarah menyedari kepentingan melahirkan graduan yang mahir secara teknikal dan berakhlak mulia. Hujah ini menyokong dapatan kajian semasa bahawa keseragaman kurikulum, budaya akademik, serta kesedaran pensyarah

terhadap integrasi nilai murni menghasilkan pola homogen dalam penghayatan dan pengamalan nilai Islam merentasi jabatan, di mana variasi kecil yang wujud tidak cukup besar untuk membentuk jurang ketara.

Haron, Ramli, Jamil, & Abdul Rahman (2022) pula menunjukkan bahawa nilai-nilai Islam diterapkan secara konsisten merentasi semua pelajar di Universiti Sains Islam Malaysia (USIM) tanpa mengira jurusan, dengan lima nilai teras iaitu Profesional, Boleh Dipercayai, Efisien, Global dan Konsensus yang selari dengan prinsip amanah, integriti, disiplin dan kerjasama. Walaupun nilai Tauhid tidak disenaraikan sebagai nilai teras, ia tertanam dalam visi universiti dan membimbing penghayatan pelajar dalam akademik dan projek. Pendekatan sistemik ini memastikan semua pelajar diberi peluang sama rata untuk menginternalisasi nilai Islam melalui modul akademik, tugasan projek, dan program pembangunan kepimpinan, menjadikan faktor jabatan atau program pengajian bukan penentu utama dalam tahap penerapan dan amalan nilai. Dapatan ini selari dengan keputusan *Kruskal-Wallis* kajian semasa, menegaskan bahawa budaya institusi, keseragaman kurikulum dan pedagogi holistik lebih mempengaruhi penginternalisasian nilai berbanding faktor demografi jabatan, sekaligus menyokong justifikasi bahawa kestabilan amalan nilai Islam berlaku merentasi semua kumpulan pelajar.

Kesimpulannya, keputusan *Kruskal-Wallis* yang menunjukkan tiada perbezaan signifikan antara jabatan pengajian bagi kedua-dua tahap penerapan dan amalan nilai Islam mencerminkan bahawa faktor seperti keseragaman kurikulum, budaya akademik dan pedagogi holistik lebih dominan berbanding perbezaan demografi jabatan. Walaupun terdapat variasi purata kecil antara jabatan, perbezaan ini lebih bersifat variasi individu daripada jurang sebenar. Hasil ini menegaskan bahawa jabatan pengajian bukan penentu utama dalam penghayatan dan pengamalan nilai Islam, dan menyokong pandangan bahawa pendekatan institusi yang konsisten dalam menerapkan nilai Islam dalam setiap tugasan dan projek membantu memastikan semua pelajar berpeluang mengamalkan nilai Islam secara menyeluruh merentasi semua program pengajian.

**Jadual 9 : Rumusan Perbezaan Tahap Penerapan dan Amalan Nilai Islam Berdasarkan Jabatan**

| Pemboleh Ubah | Nilai H (Kruskal Wallis) | df | Sig. (p) | Keputusan Umum | Jabatan dengan *Mean Rank* Tertinggi | Interpretasi Ringkas |
|---|---|---|---|---|---|---|
| Tahap Penerapan Nilai Islam (PENERAPAN) | 2.697 | 3 | 0.441 | Tiada perbezaan signifikan | Jabatan Kejuruteraan Awam (103.92) | Pelajar JKA menunjukkan kecenderungan tahap penerapan nilai Islam sedikit lebih tinggi berbanding jabatan lain, |

| Pemboleh Ubah | Nilai H (Kruskal Wallis) | df | Sig. (p) | Keputusan Umum | Jabatan dengan *Mean Rank* Tertinggi | Interpretasi Ringkas |
|---|---|---|---|---|---|---|
| | | | | | | namun perbezaan secara statistik tidak signifikan. |
| Tahap Amalan Nilai Islam dalam Tugasan dan Projek (AMALAN) | 2.656 | 3 | 0.448 | Tiada perbezaan signifikan | Jabatan Kejuruteraan Mekanikal (102.88) | Pelajar JKM menunjukkan kecenderungan amalan nilai Islam sedikit lebih tinggi, namun perbezaan masih tidak signifikan antara jabatan. |

### 3- Jantina

Jadual 10 menunjukkan analisis *Mann-Whitney* bagi perbezaan tahap penerapan dan amalan nilai Islam berdasarkan jantina menunjukkan keputusan yang berbeza bagi kedua-dua pemboleh ubah. Bagi Tahap Penerapan Nilai Islam (PENERAPAN), nilai U = 2742.500, Z = -2.114, dan p = 0.035, menandakan wujud perbezaan signifikan antara jantina. *Mean rank* pelajar lelaki (104.53) lebih tinggi berbanding pelajar perempuan (85.78), menunjukkan bahawa pelajar lelaki cenderung menunjukkan tahap penerapan nilai Islam yang lebih tinggi

dalam pembelajaran sains, teknologi, dan kejuruteraan. Perbezaan ini boleh dijelaskan melalui faktor sosial dan budaya yang mempengaruhi penghayatan nilai Islam dalam konteks pembelajaran, seperti penglibatan aktif lelaki dalam tugasan praktikal, projek kumpulan atau aktiviti kokurikulum yang menegaskankan integrasi nilai Islam seperti disiplin, amanah dan sikap tanggungjawab. Di samping itu, motivasi dalaman, persepsi terhadap tanggungjawab akademik, serta pengaruh pensyarah turut menyumbang kepada kecenderungan pelajar lelaki untuk lebih menonjol dalam penerapan nilai Islam secara berstruktur dalam aktiviti akademik formal.

Kaneez & Imtiaz (2022) menekankan bahawa tradisi keagamaan memainkan peranan penting dalam pembentukan tingkah laku yang memfokuskan kepada kebaikan bersama dalam kalangan remaja, termasuk disiplin, amanah dan tanggungjawab sosial. Walaupun kajian mereka mendapati kesan jantina tidak signifikan dalam kecenderungan bagi membantu dan memberi kebaikan kepada individu lain, prinsip yang sama dapat digunakan untuk menyokong justifikasi bahawa tahap penglibatan sosial dan budaya individu boleh menyumbang kepada perbezaan jantina dalam penghayatan nilai Islam.

Sebaliknya, bagi Tahap Amalan Nilai Islam dalam Tugasan dan Projek (AMALAN), nilai U = 2896.000, Z = -1.549, dan p = 0.121 menunjukkan tiada perbezaan signifikan antara jantina. *Mean rank* pelajar lelaki (103.55) masih lebih tinggi berbanding pelajar perempuan (89.35), tetapi perbezaan ini tidak mencapai tahap signifikan. Hal ini mencerminkan bahawa amalan nilai Islam dalam tugasan dan projek lebih dipengaruhi oleh faktor seperti kurikulum, pedagogi dan peluang yang sama diberikan kepada semua pelajar untuk menginternalisasi nilai Islam, tanpa mengira jantina. Keseragaman modul akademik, rubrik penilaian dan garis panduan fakulti memastikan pengalaman pembelajaran hampir serupa merentasi jantina, sekali gus mengurangkan jurang amalan nilai yang boleh dikesan. Faktor tambahan seperti saiz kumpulan, motivasi individu, dan kebolehan pelajar juga menyumbang kepada konsistensi amalan nilai Islam.

Kajian oleh Alghanam dan Shehadeh (2025) menjelaskan bahawa walaupun tiada perbezaan signifikan dari segi jantina dalam tahap keagamaan dan tingkah laku bertanggungjawab remaja, tahap keagamaan tetap mempunyai kaitan yang kukuh dengan tingkah laku tersebut. Hubungan ini berlaku kerana remaja yang mempunyai kawalan kendiri yang baik cenderung mengamalkan tingkah laku bertanggungjawab dengan lebih konsisten, menjadikan kawalan kendiri sebagai pengantara yang menjelaskan bagaimana keagamaan mempengaruhi tindakan mereka. Dapatan ini menyokong secara konseptual kajian semasa kerana ia menekankan bahawa penghayatan dan amalan nilai, dalam konteks kajian ini nilai Islam dalam tugasan dan projek, lebih bergantung pada faktor seperti kurikulum, pedagogi dan pengalaman pembelajaran yang konsisten, berbanding demografi jantina. Dengan kata lain, walaupun skor purata pelajar lelaki lebih tinggi, keseragaman peluang untuk mengamalkan nilai Islam dan struktur pembelajaran yang stabil mengurangkan perbezaan signifikan, selari dengan penemuan Alghanam dan Shehadeh (2025) bahawa pengaruh jantina tidak begitu menonjol apabila faktor pendidikan dan kawalan kendiri memainkan peranan utama.

Secara keseluruhan, dapatan ini menegaskan bahawa jantina mempunyai pengaruh terhadap tahap penerapan nilai Islam dalam pembelajaran, dengan pelajar lelaki mencatat skor purata

lebih tinggi, tetapi tidak mempengaruhi amalan nilai Islam dalam tugasan dan projek secara signifikan. Hal ini menunjukkan bahawa faktor pedagogi, budaya akademik dan integrasi nilai dalam aktiviti pembelajaran lebih dominan dalam membentuk amalan nilai Islam berbanding jantina. Kesimpulannya, institusi pendidikan perlu terus menekankan pendekatan holistik dan menyediakan peluang sama rata dalam pengamalan nilai Islam bagi memastikan semua pelajar, tanpa mengira jantina, dapat mengamalkan nilai Islam secara optimum dalam konteks akademik dan projek.

**Jadual 10 : Rumusan Perbezaan Tahap Penerapan dan Amalan Nilai Islam Berdasarkan Jantina**

| Pembolehubah | Nilai U (*Mann-Whitney*) | Z | Sig. (2-tailed) | Keputusan Umum | Jantina dengan *Mean Rank* Tertinggi |
|---|---|---|---|---|---|
| Tahap Penerapan Nilai Islam (PENERAPAN) | 2742.500 | -2.114 | 0.035 | Terdapat perbezaan signifikan antara jantina | Lelaki (104.53) |
| Tahap Amalan Nilai Islam dalam Tugasan dan Projek (AMALAN) | 2896.000 | -1.549 | 0.121 | Tiada perbezaan signifikan antara jantina | Lelaki (103.55) |

**Kesimpulan**

Kajian ini membuktikan bahawa penerapan nilai Islam dalam pembelajaran teknikal di PSMZA berada pada tahap tinggi dan konsisten. Pelajar bukan sahaja memahami kepentingan nilai Islam seperti amanah, integriti, disiplin, ihsan dan adab, tetapi turut mengamalkannya dalam tugasan dan projek teknikal. Perbezaan signifikan berdasarkan jantina menunjukkan bahawa faktor sosial dan budaya mempengaruhi cara nilai Islam dihayati dalam konteks pembelajaran teknikal. Hubungan positif yang signifikan antara penerapan dan amalan nilai Islam menegaskan bahawa kefahaman mendalam terhadap prinsip Islam mendorong pelaksanaan tugasan teknikal secara beretika dan profesional.

Pensyarah disaran merangka strategi pengajaran yang lebih bersepadu dengan menekankan penerapan nilai Islam dalam tugasan praktikal, projek reka bentuk dan kerja makmal. Aktiviti kokurikulum serta projek berstruktur juga boleh dijadikan medium untuk memperkukuh nilai amanah, integriti dan tanggungjawab sosial dalam kalangan pelajar. Selain itu, pihak pengurusan politeknik wajar membangunkan modul khusus yang mengintegrasikan nilai Islam dengan pembelajaran teknikal, selaras dengan keperluan industri dan tuntutan pembangunan insan. Dalam masa yang sama, usaha memperkecil jurang jantina perlu diberi perhatian dengan menyediakan peluang pembelajaran yang seimbang dan inklusif bagi pelajar lelaki dan perempuan, agar penerapan nilai Islam dapat diamalkan secara menyeluruh tanpa dipengaruhi oleh faktor demografi.

Kajian lanjutan boleh menumpukan pada penerapan nilai Islam dalam sektor teknologi maklumat dan komunikasi (ICT) menggunakan pendekatan kualitatif untuk memahami pengalaman pelajar secara holistik. Selain itu, perbandingan antara politeknik di Malaysia boleh dilakukan bagi mengenal pasti pola penerapan nilai Islam dalam konteks TVET yang berbeza, seterusnya memberikan gambaran lebih menyeluruh mengenai amalan nilai Islam di peringkat nasional. Kajian masa depan juga boleh menilai impak penerapan nilai Islam terhadap pencapaian akademik dan kebolehpasaran graduan dalam industri teknikal, bagi memastikan integrasi nilai Islam bukan sahaja membentuk sahsiah pelajar tetapi turut memperkukuhkan kebolehpasaran graduan.

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# KEBERKESANAN PLATFORM TECHDEEN DALAM MENINGKATKAN KEFAHAMAN FEQAH KSSM TINGKATAN LIMA

## THE EFFECTIVENESS OF THE TECHDEEN PLATFORM IN ENHANCING UNDERSTANDING OF FORM FIVE KSSM FIQH

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***Abstrak:*** *Perkembangan pesat teknologi maklumat dan komunikasi (ICT) dalam era Revolusi Industri 4.0 telah mendorong transformasi dalam pendekatan pengajaran dan pembelajaran, termasuk dalam bidang Pendidikan Islam. Kajian ini bertujuan membangunkan dan menilai keberkesanan laman web pembelajaran digital TECHDEEN sebagai medium sokongan pembelajaran bagi topik Feqah Tingkatan Lima Kurikulum Standard Sekolah Menengah (KSSM). Pembangunan TECHDEEN memberi tumpuan kepada penyediaan nota ringkas, kandungan visual serta elemen interaktif seperti kuiz dan permainan pendidikan bagi meningkatkan kefahaman, motivasi dan penglibatan pelajar. Kajian ini menggunakan reka bentuk kuantitatif deskriptif dengan kaedah pengumpulan data melalui soal selidik dalam talian menggunakan Google Form. Seramai 125 orang responden yang terdiri daripada pelajar Tingkatan Lima, guru Pendidikan Islam dan ibu bapa terlibat sebagai sampel kajian. Data dianalisis menggunakan statistik deskriptif bagi menilai tahap kefahaman, kebolehgunaan serta penerimaan pengguna terhadap platform TECHDEEN. Dapatan kajian menunjukkan tahap kefahaman pelajar terhadap semua tajuk Feqah berada pada tahap tinggi, dengan majoriti responden memberikan maklum balas positif terhadap reka bentuk, kekemasan dan keberkesanan platform sebagai bahan pembelajaran dan ulang kaji. Secara keseluruhan, kajian ini membuktikan bahawa integrasi teknologi digital melalui pembangunan*

*laman web TECHDEEN berpotensi meningkatkan keberkesanan pengajaran dan pembelajaran Pendidikan Islam serta menyokong pelaksanaan pedagogi abad ke-21 secara lebih interaktif dan berpusatkan pelajar.*

***Kata Kunci:*** *Pendidikan Islam, Feqah Tingkatan Lima, pembelajaran digital, laman web pendidikan, teknologi pendidikan, KSSM.*

***Abstract:*** *The rapid development of information and communication technology (ICT) in the era of the Fourth Industrial Revolution has driven significant transformations in teaching and learning approaches, including in the field of Islamic Education. This study aims to develop and evaluate the effectiveness of the TECHDEEN digital learning website as a supportive learning medium for the Form Five Fiqh topics of the Kurikulum Standard Sekolah Menengah (KSSM). The development of TECHDEEN focuses on providing concise notes, visual content, and interactive elements such as quizzes and educational games to enhance students' understanding, motivation, and engagement.This study employed a descriptive quantitative research design, with data collected through an online questionnaire using Google Form. A total of 125 respondents, consisting of Form Five students, Islamic Education teachers, and parents, participated as the study sample. The data were analysed using descriptive statistics to evaluate the level of understanding, usability, and user acceptance of the TECHDEEN platform. The findings indicate that students' understanding of all Fiqh topics was at a high level, with the majority of respondents providing positive feedback on the design, neatness, and effectiveness of the platform as a learning and revision tool. Overall, this study demonstrates that the integration of digital technology through the development of the TECHDEEN website has the potential to enhance the effectiveness of teaching and learning in Islamic Education and to support the implementation of 21st-century pedagogy in a more interactive and student-centred manner.*

***Keywords****: Islamic Education, Form Five Fiqh, digital learning, educational website, educational technology, KSSM.*

## Pengenalan

Perkembangan teknologi maklumat dan komunikasi (ICT) dalam era Revolusi Industri 4.0 telah mengubah pendekatan pengajaran dan pembelajaran dalam sistem pendidikan moden (Maimun Aqsha Lubis et al., 2011). Kini, penggunaan platform digital seperti laman web interaktif, permainan pendidikan dan kuiz dalam talian semakin meluas bagi meningkatkan kefahaman pelajar dalam pelbagai bidang ilmu. Dalam konteks Pendidikan Islam, inovasi digital ini membuka peluang pembelajaran yang lebih menarik dan berkesan, khususnya bagi topik-topik yang bersifat konseptual seperti bidang Feqah (Nawi, 2020). Kaedah pembelajaran tradisional yang terlalu bergantung kepada buku teks dan syarahan guru kadang-kala kurang mampu menarik minat pelajar untuk memahami hukum-hakam ibadah secara mendalam dan konsisten (Tamuri, 2012). Dengan itu, pembangunan bahan digital dalam Pendidikan Islam merupakan

usaha penting untuk memperkukuh kefahaman pelajar serta memastikan pembelajaran berlaku secara lebih aktif, mandiri dan berfokus (Azhan & Shamshinar, 2024). Sehubungan itu, laman web TechDeen telah dibangunkan sebagai medium digital yang menyediakan

kandungan pembelajaran Feqah Tingkatan 5 serta aktiviti interaktif untuk menyokong penguasaan ilmu secara lebih menyeronokkan dan efektif

## Latar Belakang Kajian

Bidang Feqah merupakan komponen utama dalam Pendidikan Islam Tingkatan 5 KSSM yang menekankan kefahaman pelajar terhadap hukum amali berkaitan ibadah, muamalah dan kehidupan seharian sebagai seorang Muslim. Namun, cabaran yang dihadapi dalam pengajaran bidang ini antaranya ialah isi pelajaran yang agak kompleks, bersifat hukum dan memerlukan pemahaman mendalam serta aplikasi dalam situasi sebenar (Mohd Nawi et al., 2024). Tambahan pula, pelajar generasi kini lebih terdedah kepada teknologi dan cenderung untuk belajar melalui platform digital (Prensky, 2001). Berdasarkan situasi ini, kajian dijalankan untuk membangunkan laman web TechDeen dengan menyediakan nota ringkas dan mudah difahami berdasarkan sukatan KSSM, serta dilengkapi kuiz dan permainan interaktif bagi pengukuhan pembelajaran. Laman web ini memberi ruang kepada pelajar untuk mengakses maklumat pada bila-bila masa dan mengawal proses pembelajaran mereka sendiri.

## Pernyataan Masalah

Walaupun Pendidikan Islam merupakan subjek teras yang penting dalam pembangunan sahsiah pelajar Muslim, khususnya dalam memahami hukum-hakam ibadah melalui bidang Feqah, terdapat beberapa isu yang menjejaskan keberkesanan pembelajaran topik ini di sekolah. Kaedah pengajaran tradisional yang masih bergantung sepenuhnya kepada buku teks dan penyampaian secara syarahan menjadikan proses pembelajaran kurang interaktif serta tidak dapat memenuhi keperluan gaya pembelajaran pelajar masa kini yang lebih cenderung kepada penggunaan teknologi digital (Maimun Aqsha Lubis et al., 2011). Tambahan pula, topik Feqah melibatkan konsep hukum yang abstrak dan memerlukan aplikasi dalam kehidupan sebenar, menyebabkan pelajar berasa sukar untuk memahami dan mengingati isi pelajaran jika tidak disertakan dengan bahan sokongan visual dan aktiviti interaktif. Selain itu, sumber pembelajaran digital khususnya yang mematuhi sukatan KSSM dalam Pendidikan Islam Tingkatan 5 masih terhad, sekali gus menyukarkan pelajar untuk mendapatkan rujukan yang sahih dan tepat ketika belajar secara kendiri. Kekurangan platform yang menyediakan penilaian kendiri seperti kuiz dan permainan pendidikan turut menjejaskan usaha mengukuhkan pemahaman pelajar secara menyeronokkan dan berkesan. Oleh itu, wujudnya keperluan mendesak untuk menghasilkan satu platform pembelajaran berasaskan digital yang mampu mengatasi kelemahan-kelemahan ini dan seterusnya menyokong peningkatan motivasi serta pencapaian pelajar dalam bidang Feqah (Gikandi et al., 2011).

## Objektif Kajian

Kajian ini dijalankan untuk membangunkan laman web pembelajaran TechDeen bagi menyediakan nota dan aktiviti interaktif bagi Feqah Tingkatan 5. Selain itu, kajian ini juga bertujuan untuk menilai penerimaan pelajar terhadap penggunaan laman web TechDeen dalam meningkatkan motivasi dan kefahaman pembelajaran mereka.

## Kepentingan Kajian

Kajian ini memberi manfaat kepada pelbagai pihak termasuk pelajar dengan menyediakan platform pembelajaran yang interaktif dan fleksibel untuk mengulang kaji pada bila-bila masa, di mana aktiviti kuiz dan permainan membantu menilai kefahaman secara menyeronokkan (Nawi, 2020). Bagi guru pula, ia menjadi bahan sokongan PdP yang boleh digunakan dalam pengajaran atau tugasan pengayaan. Dari sudut bidang Pendidikan Islam, usaha ini menambah bilangan sumber digital berautoriti selaras KSSM, sekali gus menyokong agenda pendigitalan pendidikan. Kajian ini juga menyumbang kepada pembangunan inovasi pembelajaran yang menyokong pedagogi abad ke-21 (Kementerian Pendidikan Malaysia, 2013).

## Kajian Literatur

Kajian terdahulu menunjukkan bahawa penggunaan teknologi dalam pendidikan memberi impak positif terhadap pembelajaran pelajar (Maimun Aqsha Lubis et al., 2011). Interaktiviti dalam platform digital dapat meningkatkan minat, fokus dan kefahaman terhadap topik pembelajaran. Dalam Pendidikan Islam, bahan multimedia didapati membantu pelajar memahami konsep ibadah melalui pendekatan visual dan situasi simulasi kehidupan sebenar (Nawi, 2020). Selain itu, pengajaran menggunakan permainan (gamification) dan kuiz digital mampu meningkatkan motivasi intrinsik pelajar dan menggalakkan pembelajaran berasaskan pengalaman. Kajian juga membuktikan bahawa pembelajaran kendiri melalui platform dalam talian memberi peluang kepada pelajar untuk mengawal tempo pembelajaran mereka mengikut tahap keupayaan masing-masing. Oleh itu, pembangunan laman web TechDeen adalah selaras dengan dapatan kajian-kajian lepas yang menegaskan bahawa teknologi digital berpotensi memperkukuh PdP dalam Pendidikan Islam, terutama dalam topik yang memerlukan pemahaman aplikasi seperti bidang Feqah.

## Metodologi Kajian

### *Reka Bentuk Kajian*

Kajian ini menggunakan reka bentuk kajian kuantitatif deskriptif bagi menilai keberkesanan laman web TECHDEEN sebagai platform pembelajaran digital bagi topik Fekah Tingkatan Lima KSSM. Reka bentuk ini dipilih kerana ia sesuai untuk mengumpul data berbentuk persepsi dan maklum balas responden secara sistematik serta menggambarkan tahap kefahaman, kebolehgunaan dan keberkesanan platform pembelajaran digital yang dibangunkan. Data kajian dikumpul melalui kaedah soal selidik berstruktur secara dalam talian menggunakan Google Form. Pendekatan ini membolehkan pengumpulan data dilakukan secara cepat, meluas dan kos efektif, di samping memudahkan responden menjawab soalan berdasarkan pengalaman mereka menggunakan laman web TECHDEEN. Data yang diperolehi dianalisis menggunakan statistik deskriptif untuk mendapatkan gambaran keseluruhan dapatan kajian.

### *Sampel Kajian*

Sampel kajian terdiri daripada 125 orang responden yang terdiri daripada pelajar Tingkatan Lima, guru Pendidikan Islam dan ibu bapa. Pemilihan sampel dilakukan menggunakan

kaedah persampelan mudah (convenience sampling) kerana responden dipilih berdasarkan kemudahan capaian dan kesediaan untuk terlibat dalam kajian. Daripada keseluruhan responden, 70% merupakan pelajar Tingkatan Lima yang menjadi kumpulan sasaran utama kajian, manakala 30% lagi terdiri daripada guru dan ibu bapa. Pengumpulan data dijalankan dalam tempoh dua minggu, dan edaran soal selidik dilakukan melalui platform komunikasi digital seperti WhatsApp, Telegram serta kumpulan komuniti sekolah. Semua responden diberi penerangan ringkas berkaitan tujuan kajian dan kerahsiaan maklumat sebelum menjawab soal selidik.

## Instrumentasi Kajian

Instrumen kajian yang digunakan ialah soal selidik berstruktur yang dibangunkan menggunakan Google Form. Instrumen ini mengandungi 17 item yang dibahagikan kepada beberapa bahagian utama, iaitu status pengguna, tahap penggunaan TECHDEEN, tahap kefahaman terhadap empat tajuk utama Fekah, kebolehgunaan laman web beserta keberkesanan TECHDEEN sebagai bahan pembelajaran dan ulang kaji. Item kefahaman dan keberkesanan menggunakan skala Likert lima mata, manakala item lain menggunakan pilihan respons berstruktur seperti Ya, Sederhana dan Sukar. Selain itu, satu soalan terbuka disediakan bagi mendapatkan cadangan penambahbaikan daripada responden. Sebelum edaran rasmi, satu ujian awal (pilot test) telah dijalankan dalam kalangan ahli kumpulan kajian bagi memastikan kejelasan bahasa, kefahaman soalan dan kesesuaian instrumen dengan objektif kajian.

**Jadual 1: Skala Likert Lima Mata**

| Skor | Interpretasi |
|---|---|
| 1 | Sangat tidak setuju |
| 2 | Tidak setuju |
| 3 | Sederhana |
| 4 | Setuju |
| 5 | Sangat setuju |

Skala Likert lima mata digunakan bagi mengukur tahap kefahaman, persepsi dan keberkesanan penggunaan laman web TECHDEEN dalam kalangan responden.

**Jadual 2: Interpretasi Skor Min**

| Julat Skor Min | Tahap Interpretasi |
|---|---|
| 1.00 - 2.33 | Rendah |
| 2.34 - 3.66 | Sederhana |
| 3.67 - 5.00 | Tinggi |

Skor min digunakan bagi menentukan tahap kefahaman dan keberkesanan TECHDEEN berdasarkan persepsi responden. Semakin tinggi skor min, semakin tinggi tahap keberkesanan dan penerimaan terhadap laman web TECHDEEN sebagai platform pembelajaran digital.

## Hasil & Perbincangan Kajian

Bahagian ini membentangkan dapatan kajian berdasarkan analisis data kuantitatif yang diperoleh daripada 125 orang responden yang terdiri daripada pelajar dan guru sekolah

menengah di daerah Kuala Nerus. Analisis dijalankan menggunakan statistik yang menyeluruh bagi menjawab objektif kajian berkaitan bilangan jenis responden, kenalpasti tujuan penggunaan laman web Techdeen, tahap kefahaman bagi sesuatu tajuk dan kekemasan laman web Techdeen terhadap motivasi pembelajaran.

### *Profil Responden*

Seramai 125 orang responden terlibat sebagai sampel di dalam kajian ini, yang terdiri daripada pelajar Tingkatan 5, guru dan orang awam di daerah Kuala Nerus. Bagi menentukan kecukupan saiz sampel, kajian ini merujuk kepada jadual penentuan saiz sampel Krejcie & Morgan (1970). Berdasarkan jadual tersebut, bagi jumlah populasi seramai 185 orang, saiz sampel minimum yang diperlukan adalah sebanyak 125 orang. Oleh itu, memandangkan kajian ini berjaya mengumpul data daripada 125 responden, jumlah ini adalah mencukupi, sah dan memadai untuk mewakili populasi sasaran bagi menjawab objektif kajian. Daripada keseluruhan jumlah sampel tersebut, analisis menunjukkan bahawa majoriti responden terdiri daripada golongan Pelajar iaitu sebanyak 82.6%, manakala responden dalam kalangan Guru pula adalah sebanyak 12.4%. Selebihnya merupakan responden daripada kategori Orang Awam iaitu sebanyak 4.8%. Komposisi responden ini menunjukkan bahawa data kajian mencerminkan sasaran utama laman web TechDeen iaitu para pelajar dan pendidik dalam konteks Pengajaran dan Pembelajaran (PdP) Pendidikan Islam.

### *Tujuan Utama Laman Web TechDeen*

Analisis statistik menunjukkan tujuan utama penggunaan laman web TechDeen dalam kalangan responden adalah memberangsankan.

**Jadual 3: Tujuan Utama Penggunaan Laman Web Techdeen Dalam Kalangan Pelajar Dan Guru**

| Aktiviti | Bilangan responden | Peratus |
|---|---|---|
| Ulangkaji pelajaran | 79 | 45.9% |
| Menyiapkan tugasan kerja Kursus | 22 | 12.8% |
| Mencari penerangan ringkas setiap tajuk | 49 | 28.5% |
| Rujukan guru | 22 | 12.8% |

Berdasarkan jadual di atas, peratus tertinggi 45.9 % menunjukkan majoriti responden menggunakan laman web TechDeen sebagai medium untuk mengulangkaji pelajaran sekaligus mengesahkan bahawa laman web ini sebagai alat pemudah cara untuk mengulangkaji pelajaran.

Berdasarkan hasil perbincangan kajian, majoriti responden menggunakan laman web TechDeen bagi tujuan ulang kaji pelajaran (45.9%), diikuti dengan mencari penerangan ringkas setiap tajuk (28.5%). Corak penggunaan ini menunjukkan bahawa TechDeen memenuhi keperluan pelajar terhadap pembelajaran kendiri yang mudah diakses dan berkesan. Penerimaan pengguna terhadap sesuatu sistem teknologi dipengaruhi oleh persepsi kemudahan penggunaan dan keberkesanan sistem tersebut. Oleh itu, penggunaan TechDeen yang tinggi bagi aktiviti pembelajaran utama mencerminkan bahawa platform ini dianggap mudah digunakan serta membantu meningkatkan kefahaman pelajar, sekali gus menyokong

pelaksanaan pembelajaran digital dalam Pendidikan Islam.

***Tahap Kefahaman Bagi Setiap Tajuk***

Dapatan seterusnya menilai keberkesanan setiap tajuk yang ada dalam Bab Feqah Tingkatan 5 seperti solat istikharah & solat tasbih, Perkahwinan, Faraid dan jenayah dalam islam.

**Jadual 4 Menujukkan Analisis Tahap Kefahaman Dalam Bab Feqah Tingkatan 5**

| Tajuk Feqah | Skor Min | Interpretasi |
|---|---|---|
| Solat Istikharah & Solat Tasbih | 4.12 | Tinggi |
| Perkahwinan | 4.08 | Tinggi |
| Pengurusan Harta selepas Kematian | 4.16 | Tinggi |
| Jenayah dalam Islam | 4.05 | Tinggi |

Berdasarkan jadual di atas, secara keseluruhannya skor purata min bagi setiap tajuk menunjukkan perbezaan yang tidak banyak, menunjukkan bahawa laman web TechDeen mempunyai tajuk yang menarik.

Berdasarkan hasil perbincangan kajian, persepsi responden terhadap penggunaan laman web TechDeen bagi topik-topik Feqah berada pada tahap tinggi bagi semua tajuk yang dinilai. Dapatan menunjukkan bahawa topik Pengurusan Harta selepas Kematian mencatatkan skor min tertinggi iaitu 4.16, diikuti oleh Solat Istikharah dan Solat Tasbih dengan skor min 4.12, Perkahwinan dengan skor min 4.08, serta Jenayah dalam Islam yang turut berada pada tahap tinggi dengan skor min 4.05. Skor min yang konsisten tinggi ini menunjukkan bahawa kandungan pembelajaran Feqah yang disediakan melalui TechDeen diterima dengan baik oleh responden dan berkesan dalam membantu kefahaman mereka terhadap topik-topik yang dipelajari. Secara keseluruhannya, dapatan ini membuktikan bahawa TechDeen berfungsi sebagai platform pembelajaran digital yang sesuai dan berkesan sebagai sokongan pengajaran dan pembelajaran Feqah dalam Pendidikan Islam.

***Kekemasan Laman Web Techdeen***

Dapatan seterusnya menilai kekemasan laman web TechDeen untuk kegunaan pelbagai jenis responden yang merupakan sasaran utama responden.

**Jadual 5 Menunjukkan Bahawa Bilangan Respon Terhadap Kekemasan Platform Techdeen**

| Tahap Kekemasan | Peratus |
|---|---|
| Ya | 64% |
| Sederhana | 24% |
| Sukar | 12% |

Berdasarkan jadual di atas, secara keseluruhannya peratus menunjukkan bilangan yang positif kerana peratus yang banyak pada Ya untuk bilangan kekemasan.

Berdasarkan dapatan kajian, majoriti responden menilai tahap kekemasan laman web TechDeen berada pada tahap baik, dengan 64% responden menyatakan “Ya”, menunjukkan

bahawa susun atur dan persembahan laman web ini adalah kemas serta teratur. Selain itu, 24% responden menilai tahap kekemasan TechDeen pada tahap sederhana, manakala hanya 12% responden menyatakan tahap kekemasan adalah sukar. Dapatan ini menunjukkan bahawa secara keseluruhannya, reka bentuk dan susun atur TechDeen adalah memuaskan serta mesra pengguna, sekali gus menyokong pengalaman pembelajaran digital yang lebih selesa dan berkesan.

## Rumusan

Dapatan kajian ini secara tuntas membuktikan bahawa platform *TECHDEEN* merupakan inovasi digital yang sangat efektif dalam meningkatkan kefahaman pelajar terhadap subjek Feqah KSSM Tingkatan Lima, dengan pencapaian skor min yang konsisten tinggi antara 4.05 hingga 4.16 bagi setiap tajuk. Berdasarkan saiz sampel 125 responden yang memenuhi kriteria kecukupan mengikut jadual Krejcie & Morgan (1970), majoriti pengguna (45.9%) mengiktiraf platform ini sebagai medium ulang kaji yang unggul bagi pembelajaran kendiri. Keberkesanan interaktif ini selari dengan teori bahawa transformasi multimedia dalam Pendidikan Islam mampu memacu minat serta penguasaan ilmu yang lebih mendalam dalam kalangan pelajar. Tambahan pula, tahap penerimaan positif terhadap kekemasan reka bentuk laman web (64%) menunjukkan bahawa integrasi ICT yang kreatif bukan sahaja menarik perhatian murid, malah mengukuhkan proses pengajaran dan pembelajaran digital secara lebih bersepadu. Kesimpulannya, TECHDEEN berjaya berperanan sebagai platform pembelajaran yang inklusif dan relevan dengan aspirasi pendidikan abad ke-21.

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# INOVASI DIGITAL DALAM PENGAJARAN DAN PEMBELAJARAN (PdP) PENDIDIKAN ISLAM : ANALISIS KEBERKESANAN LAMAN WEB "*MYFIQH LAB*" FIQAH TINGKATAN 2

## *(DIGITAL INNOVATION IN ISLAMIC EDUCATION TEACHING AND LEARNING (PdP): AN ANALYSIS OF THE EFFECTIVENESS OF THE "MYFIQH LAB" WEBSITE FOR FORM 2 FIQH)*

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***Abstrak***: *Kemajuan teknologi digital dalam era Revolusi Industri 4.0 telah mengubah landskap pengajaran dan pembelajaran selaras dengan aspirasi Pelan Pembangunan Pendidikan Malaysia (PPPM) 2013–2025 yang menekankan pengintegrasian ICT dalam PdP. Namun, dalam Pendidikan Islam khususnya Fiqah Tingkatan 2, amalan PdP masih banyak bergantung kepada kaedah tradisional yang kurang interaktif, menyebabkan konsep hukum-hakam yang abstrak sukar difahami oleh pelajar. Oleh itu, kajian ini dijalankan untuk menilai keberkesanan platform pembelajaran digital MyFiqh Lab sebagai bahan bantu mengajar berasaskan web. Pernyataan masalah kajian berfokus kepada kekurangan penggunaan bahan digital interaktif yang menyokong pembelajaran kendiri dan berpusatkan pelajar walaupun tahap literasi digital murid adalah tinggi. Objektif kajian adalah untuk mengenal pasti tahap kebolehgunaan MyFiqh Lab, menilai keberkesanannya dalam meningkatkan kefahaman dan pencapaian pelajar, serta meneliti tahap kepuasan pengguna. Kajian ini menggunakan pendekatan kuantitatif melalui reka bentuk tinjauan dan kuasi-eksperimen pre-test dan post-test yang melibatkan 201 orang pelajar Tingkatan 2 di sebuah Sekolah Berasrama Penuh Integrasi di Terengganu. Instrumen kajian terdiri daripada ujian pra dan pasca serta soal selidik Skala Likert lima mata, manakala data dianalisis secara statistik deskriptif. Dapatan kajian menunjukkan peningkatan prestasi akademik yang signifikan, apabila peratus pelajar*

*berprestasi tinggi meningkat daripada 8% kepada 54%, manakala pelajar berprestasi rendah menurun dengan ketara selepas penggunaan MyFiqh Lab. Selain itu, tahap kebolehgunaan, reka bentuk, kejelasan maklumat dan elemen interaktif platform berada pada tahap tinggi. Kesimpulannya, MyFiqh Lab terbukti berkesan dalam meningkatkan kefahaman, motivasi dan pencapaian pelajar serta berpotensi sebagai platform PdP Pendidikan Islam yang selari dengan keperluan pendidikan abad ke-21.*

***Kata kunci:*** *MyFiqh Lab, Pembelajaran berasaskan web, Pendidikan Islam, Fiqah Tingkatan 2, keberkesanan PdP.*

***Abstract:*** *The advancement of digital technology in the era of the Fourth Industrial Revolution has transformed teaching and learning in line with the Malaysia Education Blueprint (MEB) 2013–2025, which emphasizes ICT integration in education. However, in Islamic Education, particularly Form 2 Fiqh, teaching practices remain largely traditional and less interactive, making abstract jurisprudential concepts difficult for students to understand. This study aims to evaluate the effectiveness of the MyFiqh Lab digital platform as a web-based instructional support tool, addressing the limited use of interactive digital materials despite students' high digital literacy. The objectives are to examine the usability of MyFiqh Lab, its effectiveness in enhancing students' understanding and academic achievement, and users' satisfaction. A quantitative approach was employed using a survey and a quasi-experimental pre-test and post-test design involving 201 Form 2 students from an Integrated Fully Residential School in Terengganu. Data were collected through pre- and post-tests and a five-point Likert scale questionnaire and analysed using descriptive statistics. The findings reveal a significant improvement in academic performance, with high-achieving students increasing from 8% to 54% and low-achieving students decreasing substantially after the use of MyFiqh Lab. The platform's usability, design, clarity of information, and interactivity were rated highly. In conclusion, MyFiqh Lab is effective in enhancing students' understanding, motivation, and academic achievement and shows strong potential as an interactive Islamic Education teaching and learning platform aligned with 21st-century educational needs.*

***Keywords****: MyFiqh Lab, web-based learning, Islamic Education, Form 2 Fiqh, teaching and learning effectiveness.*

## Pengenalan

Kemajuan pesat teknologi digital pada era Revolusi Industri 4.0 telah membawa perubahan besar terhadap proses pengajaran dan pembelajaran di sekolah. Pelaksanaan Pelan Pembangunan Pendidikan Malaysia 2013–2025 (PPPM) menekankan keperluan memantapkan integrasi *Information and Communications Technology* (ICT) dalam Pengajaran dan Pembelajaran (PdP) sebagai usaha meningkatkan kualiti pembelajaran serta menerapkan kemahiran abad ke-21 dalam kalangan murid (KPM, 2013). Hal ini menunjukkan bahawa penggunaan medium digital bukan lagi satu pilihan, sebaliknya menjadi suatu keperluan bagi memastikan penyampaian ilmu lebih relevan dengan keperluan generasi semasa yang celik teknologi. Seiring dengan itu, ICT dilihat sebagai elemen penting dalam pendidikan masa kini dan *e-pembelajaran* telah menjadi amalan biasa dalam kalangan pendidik (Ahmad Saifudin & Hamzah, 2021). Walaupun pendidikan akademik kekal sebagai teras utama, perkembangan pesat teknologi dan tuntutan Revolusi Industri 4.0 menuntut agar sistem pendidikan turut

berubah dan bergerak seiring dengan keperluan era semasa bagi membekalkan pelajar dengan kemahiran yang relevan serta menyokong pelaksanaan Falsafah Pendidikan Kebangsaan secara holistik (Mohd Yusoff et al., 2024).

Pendidikan Islam merupakan mata pelajaran teras bagi semua pelajar beragama Islam di sekolah rendah dan menengah selaras dengan pelaksanaan dalam Kurikulum Standard Sekolah Menengah (KSSM) sejak tahun 2017 yang menekankan penerapan Falsafah Pendidikan Islam bagi melahirkan individu yang holistik dan seimbang. Namun, dalam pengajaran Pendidikan Islam khususnya bidang Fiqah Tingkatan 2, pendekatan tradisional seperti syarahan semata-mata didapati kurang berkesan kerana topik berkaitan hukum-hakam, dalil dan peraturan ibadah sering bersifat abstrak tanpa sokongan bahan visual dan interaktif. Oleh itu, pembangunan laman web Fiqah Tingkatan 2 berfungsi sebagai sumber pembelajaran tambahan yang menyokong PdP di dalam dan luar bilik darjah melalui penyampaian kandungan yang lengkap serta penggunaan elemen visual-interaktif yang menarik sekali gus dapat meningkatkan kemahiran, motivasi dan kefahaman murid terhadap hukum-hakam ibadah.

Walaupun teknologi pendidikan semakin berkembang dan pelajar mempunyai tahap literasi digital yang tinggi, amalan pengajaran dan pembelajaran di bilik darjah masih banyak bergantung kepada kaedah tradisional seperti penggunaan buku teks, slaid *PowerPoint* dan video ringkas yang terhad dari segi interaktiviti. Penggunaan teknologi yang tidak menekankan elemen interaktif ini menyebabkan proses pembelajaran masih berpusatkan guru dan kurang melibatkan pelajar secara aktif. Keadaan tersebut tidak selari dengan keperluan pelajar masa kini yang lebih cenderung kepada pendekatan pembelajaran berasaskan penerokaan, interaksi serta latihan kendiri, sekali gus menjejaskan keberkesanan pembelajaran yang bermakna dan berpusatkan pelajar.

Antara objektif kajian yang ingin dicapai dalam kajian ini adalah untuk; i. mengenal pasti tahap kebolehgunaan *(usability)* laman web *MyFiqh Lab* dalam kalangan pelajar; ii. menilai keberkesanan *MyFiqh Lab* sebagai platform pembelajaran digital dalam meningkatkan kefahaman dan pengalaman pembelajaran pelajar terhadap topik Fiqah; dan iii. mengenal pasti tahap kepuasan pelajar serta aspek penambahbaikan yang diperlukan untuk meningkatkan kualiti *MyFiqh Lab* daripada perspektif pengguna.

## Sorotan Literatur

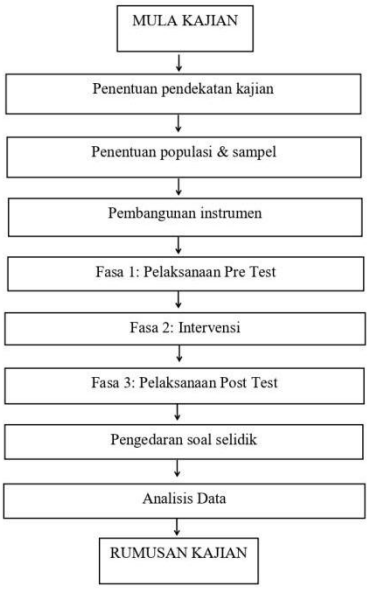
Kajian oleh Sudi, Wazir, dan Mohd (2023) dalam artikel "*Penggunaan Laman Web dan Aplikasi dalam Pengajaran Hadis di Universiti Islam Selangor"* mendapati bahawa laman web pendidikan mempunyai potensi besar sebagai bahan bantu mengajar (BBM) dalam pengajaran agama, khususnya subjek hadis. Kajian ini melibatkan temu bual pensyarah dan analisis penggunaan laman web hadis seperti *Sunnah.com* dan *Maktabah Syamilah Online*. Dapatan menunjukkan bahawa laman web menyediakan akses pantas kepada sumber rujukan autentik, memudahkan pensyarah menyampaikan contoh hadis dengan tepat serta menggalakkan pelajar membuat carian kendiri. Namun, penggunaan laman web sebagai BBM masih tidak menyeluruh kerana sesetengah pensyarah lebih selesa menggunakan kaedah tradisional. Penemuan ini mengukuhkan keperluan platform seperti *MyFiqh Lab* yang direka khusus untuk memudahkan akses, kefahaman dan rujukan fiqah dalam PdP.

Kajian oleh Azman et al. (2025) menerusi artikel "*Digital Teaching Strategies of Islamic Education Teachers"* menekankan bahawa laman web pembelajaran merupakan salah satu strategi digital paling berkesan dalam PdP Pendidikan Islam. Melalui kajian kes di sekolah rendah, penyelidik mendapati bahawa laman web sebagai BBM membolehkan guru menyusun bahan pengajaran secara sistematik, menyediakan latihan kendiri serta memudahkan pemantauan perkembangan pelajar (Azman et al., 2025). Dapatan juga menunjukkan bahawa penggunaan laman web meningkatkan minat dan penglibatan pelajar kerana struktur laman yang interaktif dan mudah dinavigasi. Ini menunjukkan bahawa keberkesanan platform seperti *MyFiqh Lab* bergantung pada reka bentuk antaramuka, kejelasan kandungan fiqah dan kebolehan laman web menyediakan pengalaman pembelajaran yang konsisten.

Dalam artikel "*Strategic Gamification for Religious Learning"*, Zainudin dan Huda (2024) mengulas peranan gamifikasi dan interaktiviti dalam laman web pembelajaran agama. Kajian literatur ini mendapati bahawa laman web yang mengandungi elemen gamifikasi seperti kuiz, skor, tahap pembelajaran dan ganjaran maya dapat meningkatkan motivasi pelajar secara signifikan. Elemen-elemen ini menjadikan pembelajaran agama termasuk fiqah lebih menyeronokkan dan mudah difahami kerana pelajar terlibat secara aktif bukan hanya menerima maklumat secara pasif. Selain itu, kajian menegaskan bahawa keberkesanan laman web pembelajaran agama sangat bergantung kepada ketepatan kandungan serta reka bentuk interaktif yang mematuhi objektif syariah. Dapatan ini sangat relevan kepada pembangunan *MyFiqh Lab*, memandangkan interaktiviti merupakan ciri penting dalam memastikan pelajar benar-benar memahami hukum-hakam fiqah melalui latihan dan simulasi maya.

Sorotan literatur menunjukkan bahawa penggunaan laman web pembelajaran interaktif berupaya meningkatkan penglibatan dan pembelajaran kendiri pelajar dalam Pendidikan Islam. Namun, kajian lepas mendapati penggunaan teknologi masih cenderung bersifat pasif dan bergantung kepada kaedah tradisional (Sudi et al., 2023; Azman et al., 2025). Elemen gamifikasi dikenal pasti berkesan dalam meningkatkan motivasi dan penglibatan pelajar, tetapi penerapannya dalam pembelajaran fiqah secara bersepadu masih terhad (Zainudin & Huda, 2024). Oleh itu, kajian ini dijalankan bagi mengisi jurang tersebut melalui pembangunan platform *MyFiqh Lab* yang menyokong pembelajaran berpusatkan pelajar.

## Metodologi Kajian




**Rajah 1: Carta Alir Metodologi Kajian**

Berdasarkan rajah 1 carta alir metodologi kajian ini menggunakan pendekatan kuantitatif yang menggabungkan reka bentuk kajian tinjauan dan kuasi-eksperimen *pre-test* dan *post-test*. Pendekatan kuantitatif dipilih kerana ia membolehkan penyelidik mengukur pembolehubah secara objektif melalui analisis numerik dan statistik (Creswell, 2014). Kajian tinjauan yang menggunakan instrumen borang soal selidik digunakan bagi mengumpulkan data persepsi pelajar terhadap keberkesanan penggunaan laman web *MyFiqh Lab* manakala reka bentuk *pre-test* dan *post-test* digunakan untuk menilai perubahan pencapaian pelajar sebelum dan selepas intervensi, selaras dengan cadangan Campbell dan Stanley (1963) untuk kajian pendidikan.

Populasi kajian ini terdiri daripada 420 orang pelajar Tingkatan 2 di Sekolah Berasrama Penuh Integrasi (SBPI), Terengganu. Daripada jumlah tersebut, seramai 201 orang pelajar telah dipilih sebagai sampel kajian melalui teknik persampelan bertujuan berdasarkan kesediaan mereka untuk mengikuti sesi PdP menggunakan laman web *MyFiqh Lab*. Pemilihan saiz sampel ini juga adalah munasabah serta selaras dengan cadangan Jadual Saiz Sampel Krejcie dan Morgan (1970) yang menyatakan bahawa populasi melebihi 400 orang memadai dengan sampel sekitar 200 responden. Instrumen soal selidik dipilih kerana membantu mendapatkan maklumat dengan cara cepat, mudah, murah dan cekap daripada sampel yang lebih besar, disamping dapat membantu dalam menghasilkan data mengenai tingkah laku, sikap, kepercayaan, pendapat dan pengetahuan responden (Etikan & Bala, 2017; Visser, Krosnick, Lavrakas & Kim, 2014). Satu set soal selidik digunakan untuk menilai tahap penerimaan, minat, kefahaman dan pengalaman pelajar menggunakan laman web *MyFiqh Lab*. Soal selidik dibina menggunakan Skala Likert lima mata yang diiktiraf sebagai instrumen berkesan untuk mengukur sikap dan persepsi responden (Joshi et al., 2015). Data soal selidik kemudiannya dianalisis menggunakan statistik deskriptif seperti frekuensi, peratus dan min (Chua, 2014). Selain soal selidik, instrumen kajian ini turut melibatkan penggunaan laman web *MyFiqh Lab* sebagai medium pembelajaran utama. Laman web ini dibangunkan sebagai platform PdP berasaskan teknologi yang menyediakan bahan interaktif berkaitan topik fiqah, termasuk penerangan kandungan, latihan, aktiviti pengukuhan serta elemen gamifikasi bagi menyokong pembelajaran kendiri pelajar.

Prosedur pelaksanaan kajian ini melibatkan tiga fasa utama bermula dengan pre-test diikuti intervensi melalui penggunaan laman web *MyFiqh Lab* dan diakhiri dengan *post-test* serta pengedaran soal selidik. Pada peringkat awal, para pelajar diminta menjawab *pre-test* bagi menentukan tahap asas pengetahuan mereka sebelum intervensi dijalankan bertujuan menetapkan garis asas untuk membandingkan tahap pencapaian sebelum dan selepas penggunaan laman web. Setelah *pre-test* selesai, intervensi pembelajaran dilaksanakan melalui penggunaan laman web *MyFiqh Lab*. Pelajar diberi peluang meneroka bahan pembelajaran, nota digital, latihan interaktif dan aktiviti yang disediakan bertujuan membantu meningkatkan kefahaman dan prestasi pelajar. Pada fasa seterusnya, pelajar menjawab *post-test* selepas selesai tempoh intervensi untuk mengukur tahap peningkatan pencapaian pelajar serta menilai keberkesanan platform sebagai bahan sokongan PdP digital. Seterusnya, satu set soal selidik diedarkan secara fizikal bagi mendapatkan maklum balas pelajar tentang persepsi mereka terhadap keberkesanan laman web tersebut. Semua langkah ini dilaksanakan secara teratur untuk memastikan kesahan dan kebolehpercayaan proses pengumpulan data.

Analisis perbandingan skor digunakan untuk mengenal pasti magnitud perubahan pencapaian dan kesan intervensi terhadap pemahaman pelajar. Keseluruhan proses analisis ini membolehkan penyelidik membuat interpretasi menyeluruh mengenai keberkesanan laman web sebagai alat PdP digital dalam topik Fiqah Tingkatan 2.

## Dapatan Kajian dan Perbincangan

Dapatan soal selidik melibatkan 201 orang pelajar yang dipilih sebagai sampel kajian menunjukkan penerimaan yang sangat positif terhadap penggunaan platform *MyFiqh Lab* sebagai medium pembelajaran fiqah. Majoriti responden bersetuju bahawa pembelajaran menggunakan laman web ini lebih menarik berbanding kaedah tradisional. Elemen interaktif seperti kuiz, glosari dan nota ringkas membantu meningkatkan kefahaman pelajar terhadap konsep-konsep asas fiqah.

Selain itu, responden menilai rekabentuk laman web sebagai jelas, tersusun dan mesra pengguna menjadikannya sesuai untuk pembelajaran kendiri. Kemudahan navigasi dan penyampaian maklumat yang ringkas memudahkan pelajar mengakses kandungan pada bila-bila masa tanpa bimbingan langsung daripada guru. Secara keseluruhannya, dapatan soal selidik membuktikan bahawa *MyFiqh Lab* diterima baik dan memberi pengalaman pembelajaran yang lebih efektif dan menarik.

**Jadual 1: Analisis *Pre-Test* dan *Post-Test***

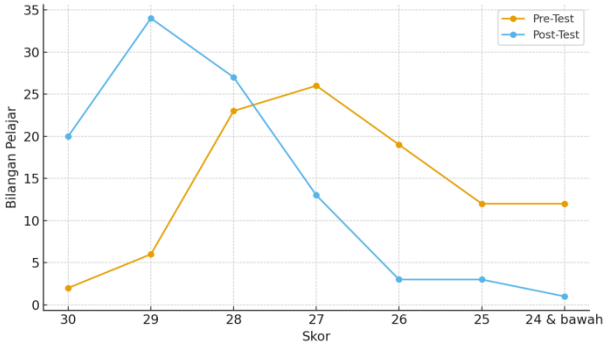
| Skor | *Pre-Test* (n) | *Post-Test* (n) |
|---|---|---|
| 30 | 4 | 40 |
| 29 | 12 | 68 |
| 28 | 46 | 54 |
| 27 | 52 | 26 |
| 26 | 38 | 6 |
| 25 | 24 | 6 |
| 24 & bawah | 24 | 0–2 |

Analisis prestasi pelajar berdasarkan pre-test dan post-test menunjukkan peningkatan yang jelas selepas penggunaan MyFiqh Lab. Dalam pre-test, bilangan pelajar yang memperoleh markah tinggi adalah rendah, iaitu hanya 2% bagi skor 30 dan 6% bagi skor 29. Namun selepas mengikuti sesi pembelajaran menggunakan platform web tersebut, bilangan pelajar yang mencapai skor tertinggi meningkat secara mendadak kepada 40% (skor 30) dan 34% (skor 29). Peningkatan ini menunjukkan lonjakan kumpulan markah tinggi daripada 8% kepada 54%, satu perubahan signifikan dalam konteks pembelajaran bilik darjah. Seterusnya, bilangan pelajar yang memperoleh markah rendah (24 markah dan ke bawah) menurun secara drastik daripada 12% kepada hanya 1% dalam post-test. Analisis juga mendapati bahawa hanya 5% pelajar mengekalkan markah yang sama manakala selebihnya menunjukkan peningkatan dalam pelbagai tahap.

Analisis terhadap perubahan skor menunjukkan perkembangan yang sangat memberangsangkan dalam prestasi pelajar selepas menggunakan platform pembelajaran *MyFiqh Lab*. Data memperlihatkan peningkatan yang ketara dalam bilangan pelajar yang memperoleh markah tinggi, iaitu dalam julat 29 hingga 30 daripada hanya 8% pada awalnya kepada 54% selepas penggunaan platform tersebut. Peningkatan ini jelas menunjukkan bahawa lebih ramai pelajar mampu mencapai prestasi cemerlang dalam subjek yang dipelajari.

Selain itu, bilangan pelajar yang tergolong dalam kategori markah rendah hampir berkurangan kepada sifar menandakan bahawa hampir tiada pelajar yang gagal menunjukkan pemahaman asas selepas menggunakan *MyFiqh Lab*. Keadaan ini sangat positif kerana ia menunjukkan bahawa platform tersebut tidak hanya membantu pelajar yang sudah kuat tetapi juga berjaya mengangkat mereka yang sebelum ini mungkin kurang menguasai topik. Menariknya, hanya sekitar 5% pelajar mengekalkan markah yang sama sebelum dan selepas penggunaan platform menunjukkan bahawa kebanyakan pelajar mengalami peningkatan dalam pemahaman dan pencapaian mereka. Ini memperkukuhkan lagi wujudnya kesan positif dan signifikan dari penggunaan *MyFiqh Lab* sebagai alat pembelajaran.

Secara keseluruhannya, perubahan skor ini membuktikan bahawa *MyFiqh Lab* bukan sekadar satu medium pembelajaran biasa tetapi ia mampu membantu pelajar memahami konsep dengan lebih baik sekali gus meningkatkan prestasi akademik mereka secara menyeluruh. Platform ini ternyata menjadi satu alat yang berkesan untuk membantu pelajar mencapai potensi maksimum dalam pembelajaran mereka.




**Rajah 2: Graf Perbandingan Skor *Pre-Test* dan *Post-Test***

Keputusan graf perbandingan skor *pre-test* dan *post-test* menunjukkan bahawa pencapaian pelajar meningkat ketara selepas penggunaan laman web *MyFiqh Lab*. Pelajar dengan skor

tinggi meningkat manakala pelajar dengan skor rendah menurun, menunjukkan bahawa platform ini berkesan dalam membantu pelajar mempelajari subjek fiqah yang sebelum ini dianggap rumit dan abstrak. Corak perubahan ini menggambarkan bahawa intervensi berasaskan laman web telah berjaya meningkatkan penguasaan konsep fiqah dalam kalangan murid Tingkatan 2 seiring dengan dapatan kajian yang menunjukkan penggunaan laman web Pendidikan Islam mampu meningkatkan skor *post-test* secara signifikan berbanding kaedah tradisional semata-mata.

Dalam perbincangan, dapatan ini mengukuhkan hasrat Matlamat PPPM 2013–2025 yang menekankan penggunaan *Information and Communications Technology* (ICT) untuk meningkatkan kualiti pembelajaran dan menyediakan pelajar dengan kemahiran yang relevan dalam era digital, disokong oleh pola peningkatan skor ini. Kajian terdahulu menunjukkan bahawa laman web dan elemen gamifikasi dalam Pendidikan Islam boleh meningkatkan motivasi dan penglibatan pelajar serta kefahaman mereka tentang kandungan abstrak seperti hukum-hakam fiqah. Hasil penggunaan *MyFiqh Lab* telah membantu pelajar meningkatkan markah mereka.

Bahagian ini akan meneliti analisis min dan sisihan piawai untuk setiap konstruk yang dinilai melalui soal selidik. Jadual 2 memaparkan tahap kebolehgunaan dan kekerapan penggunaan laman web *MyFiqh Lab* oleh pelajar, serta pandangan mereka mengenai bagaimana ia boleh dipertingkatkan.

**Jadual 2: Analisis Min dan Sisihan Piawai Soal Selidik**

| Konstruk | Min | SP | Interprestasi |
|---|---|---|---|
| Kemudahan Penggunaan Laman Web | 4.45 | 0.65 | Sangat Tinggi |
| Kekerapan Pelajar Menggunakan Laman Web | 3.19 | 0.97 | Sederhana Tinggi |
| Cadangan | 4.84 | 0.79 | Sangat Tinggi |

Secara keseluruhan, min bagi konstruk kemudahan penggunaan laman web dan cadangan penambahbaikan berada pada tahap sangat tinggi manakala kekerapan pelajar menggunakan laman web berada pada tahap sederhana tinggi. Dapatan ini menunjukkan pelajar merasakan *MyFiqh Lab* mudah untuk digunakan dan mempunyai potensi untuk dipertingkatkan, dan mereka ada mencadangkan beberapa penambahbaikan untuk menjadikan laman web ini lebih baik.




**Rajah 3: Penilaian Pelajar terhadap Reka Bentuk Laman Web *MyFiqh Lab***

Berdasarkan Rajah 3, kebanyakan pelajar memberikan penilaian yang baik untuk reka bentuk laman web *MyFiqh Lab*. Seramai 86 pelajar (42.6%) memilih skala 4 dan 98 pelajar (48.5%) memilih skala 5. Hanya 18 pelajar (8.9%) memilih skala 3 dan tiada pelajar yang memberikan skala 1 atau 2. Ini menunjukkan bahawa reka bentuk laman web ini umumnya dianggap menarik, teratur dan memenuhi keperluan pengguna.

Keputusan ini selari dengan dapatan sorotan literatur yang menekankan betapa pentingnya reka bentuk laman web pendidikan yang tersusun dan mudah digunakan untuk membantu proses PdP yang menggunakan teknologi. Reka bentuk yang teratur memudahkan pelajar untuk mendapatkan bahan-bahan seperti teks, grafik, video dan kuiz dalam satu tempat. Ini sejajar dengan dapatan kajian oleh Sudi et al., (2023) tentang kepentingan laman web agama yang memudahkan rujukan sahih kepada hadis dan fiqah. Ia juga menyokong pendapat Rusli et al., (2021) bahawa penggunaan multimedia dan platform digital yang dirancang dengan baik boleh meningkatkan minat serta perhatian pelajar berbanding Bahan Bantu Mengajar (BBM) tradisional yang kurang interaktif.




**Rajah 4: Penilaian Pelajar terhadap Maklumat di Laman Web *MyFiqh Lab***

Rajah 4 memaparkan tanggapan positif pelajar tentang kejelasan dan kepadatan maklumat dalam *MyFiqh Lab*. Majoriti pelajar, iaitu 88 orang (43.6%) memberi skor 4 dan 94 orang (46.5%) memberi skor tertinggi, iaitu 5. Hanya 20 orang (9.9%) memilih skala 3. Tiada pelajar yang memberikan skala 1 atau 2. Data ini membuktikan pelajar berpendapat kandungan *MyFiqh Lab* mudah difahami, efektif dan menyampaikan maklumat utama dengan ringkas dan terarah.

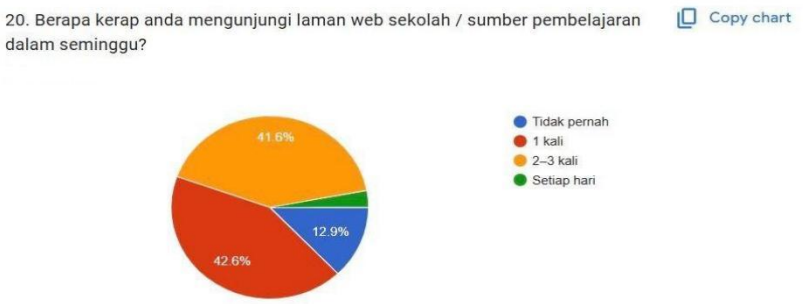
Dapatan kajian menunjukkan bahawa tahap kefahaman dan penerimaan pelajar terhadap *MyFiqh Lab* selari dengan kajian terdahulu yang membuktikan laman web pendidikan berkesan sebagai bahan bantu mengajar dalam Pendidikan Islam kerana menyediakan akses pantas, kandungan tersusun dan menyokong pembelajaran kendiri (Sudi et al., 2023; Azman et al., 2025). Selain itu, kajian literatur turut menegaskan bahawa elemen interaktiviti dan strategi digital seperti gamifikasi mampu meningkatkan motivasi serta penglibatan pelajar dalam pembelajaran agama secara lebih aktif dan bermakna (Zainudin & Huda, 2024). Justeru, dapatan ini mengukuhkan bahawa *MyFiqh Lab* berpotensi menjadi platform sokongan PdP fiqah yang efektif dan relevan dengan keperluan pedagogi digital semasa.




**Rajah 5: Tahap Kesediaan Pelajar Mengesyorkan Laman Web kepada Rakan Lain**

Rajah 5 menunjukkan bahawa kebanyakan pelajar cenderung untuk mencadangkan laman web *MyFiqh Lab* kepada rakan kelas lain. Graf menunjukkan tiada pelajar yang memilih skala 1, dan hanya 2 orang (1%) memilih skala 2. Sebanyak 28 orang (13.9%) memilih skala 3, 98 orang (48.5%) memilih skala 4 dan 74 orang (36.6%) memilih skala 5. Respon cenderung berkumpul pada skala tinggi (4 dan 5), yang menunjukkan pelajar berpuas hati dan bersedia untuk mencadangkan laman web ini sebagai BBM.

Dapatan ini menyokong naratif kajian Sudi et al., (2023) yang menyatakan bahawa laman web pendidikan mempunyai potensi besar sebagai BBM yang berkesan kerana keupayaannya memudahkan akses kepada rujukan sahih serta menggalakkan budaya pembelajaran kendiri. Kesediaan pelajar untuk mencadangkan platform ini juga menunjukkan bahawa *MyFiqh Lab* berjaya memenuhi keperluan pembelajaran interaktif yang seringkali terhad dalam penggunaan BBM tradisional seperti buku teks dan slaid *PowerPoint* sebagaimana yang dibangkitkan oleh Rusli et al., (2021). Selain itu, maklum balas positif ini selari dengan pandangan Azman et al., (2025) bahawa strategi digital yang sistematik dan mudah dinavigasi dapat meningkatkan penglibatan pelajar secara aktif. Hal ini turut mengukuhkan hujah Zainudin dan Huda (2024) bahawa integrasi elemen interaktif dalam laman web pembelajaran agama berupaya meningkatkan motivasi pelajar, sekali gus mengubah corak pembelajaran daripada pasif kepada pengalaman digital yang lebih bermakna.




**Rajah 6: Kekerapan Pelajar Mengunjungi Laman Web dalam Seminggu**

Rajah 6 menunjukkan kekerapan pelajar mengunjungi laman web sekolah atau sumber pembelajaran setiap minggu. Carta pai menunjukkan kebanyakan pelajar mengunjungi laman web itu 2–3 kali seminggu (41.6%) dan ramai juga yang mengunjungi sekali seminggu (42.6%). Hanya sebilangan kecil sahaja yang tidak pernah mengunjungi dan ada juga yang mengaksesnya setiap hari. Ini menunjukkan bahawa laman web tersebut digunakan sebagai sumber pembelajaran tetapi tidaklah begitu kerap dan bukan amalan harian biasa bagi kebanyakan pelajar.

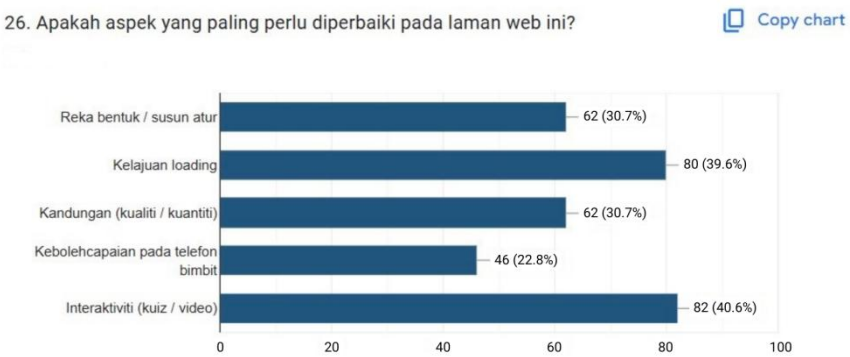
Dapatan ini menunjukkan wujudnya jurang dalam konsistensi penggunaan teknologi digital seperti yang dibincangkan oleh Sudi et al., (2023), di mana penggunaan platform dalam talian sebagai bahan bantu mengajar (BBM) masih belum menyeluruh kerana faktor keselesaan terhadap kaedah tradisional. Kekerapan akses yang tidak konsisten ini secara tidak langsung mengehadkan potensi teknologi untuk menjadikan proses PdP lebih dinamik dan interaktif, seperti yang ditekankan oleh Rusli et al., (2021). Namun begitu, menurut Azman et al. (2025), penggunaan laman web yang sistematik sebenarnya mampu meningkatkan minat dan penglibatan pelajar jika bahan pengajaran disusun dengan jelas. Oleh itu, pembangunan *MyFiqh Lab* dilihat sebagai solusi yang kritikal untuk menarik perhatian pelajar agar lebih kerap mengakses sumber digital. Dengan mengintegrasikan elemen interaktiviti dan strategi gamifikasi seperti yang dicadangkan oleh Zainudin dan Huda (2024), *MyFiqh Lab* berupaya mengubah persepsi pelajar daripada melihat laman web sebagai rujukan sampingan kepada satu keperluan pembelajaran harian yang menyeronokkan dan bermakna.




**Rajah 7: Purata Tempoh Masa Lawatan Pelajar ke Laman Web**

Rajah 7 memaparkan tempoh purata masa yang dihabiskan pelajar untuk melayari laman web dalam satu-satu lawatan. Majoriti pelajar berada dalam julat 4–7 minit (29.7%) dan 8–15 minit (26.7%), diikuti kumpulan yang meluangkan lebih 15 minit (28.7%), manakala hanya segelintir yang menghabiskan kurang daripada 3 minit. Ini menunjukkan bahawa sebahagian besar pelajar tidak sekadar melayari secara ringkas tetapi meluangkan masa sederhana hingga panjang untuk meneliti kandungan laman web.

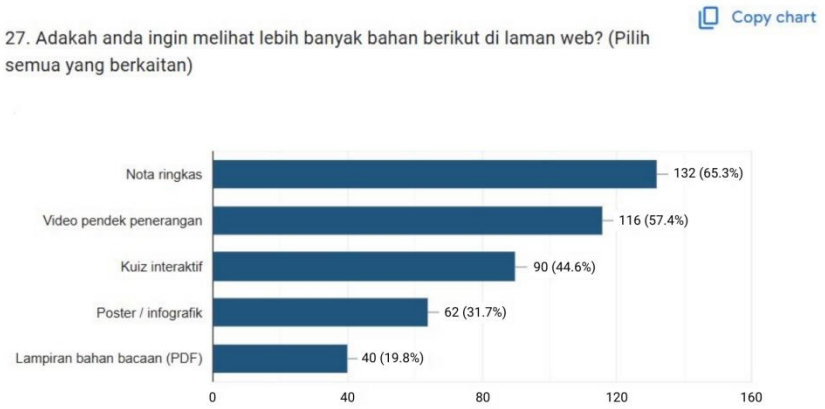
Majoriti pelajar meluangkan masa sederhana hingga panjang untuk melayari laman web menunjukkan mereka benar-benar meneliti kandungan dan bukan sekadar melayari secara sepintas lalu. Dapatan ini selari dengan sorotan literatur yang menyatakan bahawa laman web pendidikan yang tersusun, relevan dan interaktif mampu mengekalkan penglibatan pelajar serta menggalakkan pembelajaran kendiri (Azman et al., 2025). Selain itu, elemen interaktiviti dalam laman web turut membantu mengekalkan fokus dan motivasi pelajar dalam pembelajaran agama (Zainudin & Huda, 2024). Hal ini membuktikan bahawa *MyFiqh Lab* berpotensi berfungsi sebagai platform pembelajaran fiqah yang bermakna dan berkesan.




**Rajah 8: Aspek Laman Web yang Perlu Diperbaiki Mengikut Pandangan Pelajar**

Rajah 8 menunjukkan aspek yang paling perlu diperbaiki pada laman web *MyFiqh Lab*. Aspek interaktiviti (kuiz/video) mencatat peratusan tertinggi sebanyak 40.6%, diikuti kelajuan *loading* (39.6%), manakala rekabentuk / susun atur dan kandungan (kualiti/ kuantiti) masing-masing mencapai 30.7%, dan kebolehcapaian pada telefon bimbit mencatat 22.8%. Ini menunjukkan pelajar menilai laman web *MyFiqh Lab* secara kritikal dan menekankan kepentingan pengalaman pengguna yang lancar dan interaktif selain aspek estetika dan kandungan.

Dapatan kajian menunjukkan pelajar *MyFiqh Lab* menekankan kepentingan interaktiviti dan pengalaman pengguna dalam laman web pembelajaran fiqah. Kuiz dan video interaktif dianggap paling perlu diperbaiki, sejajar dengan kajian yang mendapati aplikasi pembelajaran interaktif dapat meningkatkan motivasi dan penglibatan pelajar kerana mereka terlibat secara aktif dalam proses pembelajaran (Zaini & Razak, 2022). Selain itu, aspek kebolehcapaian melalui peranti mudah alih dan prestasi antaramuka yang lancar turut penting bagi memastikan pengalaman pengguna positif dan konsisten (Ajang & Yasin, 2024). Oleh itu, penambahbaikan *MyFiqh Lab* perlu memberi tumpuan bukan sahaja kepada kandungan tetapi juga interaktiviti, reka bentuk pengalaman pengguna dan kebolehcapaian teknikal.




**Rajah 9: Jenis Bahan Tambahan yang Dikehendaki Murid di Laman Web**

Rajah 9 memaparkan jenis bahan yang pelajar ingin lihat lebih banyak di laman web *MyFiqh Lab*. Nota ringkas merupakan pilihan tertinggi (65.3%), diikuti video pendek penerangan (57.4%), kuiz interaktif (44.6%), poster/infografik (31.7%) dan lampiran bahan bacaan (PDF) (19.8%). Jelas bahawa pelajar mengutamakan bahan yang ringkas, visual dan interaktif berbanding dokumen panjang seperti *Portable Document Format* (PDF).

Dapatan menunjukkan bahawa pelajar yang menggunakan *MyFiqh Lab* lebih cenderung kepada bahan pembelajaran yang ringkas, visual dan interaktif berbanding dokumen panjang seperti PDF. Keutamaan ini sejajar dengan sorotan literatur yang menekankan bahawa penggunaan bahan yang interaktif dan mudah difahami meningkatkan penglibatan serta motivasi pelajar dalam pembelajaran agama (Azman et al., 2025). Oleh itu, *MyFiqh Lab* perlu memberi fokus kepada penghasilan nota fiqh yang padat, video penerangan pendek dan kuiz interaktif agar benar-benar menyokong keperluan murid Tingkatan 2 SBPI Terengganu dan menutup jurang BBM yang kurang tersusun serta kurang interaktif di sekolah.

Cadangan utama menekankan keperluan memperkukuh penggunaan *MyFiqh Lab* sebagai platform PdP dengan menambah baik kandungan interaktif memastikan sokongan teknikal yang berterusan serta meningkatkan latihan guru agar mereka lebih mahir menggunakan bahan digital secara efektif. Selain itu, penambahbaikan dari segi reka bentuk mesra pengguna, kepelbagaian aktiviti dan integrasi elemen gamifikasi turut dicadangkan bagi meningkatkan pengalaman pembelajaran pelajar. Kajian lanjutan juga disarankan untuk menilai keberkesanan platform ini dalam jangka panjang serta meneroka penggunaannya dalam konteks sekolah dan tahap pembelajaran yang berbeza.

## Kesimpulan

Secara keseluruhannya, dapatan kajian ini membuktikan bahawa penggunaan platform *MyFiqh Lab* memberi impak yang sangat positif terhadap pembelajaran fiqah dalam kalangan pelajar Tingkatan 2, sama ada dari aspek penerimaan, kefahaman mahupun pencapaian akademik. Analisis soal selidik menunjukkan tahap kebolehgunaan, reka bentuk dan kejelasan maklumat berada pada tahap tinggi, manakala analisis *pre-test* dan *post-test* pula memperlihatkan peningkatan prestasi yang signifikan dengan pengurangan ketara pelajar berprestasi rendah dan peningkatan besar pelajar berprestasi tinggi. Corak penggunaan laman web, tempoh lawatan

serta kesediaan pelajar untuk mengesyorkan *MyFiqh Lab* mengukuhkan lagi bahawa platform ini berkesan sebagai bahan bantu mengajar digital yang menyokong pembelajaran kendiri, interaktif dan berpusatkan pelajar. Walaupun kekerapan penggunaan masih berada pada tahap sederhana tinggi, dapatan ini menunjukkan potensi besar *MyFiqh Lab* untuk dimantapkan melalui penambahbaikan interaktiviti, kebolehcapaian dan sokongan pedagogi. Justeru, *MyFiqh Lab* bukan sahaja selari dengan hasrat PPPM 2013–2025 dalam memperkasa penggunaan ICT, malah berupaya menjadi satu medium PdP Pendidikan Islam yang sistematik, menarik dan efektif dalam meningkatkan penguasaan konsep fiqah secara menyeluruh.

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# KEBERKESANAN INTEGRASI SIRAH4TEENS DALAM PENGAJARAN DAN PEMBELAJARAN PENDIDIKAN ISLAM TINGKATAN 2

# EFFECTIVENESS OF INTEGRATING SIRAH4TEENS IN THE TEACHING AND LEARNING OF ISLAMIC EDUCATION FOR FORM 2 STUDENTS

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***Abstrak:*** *Kajian ini menilai keberkesanan laman web sirah4teens sebagai bahan bantu mengajar digital bagi topik sirah tingkatan dua. laman web ini dibangunkan untuk menyediakan pengalaman pembelajaran yang interaktif dan selaras dengan keperluan pdp berasaskan teknologi. kajian dijalankan secara gabungan kuantitatif dan kualitatif melibatkan 136 orang responden di SMKA Negeri Terengganu yang mengikuti sesi pembelajaran menggunakan Sirah4Teens. data dikumpulkan melalui soal selidik yang mengukur tahap kefahaman sebelum dan selepas intervensi serta persepsi responden terhadap reka bentuk dan kebolehgunaan laman web. dapatan menunjukkan bahawa 78.5% pelajar memahami kandungan sirah dengan lebih baik selepas menggunakan Sirah4Teens. kejelasan susun atur, penerangan yang ringkas dan penggunaan elemen multimedia dikenal pasti sebagai faktor utama keberkesanan. secara keseluruhan, Sirah4Teens terbukti sebagai platform pdp digital yang berpotensi untuk dikembangkan di peringkat sekolah-sekolah nasional bagi meningkatkan kualiti pembelajaran pendidikan islam.*

***Kata Kunci:*** *Sirah Tingkatan Dua, Sirah4Teens, PdP Digital, Kefahaman Pelajar, Bahan Bantu Mengajar Interaktif.*

***Abstract:*** *This study evaluates the effectiveness of the Sirah4Teens website as a digital teaching aid for the Form Two Sirah topic. The website was developed to provide an interactive learning*

*experience that aligns with technology-based teaching and learning requirements. The study employed a mixed-methods approach, combining quantitative and qualitative methods, and involved 136 respondents from SMKA Negeri Terengganu who participated in learning sessions using Sirah4Teens. Data were collected through questionnaires that measured students' levels of understanding before and after the intervention, as well as their perceptions of the website's design and usability. The findings indicate that 78.5% of students demonstrated improved understanding of Sirah content after using Sirah4Teens. Clear layout, concise explanations, and the use of multimedia elements were identified as the main factors contributing to its effectiveness. Overall, Sirah4Teens has proven to be a promising digital teaching and learning platform with potential for expansion at the national school level to enhance the quality of Islamic Education learning.*

***Keywords:*** *Form Two Sirah, Sirah4Teens, Digital Learning, Technology-Enhanced Pedagogy, Student Comprehension, Interactive Educational Tools.*

## 1. Pengenalan

Perkembangan teknologi maklumat dan komunikasi telah membawa perubahan signifikan dalam landskap pendidikan. Pendidikan abad ke-21 menuntut pengajaran yang bukan sahaja menyampaikan fakta tetapi juga memupuk kemampuan kritis, pemikiran historis dan literasi digital dalam kalangan pelajar. Dalam Pendidikan Islam, subjek Sirah Nabawiyah menuntut pelajar memahami urutan peristiwa, konteks sejarah dan nilai moral aspek yang sering sukar dicapai sekiranya pendekatan pengajaran masih bergantung kepada hafalan semata-mata.

Sirah4Teens dikembangkan sebagai satu respons kepada cabaran ini dengan menyediakan bahan berbentuk multimedia yang padat dan interaktif. Platform ini direka bagi memudahkan pemahaman kronologi, mengaktifkan recall melalui kuiz dan menyampaikan maklumat dalam bentuk visual yang meminimumkan beban kognitif. Kajian ini bertujuan menilai impak penggunaan Sirah4Teens ke atas kefahaman pelajar Tingkatan Dua serta menilai penerimaan pengguna terhadap aspek kebolehgunaan dan kualiti kandungan.

## 2. Kajian Literatur

Kajian-kajian terdahulu menunjukkan bahawa pembelajaran berasaskan multimedia dan web menyumbang kepada peningkatan motivasi, penglibatan dan pencapaian pelajar apabila direka dengan prinsip pedagogi yang kukuh (Mayer, 2009; Sweller, 2011). Dalam konteks mata pelajaran sejarah dan agama, penggunaan visualisasi kronologi, penceritaan berstruktur dan latihan berulang (retrieval practice) dilaporkan membantu pembentukan peta mental dan pengekalan maklumat (Ghazali & Ismail, 2020; Musa & Che Cob, 2022). Namun demikian, literatur turut menekankan bahawa keberkesanan teknologi bergantung kepada kualiti reka bentuk instruksional, pengurusan beban kognitif, serta kebolehcapaian dan kebolehgunaan antaramuka (Rahman & Abdul Razak, 2021). Sokongan guru sebagai fasilitator juga dikenal pasti sebagai faktor penting dalam memastikan aplikasi teknologi memberi impak pedagogi yang sebenar. Oleh itu, kajian ini tidak sahaja mengukur prestasi tetapi juga mengambil kira persepsi pengguna untuk memahami aspek penerimaan dan cabaran pelaksanaan.

## 3. Objektif Kajian

Kajian ini bertujuan untuk menilai keberkesanan penggunaan platform Sirah4Teens dalam menyokong pengajaran dan pembelajaran Sirah bagi pelajar Tingkatan Dua, di samping melibatkan guru dan orang awam sebagai responden sokongan. Secara khusus, kajian ini menumpukan kepada penilaian impak penggunaan Sirah4Teens terhadap tahap kefahaman responden melalui perbandingan skor ujian pra dan pasca bagi mengenal pasti perubahan serta peningkatan pembelajaran yang berlaku selepas intervensi. Selain itu, kajian ini turut mengkaji persepsi responden terhadap platform Sirah4Teens dari aspek kebolehgunaan, kejelasan penyampaian kandungan serta nilai instruksional yang ditawarkan dalam menyokong proses pembelajaran. Di samping itu, kajian ini bertujuan mengenal pasti elemen-elemen dalam platform yang menyumbang kepada peningkatan kefahaman dan penglibatan pembelajaran, serta mengenal pasti aspek-aspek tertentu yang memerlukan penambahbaikan bagi meningkatkan keberkesanan dan kualiti platform sebagai bahan bantu mengajar digital.

## 4. Metodologi

### *4.1 Reka Bentuk Kajian*

Kajian menggunakan reka bentuk kuasi-eksperimen pra–pasca yang digabungkan dengan tinjauan deskriptif bagi mengumpul data kuantitatif dan sedikit data kualitatif melalui item terbuka.

### *4.2 Sampel dan Prosedur*

Seratus (n = 210) pelajar Tingkatan Dua, guru dan orang awam daripada sebuah SMKA di Terengganu dipilih secara purposive berdasarkan kriteria akses makmal komputer dan kesesuaian silibus. Semua peserta menerima taklimat ringkas mengenai tujuan kajian dan prosedur; persetujuan sekolah dan ibu bapa diperoleh mengikut keperluan etika penyelidikan. Sesi intervensi dijalankan di makmal komputer dengan pengawasan guru bertanggungjawab.

### *4.3 Intervensi Sirah4Teens*

Platform mengandungi modul bertema yang merangkumi: video animasi ringkas (3–7 minit) yang memaparkan kronologi peristiwa, infografik ringkas yang merumuskan fakta penting, dan kuiz interaktif objektif yang memberikan maklum balas segera. Antara muka direka ringkas, dengan navigasi yang jelas dan indikator kemajuan bagi setiap modul.

### *4.4 Instrumen Pengukuran*

i. Ujian pra dan pasca: dua set soalan objektif yang setara dari segi aras kognitif dan kandungan, dibangunkan untuk mengukur pemahaman dan hubungan sebab-akibat.
ii. Soal selidik persepsi: instrumen Likert 5 mata menilai aspek kebolehgunaan (usability), kejelasan kandungan, dan kepuasan pembelajaran; disertakan juga beberapa item terbuka untuk maklum balas kualitatif.
iii. Kebolehpercayaan instrumen diuji secara dalaman melalui ujian rintang (pilihan instrumen sedia ada atau diuji alpha jika perlu).

**Jadual 1: Menerangkan Interpretasi Skor Min**

| Julat Skor Min | Tahap Interpretasi |
|---|---|
| 1.00 - 2.33 | Rendah |
| 2.34 - 3.66 | Sederhana |
| 3.67 - 5.00 | Tinggi |

Berdasarkan Jadual 1 diatas skor min digunakan bagi menentukan tahap kefahaman dan keberkesanan Sirah4Teens berdasarkan persepsi responden. Semakin tinggi skor min, semakin tinggi tahap keberkesanan dan penerimaan terhadap laman web Sirah4Teens sebagai platform pembelajaran digital.

### 4.5 Prosedur Pengumpulan Data

Prosedur pengumpulan data dimulakan dengan responden menjalani ujian pra yang berfungsi sebagai ukuran awal atau garis dasar bagi menilai tahap kefahaman sedia ada sebelum intervensi dijalankan. Seterusnya, selepas diberikan taklimat ringkas berkaitan penggunaan platform, responden diberi masa kira-kira 60 minit untuk meneroka dan menggunakan modul-modul pembelajaran yang telah ditetapkan dalam Sirah4Teens. Setelah sesi penggunaan platform selesai, responden dikehendaki menjawab ujian pasca bagi mengukur perubahan tahap kefahaman selepas intervensi, di samping melengkapkan soal selidik persepsi bagi menilai pandangan mereka terhadap kebolehgunaan, kejelasan kandungan dan keberkesanan keseluruhan platform Sirah4Teens.

## 5.0 Analisis dan Dapatan

Dapatan kajian yang diperoleh adalah berdasarkan objektif kajian yang dinyatakan sebelum ini. Soal selidik diedarkan kepada 210 orang responden yang terdiri daripada pelbagai jenis. Seramai 136 orang responden terlibat sebagai sampel dalam kajian ini, yang terdiri daripada pelajar Tingkatan 2 guru dan orang awam. Analisis yang dilakukan berdasarkan item-item yang ditemui di dalam soal selidik mengikut bahagian A, bahagian B, bahagian C dan bahagian D.

### 5.1 Analisis dapatan kajian Bahagian A: Demografi

Bahagian ini melaporkan analisis demografi responden yang terdiri daripada pelbagai jenis responden.

**Jadual 2: Menerangkan Taburan responden**

| Jenis Responden | Jumlah | Peratus |
|---|---|---|
| Pelajar | 116 Orang | 85.29% |
| Guru | 14 Orang | 10.29% |
| Orang Awam | 6 Orang | 4.41% |

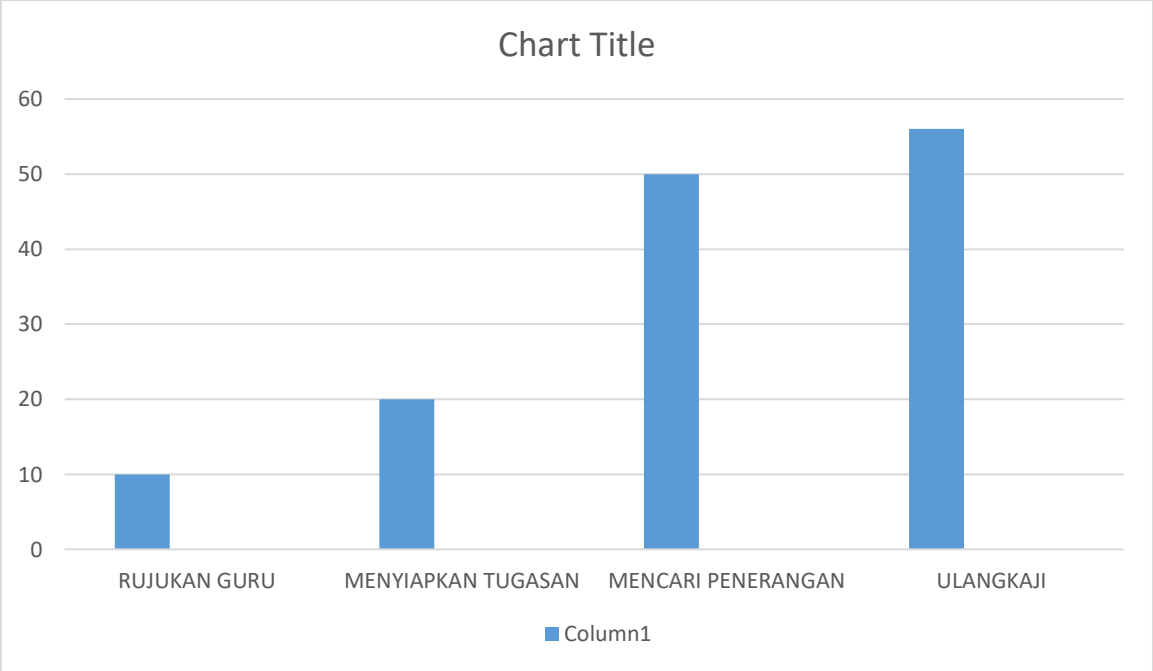
Jadual 2 menunjukkan responden pelajar, guru dan orang awam

Berdasarkan jadual taburan responden, majoriti responden kajian terdiri daripada pelajar iaitu seramai 116 orang (85.29%), diikuti oleh guru seramai 14 orang (10.29%) dan orang awam

seramai 6 orang (4.41%). Dapatan ini menunjukkan bahawa golongan pelajar merupakan kumpulan sasaran utama yang terlibat secara langsung dalam penggunaan laman web.

### 5.2 Analisis dapatan kajian Bahagian B: Mengenalpasti tujuan utama menggunakan Sirah4Teens

Graf 1 menunjukkan tujuan utama penggunaan platform Sirah4Teens




Berdasarkan graf 1 tujuan penggunaan laman web Sirah4teens, majoriti responden menggunakan platform ini sebagai medium ulang kaji pelajaran iaitu seramai 56 orang (48.52%). Dapatan ini menunjukkan bahawa Sirah4teens berperanan sebagai sumber sokongan pembelajaran yang membantu pelajar mengukuhkan kefahaman terhadap topik Sirah yang dipelajari. Selain itu, seramai 50 orang responden (36.76%) menggunakan Sirah4teens untuk mencari penerangan ringkas setiap tajuk, manakala 20 orang responden (14.70%) menggunakannya untuk menyiapkan tugasan kerja kursus dan 10 orang responden (7.35%) sebagai rujukan guru.

### 5.3 Analisis dapatan kajian Bahagian C: Mengkaji tahap kefahaman bagi setiap subtopik di dalam bab Sirah Tingkatan 2 oleh responden

**Jadual 3 Menerangkan Skor Min Tahap Kefahaman Responden**

| Bil | Tajuk Sirah | Skor Min | Interprestasi |
|---|---|---|---|
| 1. | Terbitnya Fajar Dakwah | 4.16 | Tinggi |
| 2. | Hijrah Detik Bersejarah | 4.12 | Tinggi |
| 3. | Kepimpinan Rasulullah Saw di Madinah | 4.08 | Tinggi |
| 4. | Wanita Suri Teladan Ummah | 4.05 | Tinggi |

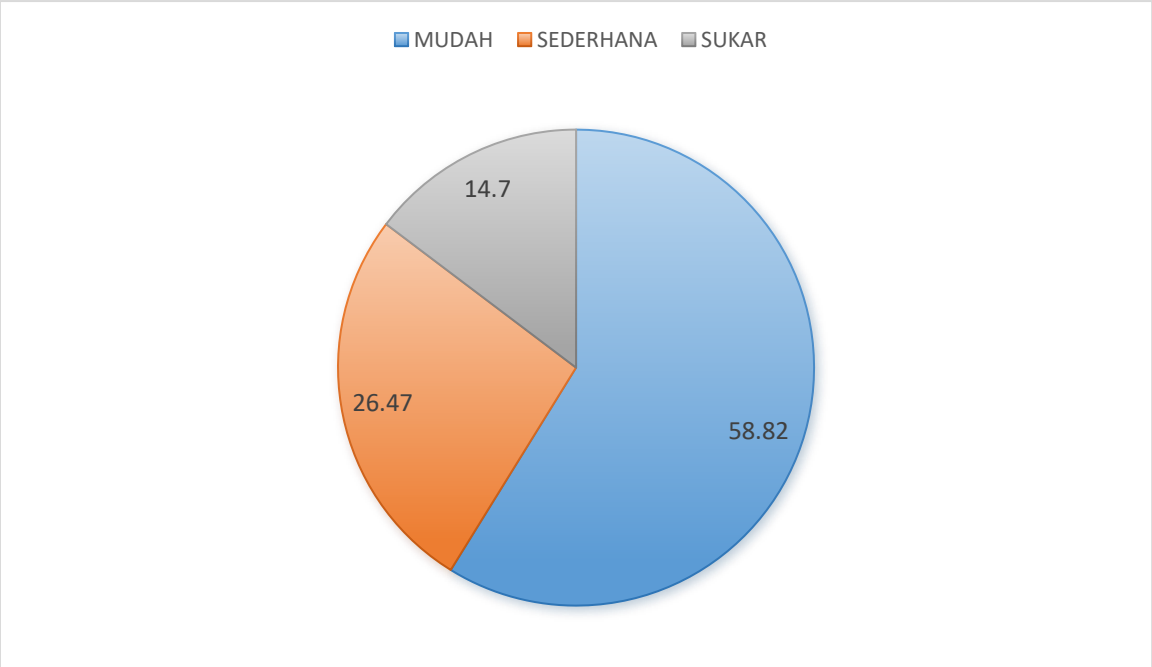
Jadual 3 menunjukkan skor min tertinggi bagi setiap subtopik Sirah Tingkatan 2.

Berdasarkan Jadual 3, tahap kefahaman responden terhadap keempat-empat tajuk Sirah Tingkatan Dua menunjukkan skor min yang tinggi bagi semua tajuk yang dikaji. Tajuk Terbitnya Fajar Dakwah mencatatkan skor min tertinggi iaitu 4.16, diikuti oleh tajuk Hijrah Detik Bersejarah dengan skor min 4.12. Seterusnya, tajuk Kepimpinan Rasulullah SAW di Madinah mencatatkan skor min 4.08, manakala tajuk Wanita Suri Teladan Ummah merekodkan skor min 4.05.

Secara keseluruhan, semua skor min berada dalam julat 3.67 hingga 5.00, yang menunjukkan bahawa tahap kefahaman responden terhadap tajuk-tajuk Sirah berada pada tahap tinggi. Dapatan ini menunjukkan bahawa penggunaan platform Sirah4teens berjaya membantu responden memahami kandungan pembelajaran Sirah dengan lebih berkesan.

### 5.4 Analisis dapatan kajian Bahagian D: Kekemasan platform Sirah4teens untuk kegunaan responden

Carta Pai 1 menunjukkan bilangan respon terhadap kekemasan platform Sirah4teens




Carta Pai 1 menunjukkan bilangan respon terhadap kekemasan platform Sirah4teens.

Carta pai 1 menunjukkan tahap kekemasan platform Sirah4teens berdasarkan persepsi 136 orang responden. Kajian menunjukkan bahawa majoriti responden memberikan maklum balas positif terhadap kekemasan platform, di mana seramai 80 orang responden (58.82%) memilih kategori Ya. Hal ini menunjukkan bahawa kebanyakan responden berpuas hati dengan susun atur dan reka bentuk platform Sirah4teens.

Selain itu, seramai 36 orang responden (26.47%) memilih kategori sederhana, manakala 20 orang responden (14.70%) memilih kategori Sukar. Peratusan yang lebih kecil bagi kategori Sukar menunjukkan bahawa hanya sebilangan kecil responden menghadapi kesukaran dari segi

kekemasan penggunaan platform. Secara keseluruhannya, dapatan ini membuktikan bahawa platform Sirah4teens mempunyai tahap kekemasan yang baik dan sesuai digunakan.

## 7. Kesimpulan

Kajian ini secara keseluruhannya membuktikan bahawa penggunaan platform Sirah4Teens dalam pengajaran dan pembelajaran Pendidikan Islam Tingkatan Dua memberikan kesan positif terhadap tahap kefahaman terhadap kandungan Sirah. Dapatan kajian menunjukkan peningkatan kefahaman yang ketara merentas semua subtopik yang dikaji, dengan skor min berada pada tahap tinggi. Hal ini menunjukkan bahawa pendekatan pembelajaran berasaskan teknologi, khususnya melalui penggunaan bahan bantu mengajar digital yang interaktif, mampu menyokong proses pembelajaran yang lebih berkesan dan bermakna.

Keberkesanan Sirah4Teens dipengaruhi oleh reka bentuk antaramuka yang kemas, kandungan yang disusun secara sistematik serta penggunaan elemen multimedia seperti video animasi, infografik dan kuiz interaktif. Elemen-elemen ini bukan sahaja membantu pelajar memahami kronologi dan konteks peristiwa Sirah dengan lebih jelas, malah meningkatkan penglibatan aktif pelajar sepanjang sesi pembelajaran. Dapatan ini selari dengan keperluan pendidikan abad ke-21 yang menekankan penggunaan teknologi sebagai pemangkin kepada pembelajaran kendiri dan berpusatkan pelajar.

Selain itu, maklum balas responden menunjukkan bahawa platform Sirah4Teens berfungsi sebagai sumber sokongan pembelajaran yang berkesan, terutamanya untuk tujuan ulang kaji dan rujukan kendiri. Peranan guru sebagai fasilitator turut dikenal pasti sebagai faktor penting dalam memastikan penggunaan platform ini memberi impak pedagogi yang optimum. Walaupun terdapat sebilangan kecil responden yang menghadapi kekangan dari segi penggunaan, tahap penerimaan keseluruhan terhadap platform ini adalah memberangsangkan. Sebagai rumusan, Sirah4Teens mempunyai potensi besar untuk dikembangkan sebagai platform PdP digital yang menyokong peningkatan kualiti pengajaran Pendidikan Islam di sekolah. Kajian lanjutan dicadangkan bagi menilai keberkesanan jangka panjang serta peluasan pelaksanaan dalam konteks pendidikan yang lebih pelbagai.

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# WEBSITE E-IAKHLAKGO SEBAGAI ALAT DIGITAL PEMBELAJARAN BERKESAN UNTUK PELAJAR SEKOLAH MENENGAH TINGKATAN 2

## (E-IAKHLAKGO WEBSITE AS AN EFFECTIVE DIGITAL LEARNING TOOL FOR SECONDARY SCHOOL FORM 2 STUDENTS)

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***Abstrak:*** *Kajian ini bertujuan untuk menilai keberkesanan dan penerimaan Laman Web E-IAKHLAKGO mengikut buku teks KSSM Pendidikan Islam Tingkatan 2 Berasaskan Model VARK sebagai medium pembelajaran yang selaras dengan era modenisasi dan kecenderungan digital pelajar. Laman web ini dibangunkan bagi menyokong pembelajaran luar bilik darjah (e-pembelajaran atau PdPR) dan menyediakan akses bahan (video, slaid, poster dan aktiviti gamifikasi) bagi topik Akhlak, yang membolehkan pelajar belajar di mana-mana dan pada bila-bila masa. Isu utama yang ditangani ialah peningkatan masa yang dihabiskan pelajar dengan teknologi, justeru memerlukan pendekatan pembelajaran yang berasaskan teknologi untuk meningkatkan keberkesanan PdP. Reka bentuk kajian kuantitatif tinjauan telah digunakan, melibatkan 100 orang pelajar Tingkatan 2 dari beberapa buah sekolah menengah. Data dikumpul melalui soal selidik Google Form yang mengandungi 20 soalan, bertujuan untuk menilai penerimaan pengguna dan keberkesanan E-IAKHLAKGO. Hasil utama daripada analisis deskriptif menunjukkan bahawa penerimaan keseluruhan laman web E-IAKHLAKGO berada pada tahap yang tinggi. Pelajar menunjukkan keberkesanan produk melalui keupayaan mereka menjawab soalan dalam permainan yang disediakan dalam laman web tersebut. Maklum balas daripada guru turut positif, mengesahkan kebolehgunaan (usability) laman web, termasuk slaid buku teks, di dalam kelas dan sebagai alat sokongan penting sekiranya berlaku PdPR. Kesimpulannya, laman web E-IAKHLAKGO Pendidikan Islam yang mengintegrasikan model VARK dan teknologi pendidikan ini berpotensi tinggi*

*untuk menjadi alat yang berkesan dalam membantu meningkatkan keberkesanan pengajaran dan pembelajaran, sekali gus memenuhi keperluan pembelajaran pelajar dalam dunia teknologi pendidikan yang semakin berkembang.*

***Kata Kunci**: E-IAKHLAKGO, Penyelidikan Pendidikan, Teori dan Amalan Pedagogi, Pendidikan Teknologi*

***Abstract:** This study aims to evaluate the effectiveness and acceptance of the E-IAKHLAKGO Website, which aligns with the KSSM Islamic Education Form 2 textbook and is based on the VARK Model, as a learning medium synchronized with the era of modernization and the digital inclination of students. The website was developed to support learning outside the classroom (e-learning or PdPR - Home-Based Teaching and Learning) and provides access to materials (videos, slides, posters and gamification activities) for Akhlak (Moral) topics, enabling students to learn anywhere and anytime. The main issue addressed is the increasing amount of time students spend with technology, thus necessitating a technology-based learning approach to enhance the effectiveness of Teaching and Learning (T&L). A quantitative survey research design was employed, involving 100 Form 2 students from several secondary schools. Data were collected via a Google Form questionnaire containing 20 questions, aimed at assessing user acceptance and the effectiveness of E-IAKHLAKGO. The key findings from the descriptive analysis indicate that the overall acceptance of the E-IAKHLAKGO website is at a high level. Students demonstrated the product's effectiveness through their ability to answer questions in the games provided within the website. Feedback from teachers was also positive, confirming the usability of the website, including the textbook slides, in class and as a vital supporting tool in the event of PdPR. In conclusion, the E-IAKHLAKGO Islamic Education website, which integrates the VARK model and educational technology, has high potential to be an effective tool in assisting and improving the effectiveness of teaching and learning, thereby meeting the learning needs of students in the ever-evolving world of educational technology.*

***Keywords**: E-IAKHLAKGO, Educational Research, Pedagogical Theories and Practices, Technology Education*

## Pengenalan

Perkembangan teknologi digital masa kini telah membawa perubahan besar dalam dunia pendidikan, termasuklah dalam pembelajaran Pendidikan Islam di sekolah menengah. Pelajar semakin terbiasa dengan penggunaan gajet, media sosial dan platform digital sebagai sumber maklumat harian, justeru menuntut pendekatan PdP yang lebih kreatif dan dekat dengan dunia mereka. Pembinaan laman web E-IAKHLAKGO merupakan langkah seiring dengan tuntutan semasa kerana ia dibangunkan berasaskan kandungan buku teks KSSM Pendidikan Islam Tingkatan 2 dan disokong oleh Model VARK bagi memenuhi keperluan gaya pembelajaran berbeza. Inisiatif ini penting kerana pelajar menghabiskan banyak masa di hadapan skrin, dan jika ruang digital digunakan dengan betul, ia boleh meningkatkan keberkesanan pembelajaran. Tambahan pula, subtopik Akhlak Islamiah seperti Malu Perisai Iman, Menyemai Kasih Menuai Sayang, Muliakan Ibu Bapa Bahagiakan Keluarga, Santuni Jiranmu dan Masjid Destinasiku memerlukan penyampaian yang menarik agar pelajar memahami konsep, kepentingan dan aplikasinya dalam kehidupan seharian.

Usaha pembinaan laman web pendidikan ini turut sejalan dengan pandangan tokoh pendidikan Malaysia, Tan Sri Dr. Wan Mohd Zahid Mohd Noordin, yang menekankan bahawa pendidikan abad ke-21 mesti *"menghubungkan pelajar dengan dunia sebenar melalui teknologi agar pembelajaran lebih bermakna dan berkesan"* (Wan et al., 2018). Pandangan beliau menunjukkan bahawa penyampaian Pendidikan Islam tidak boleh bergantung sepenuhnya pada kaedah tradisional, sebaliknya perlu memanfaatkan kemajuan digital untuk menarik minat pelajar dan meningkatkan kefahaman mereka terhadap nilai serta akhlak Islam. Di Indonesia pula, tokoh pendidikan Ki Hajar Dewantara dengan prinsip *"Ing ngarso sung tulodo, ing madya mangun karso, tut wuri handayani"* menegaskan peranan guru sebagai pembimbing yang menyediakan suasana pembelajaran sesuai dengan zaman pelajar (Rahayuningsih, 2021). Prinsip ini relevan dengan konteks pendidikan masa kini apabila guru perlu menyediakan medium pembelajaran digital, dan E-IAKHLAKGO memenuhi pendekatan tersebut dengan modul, poster, video serta aktiviti gamifikasi.

Objektif utama kajian ini adalah menilai keberkesanan penggunaan platform E-IAKHLAKGO yang interaktif dan responsif dalam pendidikan nilai serta meneliti bagaimana ia memperkukuh pengamalan nilai dalam kehidupan harian pelajar. Dapatan kajian menunjukkan tahap penerimaan pelajar terhadap E-IAKHLAKGO berada pada tahap tinggi, membuktikan bahawa mereka bukan sahaja selesa menggunakan teknologi dalam pembelajaran, malah lebih mudah memahami konsep apabila bahan bersifat interaktif. Guru turut memberi maklum balas positif kerana platform ini membantu PdP di bilik darjah dan menjadi sokongan semasa PdPR, selaras dengan keperluan pendidikan fleksibel masa kini.

Secara keseluruhannya, pengembangan laman web E-IAKHLAKGO bukan sekadar inovasi teknologi, tetapi usaha memantapkan pembelajaran akhlak dalam kalangan remaja era digital. Dengan pendekatan yang sesuai dengan gaya pembelajaran pelajar serta sejajar dengan pemikiran tokoh pendidikan Malaysia dan Indonesia, platform ini berpotensi besar meningkatkan pemahaman dan penghayatan murid terhadap nilai akhlak mulia. Oleh itu, inovasi teknologi perlu dimanfaatkan sebagai medium penyampaian pendidikan nilai yang lebih berkesan, bukan sahaja untuk meningkatkan kefahaman, tetapi juga mendorong perubahan positif dalam tingkah laku dan pembangunan moral pelajar. Pendekatan ini diyakini mampu memperkukuh usaha membentuk masyarakat berakhlak mulia, bertanggungjawab dan selaras dengan aspirasi pembangunan pendidikan di Malaysia dan Indonesia.

### *Objektif Kajian*

Kajian ini bertujuan untuk:

1. Menilai keberkesanan penggunaan platform E-IAKHLAKGO yang interaktif dan responsif dalam pendidikan nilai.
2. Meneliti bagaimana platform ini dapat memperkukuh pengamalan nilai dalam kehidupan harian pelajar.
3. Memberikan panduan serta model yang lebih berkesan untuk diaplikasikan dalam konteks sistem pendidikan masa kini.

### *Penyataan Masalah (Problem Statement)*

Bidang Akhlak dalam Pendidikan Islam Tingkatan 2 dalam Kurikulum Standard Sekolah Menengah (KSSM) merangkumi lima tajuk utama yang menekankan pembentukan sahsiah murid melalui nilai-nilai murni yang selari dengan ajaran Islam. Walaupun kurikulum ini telah dirangka secara sistematik untuk membentuk akhlak pelajar, realiti semasa menunjukkan bahawa tahap penghayatan nilai-nilai akhlak dalam kalangan remaja masih belum mencapai tahap yang diharapkan. Fenomena seperti kurang rasa hormat kepada ibu bapa dan guru, sikap sambil lewa dalam menunaikan amanah, penyebaran maklumat palsu, keterlibatan dalam buli siber, dan kelemahan mengurus kendiri semakin membimbangkan dan sering dilaporkan dalam media serta dapatan kajian tempatan. Masalah ini berpunca daripada beberapa faktor, antaranya pengaruh media sosial yang tidak terkawal, kelemahan pemantauan kendiri murid, serta kurangnya pendekatan pembelajaran akhlak yang benar-benar menyentuh aspek dalaman (tazkiyah al-nafs) dan bukan sekadar hafalan teori. Walaupun Pendidikan Islam menyediakan lima tajuk akhlak utama untuk menangani isu-isu ini, masih terdapat jurang antara apa yang dipelajari oleh murid dan penghayatan mereka dalam kehidupan seharian. Kajian-kajian lepas lebih banyak menumpukan kepada pencapaian akademik Pendidikan Islam, tetapi kurang memberi tumpuan khusus kepada keberkesanan pengajaran bidang akhlak Tingkatan 2 dalam membentuk tingkah laku murid secara menyeluruh.

Jurang ini menunjukkan bahawa terdapat keperluan mendesak untuk meneliti semula bagaimana kandungan lima tajuk akhlak Tingkatan 2 difahami, diaplikasi, dan dihayati oleh murid dalam konteks cabaran sosial moden. Tanpa penyelesaian yang berkesan, kekurangan penghayatan akhlak ini berpotensi menyumbang kepada masalah disiplin, keruntuhan moral, dan krisis nilai dalam kalangan remaja masa kini. Justeru, satu kajian yang lebih mendalam diperlukan untuk memahami kedudukan sebenar penguasaan dan penghayatan murid terhadap kelima-lima tajuk akhlak dalam KSSM serta strategi yang boleh mengukuhkan pembentukan akhlak mereka.

### *Kepentingan Kajian*

Kajian ini penting dalam memperkasa pendidikan nilai melalui E-IAKHLAKGO yang berfungsi meningkatkan minat dan kefahaman kendiri pelajar terhadap topik Akhlak Islamiah secara interaktif. Bagi guru, inovasi ini menyediakan alat bantu mengajar digital yang menyokong transformasi pedagogi tradisional kepada integrasi ICT yang lebih dinamik dan relevan dengan gaya pembelajaran generasi *digital natives*. Selain itu, kajian ini menyokong aspirasi pendidikan abad ke-21(Idriki, N. A. M., & Tan, B. P. (2022). dengan menyediakan platform inklusif yang merapatkan jurang digital dalam pendidikan agama serta memastikan proses pemupukan karakter berlaku secara berterusan dan berkesan.

## Kajian Literatur

Berpandukan sorotan literatur, pembangunan E-IAKHLAKGO bagi tajuk Akhlak Islamiah Tingkatan 2 merupakan inovasi strategik untuk melahirkan murid beradab yang menguasai domain kognitif, afektif, dan psikomotor secara bersepadu. Mengambil kira kelemahan kaedah tradisional yang kurang relevan bagi generasi *digital natives*, platform ini mengintegrasikan elemen ICT melalui reka bentuk menarik (User Experience) dan kemudahan penggunaan yang terbukti meningkatkan penerimaan pelajar (Said, I., Ahmad, K., Seman, R., Ahmad, R. S., & Fadzil, M. F. (2020). Melalui prinsip interaktiviti seperti simulasi dan kuiz aktif, E-

IAKHLAKGO memacu penghayatan nilai yang lebih mendalam serta menjamin pengekalan amalan akhlak dalam diri murid. Kesimpulannya, inovasi ini menyediakan landasan pedagogi dinamik yang merapatkan jurang antara teori dan amalan selari dengan transformasi pendidikan nasional.

## Metodologi Kajian

Kajian ini mengaplikasikan reka bentuk tinjauan kuantitatif bagi mengumpulkan maklum balas empirikal mengenai persepsi dan penerimaan portal pembelajaran E-IAKHLAKGO. Pendekatan ini membolehkan pengkaji mengukur tahap persetujuan responden terhadap integrasi model VARK dan elemen gamifikasi dalam pendidikan akhlak melalui analisis statistik yang objektif. (A. Ziadat, 2021)

Berdasarkan jadual 1 Krejcie dan Morgan (1970), bagi populasi kajian ialah 340 orang dan mengambil sampel kajian seramai 181 orang responden yang dapat dikumpulkan.

**Jadual 1 Menunjukkan Pecahan Sampel Kajian Mengikut Kategori:**

| Kategori Responden | Bilangan | Peratus (%) |
|---|---|---|
| Pelajar | 125 orang | 69.1% |
| Guru | 56 orang | 30.9% |
| **Jumlah** | **181 orang** | **100%** |

Dari segi profil kewarganegaraan, seramai 17 orang responden (9.3%) merupakan pelajar dari Indonesia, manakala selebihnya adalah warga Malaysia. Populasi sasaran merangkumi pelajar sekolah menengah serta guru-guru pelbagai bidang yang terlibat secara langsung dengan silibus Kurikulum Standard Sekolah Menengah (KSSM). Penggunaan teknik persampelan bertujuan memastikan data diperoleh daripada audiens yang relevan dengan domain afektif digital bagi menjamin kesahan dapatan (Lily Hanefarezan Asbulah et al., 2018). Data dikumpul melalui soal selidik Google Form yang mengandungi 20 item merangkumi konstruk reka bentuk, kandungan, pedagogi VARK, serta impak keberkesanan. Setiap item dinilai menggunakan skala Likert empat mata bagi meminimumkan ralat pemusatan, sekali gus meningkatkan ketepatan maklum balas dalam ekosistem pembelajaran hibrid (Chieng dan Tan, 2019).

Bagi menjamin kualiti data, instrumen telah melalui proses kesahan kandungan oleh pakar mata pelajaran serta teknologi pendidikan bagi memastikan setiap item mewakili objektif pembelajaran akhlak dengan tepat. Kebolehpercayaan instrumen pula ditentukan melalui kajian rintis dengan nilai Cronbach's Alpha melebihi 0.70 sebagai penanda aras ketekalan yang memuaskan. Semua data diproses menggunakan perisian *Statistical Package for Social Sciences* (SPSS) melalui analisis deskriptif yang melibatkan kekerapan, peratusan, min, dan sisihan piawai. Kaedah ini digunakan untuk merumuskan kecenderungan minat dan tahap keberkesanan portal E-IAKHLAKGO dalam menyokong proses PdP.

## Dapatan Kajian

***Bahagian A: Maklumat Demografi***

Kajian ini melibatkan 181 responden, jumlah yang mencukupi merujuk jadual Krejcie & Morgan (1970) untuk mewakili populasi sasaran secara sah. Komposisi jantina adalah seimbang (51.5% lelaki, 48.5% perempuan), manakala kumpulan umur 13-18 tahun (50.3%) dan pelajar sekolah menengah (71%) membentuk majoriti sebagai pengguna sasaran. Penglibatan guru (29%) dan responden berpendidikan tinggi (41.4%) pula memberikan nilai tambah dari perspektif penilaian profesional. Walaupun didominasi warganegara Malaysia (90.5%), penyertaan responden Indonesia (9.5%) memperluas perspektif kebolehgunaan portal secara global.

Keseimbangan demografi ini memperkukuh kesahan dalaman dan luaran kajian. Dominasi pelajar (71%) memastikan maklum balas tepat mengenai Model VARK, manakala penyertaan guru (29%) bertindak sebagai pengesahan pakar terhadap kualiti pedagogi . Keseimbangan jantina turut membuktikan bahawa keberkesanan teknologi lebih bergantung kepada kualiti interaktiviti media berbanding faktor jantina . Walaupun homogen dari segi bangsa, data ini memberikan ketepatan tinggi dalam konteks kurikulum KSSM di Malaysia yang memerlukan inovasi digital yang responsif terhadap nilai tempatan. (Abd Samad, M. R., Iksan, Z., & Khalid, F. (2022).

***Bahagian B: Reka Bentuk & Kebolehgunaan***

**Jadual 2 Merupakan Hasil Analisis Yang Menunjukkan Keseluruhan Pandangan Pengguna Berada Pada Tahap Tinggi Hingga Sangat Tinggi.**

| Aspek Dinilai | Min | Sisihan Piawai | Tahap |
|---|---|---|---|
| Mesra pengguna | 4.33 | 0.58 | Tinggi |
| Elemen multimedia | 4.40 | 0.55 | Tinggi |
| Kemudahan penggunaan | 4.19 | 0.64 | Tinggi |
| Kejelasan dan kualiti nota (audio, animasi, kuiz) | 4.31 | 0.62 | Tinggi |

Secara keseluruhannya, portal E-IAKHLAKGO mencatatkan tahap penerimaan sangat tinggi dengan purata min 4.28 (SP=0.62). Elemen multimedia (audio, animasi, kuiz) menjadi penyumbang tertinggi (M=4.40), membuktikan keberkesanan bahan interaktif dalam menarik minat pengguna. Aspek mesra pengguna (M=4.33) dan kualiti nota (M=4.31) turut mendapat penilaian cemerlang. Walaupun aspek kemudahan penggunaan mencatatkan skor terendah (M=4.19), ia tetap berada pada tahap tinggi, sekali gus mengesahkan portal ini sebagai persekitaran pembelajaran digital yang holistik.

Skor multimedia yang tinggi menunjukkan keperluan rangsangan digital dalam Pendidikan Islam untuk memudahkan pemahaman konsep akhlak yang abstrak melalui gamifikasi. Kejayaan ini turut didorong oleh aplikasi Model VARK yang memenuhi kepelbagaian gaya belajar pelajar (Pratama & Nurdin, 2022). Selain itu, kualiti pengalaman pengguna (UX) yang berkesan menjadikan E-IAKHLAKGO sebuah alat digital yang responsif dan selari dengan matlamat memperkasakan teknologi pendidikan dalam kurikulum KSSM (Perrig SAC et al., 2024).

***Bahagian C: Kandungan Kurikulum***

**Jadual 3 Menunjukkan Skor Yang *Menilai Ketepatan Silibus Tingkatan 2 Dan Kualiti Bahan***

| Konstruk | Min | Sisihan Piawai | Interpretasi |
|---|---|---|---|
| Kandungan yang menepati silibus | 4.09 | 0.71 | Tinggi |
| Topik akhlak yang lengkap | 4.24 | 0.66 | Tinggi |
| Bahasa yang mudah difahami | 4.18 | 0.70 | Tinggi |
| Maklumat yang tepat dalam poster/slaid | 4.52 | 0.49 | Sangat Tinggi |

Berdasarkan Jadual 3, skor min tertinggi dicatatkan oleh aspek ketepatan maklumat dalam poster/slaid iaitu 4.52 (Sangat Tinggi). Hal ini menunjukkan bahan grafik dalam portal E-IAKHLAKGO mempunyai tahap kesahan kandungan yang sangat baik. Selain itu, aspek kelengkapan topik (M=4.24), bahasa yang mudah difahami (M=4.18) dan ketepatan silibus (M=4.09) turut mencatatkan skor min yang tinggi. Secara keseluruhan, data ini mengesahkan portal ini berjaya menterjemahkan kurikulum sedia ada ke dalam bentuk digital yang berkualiti untuk pelajar sekolah menengah.

Dapatan ini selari dengan hujah Zulkhaeriyah, T. 2024 bahawa ketepatan maklumat merupakan faktor penentu utama kepercayaan pengguna terhadap sistem e-pembelajaran. Kejayaan portal ini dalam menyelaraskan kandungan dengan DSKP Pendidikan Islam Tingkatan 2 juga menunjukkan kepatuhan tinggi terhadap objektif KPM (2017). Selain itu, penggunaan bahasa yang mudah difahami menyokong pandangan bahawa penyampaian yang ringkas dan padat adalah strategi pedagogi paling berkesan untuk menarik minat generasi masa kini. Secara rumusnya, kualiti bahan yang berautoriti ini menjadikan E-IAKHLAKGO sebagai alat sokongan PdP yang kredibel bagi memperkukuh penghayatan akhlak pelajar.

***Bahagian D: Pedagogi & Elemen Vark***

**Jadual 4 Menunjukkan Skor Penggunaan Laman Web**

| Konstruk | Min | Sisihan Piawai | Interpretasi |
|---|---|---|---|
| Peningkatan Kefahaman Melalui Video | 3.55 | 0.54 | Tinggi |
| Kepelbagaian Media (Model VARK) | 3.56 | 0.53 | Tinggi |
| Unsur Hiburan dalam Pembelajaran | 3.61 | 0.53 | Tinggi |
| Pengukuhan Ingatan dan Fakta | 3.55 | 0.54 | Tinggi |
| Relevansi Teknologi | 3.60 | 0.53 | Tinggi |

Berdasarkan Jadual 4, skor min tertinggi iaitu 3.61 menunjukkan majoriti responden sangat bersetuju bahawa unsur hiburan (gamifikasi) menjadikan proses pembelajaran lebih menyeronokkan. Hal ini membuktikan bahawa integrasi elemen permainan berjaya menggalakkan pembelajaran aktif yang berupaya meningkatkan penyerapan maklumat pelajar.

Hasil kajian juga menunjukkan portal ini sangat relevan dengan kecenderungan teknologi masa kini (M=3.60). Penggunaan kepelbagaian media yang mencatatkan skor min 3.56 membuktikan keberkesanan E-IAKHLAKGO dalam memenuhi gaya pembelajaran yang berbeza selaras dengan Model VARK. Selain itu, keberkesanan elemen video dan aktiviti pengukuhan fakta (masing-masing M=3.55) mengesahkan bahawa penggunaan multimedia interaktif adalah lebih efektif dalam menyampaikan topik Akhlak berbanding kaedah

tradisional. Secara keseluruhannya, pencapaian min yang tinggi bagi semua konstruk mencerminkan portal ini sebagai platform pembelajaran digital yang dinamik, efektif, dan menepati keperluan generasi masa kini. Dinata, V. M., Wedi, A., & Fajarianto, O. (2024)

***Bahagian E: Keberkesanan & Impak***

**Jadual 5 Menunjukkan Analisis Korelasi Pearson Dijalankan Bagi Melihat Hubungan Antara Tahap Penggunaan Laman Web E-IAKHLAKGO Dengan Motivasi Pembelajaran Responden.**

| Pembolehubah | Pekali Korelasi (r) | Interpretasi |
|---|---|---|
| Penggunaan ↔ Motivasi | r = 0.89 | Positif Sangat Kuat |

Berdasarkan Jadual 5, hasil analisis korelasi Pearson menunjukkan terdapat hubungan yang signifikan antara tahap penggunaan laman web E-IAKHLAKGO dengan motivasi pembelajaran responden. Nilai pekali korelasi (r) yang diperoleh adalah sebanyak 0.89, yang membawa interpretasi hubungan positif pada tahap sangat kuat. Dapatan ini menggambarkan bahawa kekerapan dan kualiti interaksi pelajar terhadap portal tersebut mempunyai perkaitan linear yang sangat tinggi dengan peningkatan dorongan serta minat mereka untuk mendalami subjek Pendidikan Islam.

Hubungan positif yang sangat kuat (r = 0.89) ini membuktikan bahawa keberkesanan teknikal dan kandungan interaktif E-IAKHLAKGO bertindak sebagai pemangkin utama kepada motivasi intrinsik pelajar. Hal ini selari dengan kajian yang menyatakan bahawa penggunaan elemen gamifikasi dalam pendidikan nilai mampu merangsang penglibatan aktif serta mempengaruhi sikap positif pelajar terhadap proses pembelajaran. Selain itu, kekuatan korelasi ini turut menyokong hujah Abdullah, M. H., & Rahman, S. (2018) bahawa media digital yang menyantuni pelbagai gaya belajar melalui Model VARK secara automatik akan meningkatkan keinginan pelajar untuk terus meneroka bahan pendidikan secara kendiri dan bermakna. Dinata, V. M., Wedi, A., & Fajarianto, O. (2024)

### *4.7 Rumusan Hasil Kajian*

Dapatan kajian membuktikan platform E-AKHLAKGO sangat efektif sebagai inovasi digital bagi subjek Pendidikan Islam Tingkatan 2 (Akhlak Islamiah) dengan skor min tinggi antara 4.24 hingga 4.52. Berdasarkan sampel 181 responden daripada 340 populasi yang memenuhi kriteria Krejcie & Morgan (1970), majoriti pengguna (45.9%) mengiktirafnya sebagai medium ulang kaji kendiri yang unggul. Tahap penerimaan reka bentuk yang mencapai 64% menunjukkan integrasi ICT kreatif ini berjaya meningkatkan minat dan penguasaan ilmu murid secara bersepadu. Kesimpulannya, E-AKHLAKGO merupakan platform pembelajaran inklusif yang relevan dengan aspirasi pendidikan abad ke-21.

## 5.0 Kesimpulan

Kesimpulannya, kajian mengenai pembangunan dan keberkesanan portal E-IAKHLAKGO menunjukkan bahawa inovasi digital ini berupaya memperkukuh pembelajaran Akhlak Islamiah Tingkatan 2 dalam Kurikulum Standard Sekolah Menengah (KSSM) dengan pendekatan yang lebih interaktif, responsif dan sesuai dengan keperluan generasi digital masa

kini. Web ini dibangunkan berasaskan kandungan buku teks KSSM serta disokong oleh Model VARK yang mengambil kira kepelbagaian gaya pembelajaran pelajar, sekali gus menjadikan proses pengajaran dan pembelajaran lebih bermakna. Dapatan kajian membuktikan tahap penerimaan pelajar dan guru berada pada tahap tinggi, dengan skor min konsisten dalam aspek reka bentuk, kandungan kurikulum, pedagogi serta elemen multimedia. Malah, analisis korelasi Pearson menunjukkan hubungan positif yang sangat kuat (r=0.89) antara penggunaan portal dengan motivasi pembelajaran, menandakan bahawa interaksi pelajar terhadap bahan digital mempunyai kesan langsung terhadap minat dan dorongan mereka untuk memahami nilai akhlak. Keberkesanan portal ini turut disokong oleh integrasi elemen gamifikasi, video interaktif dan bahan grafik yang membantu pelajar memahami konsep akhlak yang abstrak serta menghayatinya dalam kehidupan seharian. Usaha ini selari dengan pandangan tokoh pendidikan Malaysia, Tan Sri Dr. Wan Mohd Zahid Mohd Noordin, yang menekankan bahawa pendidikan abad ke-21 mesti menghubungkan pelajar dengan dunia sebenar melalui teknologi, serta prinsip Ki Hajar Dewantara di Indonesia yang menegaskan peranan guru sebagai pembimbing dalam menyediakan medium pembelajaran yang sesuai dengan zaman. Justeru, E-IAKHLAKGO bukan sekadar alat bantu mengajar, tetapi satu model pendidikan nilai yang mampu merapatkan jurang antara teori dan amalan, memperkukuh aspek tazkiyah al-nafs, serta menyokong aspirasi pendidikan nasional. Secara keseluruhannya, web ini berpotensi besar menjadi medium pembelajaran yang bukan sahaja meningkatkan kefahaman pelajar terhadap nilai akhlak, tetapi juga mendorong perubahan positif dalam tingkah laku dan pembangunan moral mereka. Inovasi teknologi seperti ini diyakini dapat memperkukuh usaha membentuk masyarakat berakhlak mulia, bertanggungjawab dan selaras dengan aspirasi pembangunan pendidikan di Malaysia dan Indonesia.

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# ANALISIS PERBANDINGAN PENCAPAIAN PENTAKSIRAN FORMATIF DAN SUMATIF DALAM KALANGAN PELAJAR PINTAR DAN BERBAKAT BAGI SUBJEK PENDIDIKAN ISLAM

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***Abstrak:*** *Kajian ini bertujuan menganalisis pencapaian pentaksiran formatif (40%) dan pentaksiran sumatif (60%) dalam kalangan pelajar pintar dan berbakat bagi subjek Pendidikan Islam serta meneliti perbezaan pencapaian berdasarkan jantina. Reka bentuk kajian ini adalah kuantitatif menggunakan kaedah analisis dokumen. Data melibatkan seramai 91 orang pelajar Tahap 1 yang mengikuti program Pendidikan Islam dianalisis menggunakan statistik deskriptif, ujian paired sample t-test dan ujian independent sample t-test. Dapatan kajian menunjukkan bahawa pelajar mencapai skor yang lebih tinggi dalam pentaksiran sumatif (min = 53.55, SP = 7.10) berbanding pentaksiran formatif (min = 38.88, SP = 2.17). Ujian paired t-test menunjukkan terdapat perbezaan yang signifikan antara kedua-dua komponen pentaksiran, t(90) = –21.24, p < 0.001. Walau bagaimanapun, analisis ujian independent t-test mendapati tiada perbezaan signifikan pencapaian sumatif berdasarkan jantina (p > 0.05). Dapatan kajian ini menonjolkan peranan dominan pentaksiran sumatif dalam menentukan pencapaian akademik pelajar pintar dan berbakat serta menekankan keperluan memperkukuh amalan pentaksiran formatif bagi menyokong pembelajaran berterusan. Implikasi kajian terhadap reka bentuk pengajaran, dasar pentaksiran dan pembangunan kurikulum dalam pendidikan pelajar pintar dan berbakat turut dibincangkan.*

***Kata kunci:*** *pelajar pintar dan berbakat, pentaksiran formatif, pentaksiran sumatif, Pendidikan Islam, perbezaan jantina.*

## Pengenalan

Pelajar pintar dan berbakat merupakan satu kelompok unik dalam kalangan pelajar yang memiliki keupayaan kognitif tinggi, kadar pembelajaran yang pantas serta potensi akademik yang luar biasa. Ciri-ciri ini menuntut pendekatan pengajaran yang berbeza serta amalan pentaksiran yang lebih khusus dan bersesuaian (Subotnik, Olszewski-Kubilius, & Worrell, 2020). Pentaksiran yang berkesan bukan sahaja berfungsi untuk mengukur pencapaian akademik, malah berperanan penting dalam perancangan pengajaran, penyesuaian kurikulum serta pemantauan perkembangan pembelajaran pelajar secara berterusan (Viders, 2022). Dalam konteks Pendidikan Islam, kajian empirikal yang membincangkan amalan pentaksiran khusus

bagi pelajar pintar dan berbakat masih terhad, terutamanya dalam persekitaran Asia Tenggara yang masih membangunkan program pendidikan pintar dan berbakat secara sistematik. Pentaksiran dalam pendidikan secara umumnya mempunyai dua fungsi utama, iaitu pentaksiran formatif yang menyokong pembelajaran berterusan melalui maklum balas dan penambahbaikan, serta pentaksiran sumatif yang menilai pencapaian kumulatif pelajar pada akhir sesuatu tempoh pembelajaran (Black & Wiliam, 2022).

Bagi pelajar pintar dan berbakat, pentaksiran formatif berpotensi menjadi instrumen yang sangat berkesan kerana ia membolehkan pemberian maklum balas lanjutan, cabaran pemikiran aras tinggi serta tugasan yang dibezakan mengikut tahap kesediaan, minat dan profil pembelajaran pelajar (Tomlinson, 2021). Sebaliknya, pentaksiran sumatif sering diberi penekanan dalam budaya akademik yang menilai pencapaian berdasarkan peperiksaan berisiko tinggi yang menentukan hala tuju akademik pelajar. Oleh itu, pemahaman terhadap corak pencapaian pelajar pintar dan berbakat dalam kedua-dua bentuk pentaksiran ini adalah penting bagi membangunkan model pengajaran dan pentaksiran yang lebih berkesan.

Isu perbezaan jantina dalam pencapaian akademik turut menjadi topik perbincangan berpanjangan dalam penyelidikan pendidikan. Walaupun terdapat kajian yang menunjukkan pelajar perempuan cenderung mencapai prestasi lebih baik dalam subjek berasaskan bahasa, manakala pelajar lelaki lebih menonjol dalam domain matematik dan sains (Else-Quest, 2022), dapatan kajian dalam kalangan pelajar pintar dan berbakat menunjukkan hasil yang lebih seimbang. Beberapa kajian mendapati perbezaan jantina menjadi tidak signifikan apabila faktor persekitaran pembelajaran dan kualiti pengajaran dikawal (Putnick & Bornstein, 2023). Namun, kajian dalam konteks Pendidikan Islam masih sangat terhad.

Sehubungan itu, kajian ini bertujuan untuk mengisi jurang kajian dengan menganalisis pencapaian pentaksiran formatif dan sumatif menggunakan data pentaksiran sebenar serta meneliti perbezaan pencapaian berdasarkan jantina dalam kalangan pelajar pintar dan berbakat bagi subjek Pendidikan Islam.

## Kajian Literatur

### *Pelajar Pintar dan Berbakat: Ciri dan Keperluan Pendidikan*

Pelajar pintar dan berbakat lazimnya menunjukkan keupayaan intelek yang tinggi, penguasaan pantas terhadap konsep baharu, kecekapan penyelesaian masalah yang luar biasa serta motivasi yang tinggi terhadap tugasan pembelajaran yang mencabar (Renzulli, 2021). Golongan ini memerlukan pendekatan pendidikan seperti pemecutan kurikulum, pengayaan dan pengajaran terbeza bagi mengekalkan penglibatan serta mengelakkan masalah kurang pencapaian (Plucker & Peters, 2020).

Dalam konteks Pendidikan Islam, pelajar pintar dan berbakat juga berpotensi menunjukkan keupayaan analisis mendalam terhadap teks agama, kesedaran moral yang tinggi serta kemahiran hafazan yang cemerlang, selari dengan tradisi keilmuan Islam. Namun, tanpa mekanisme pentaksiran yang sesuai, keperluan pembelajaran mereka mungkin tidak dapat dikenal pasti atau disokong secara optimum.

### *Pentaksiran Formatif untuk Pelajar Pintar dan Berbakat*

Pentaksiran formatif merujuk kepada proses pemantauan perkembangan pembelajaran pelajar secara berterusan melalui pelbagai kaedah seperti pemerhatian, kuiz, tugasan prestasi, pemberian maklum balas dan penilaian kendiri (Wiliam, 2022). Dalam konteks pelajar pintar dan berbakat, pentaksiran formatif didapati sangat berkesan kerana ia membolehkan pemberian maklum balas yang pantas dan sejajar dengan kadar pembelajaran mereka yang cepat. Selain itu, pentaksiran formatif juga membolehkan pengajaran dilaksanakan secara terbeza berdasarkan tahap kesediaan dan profil pembelajaran pelajar, di samping menggalakkan perkembangan metakognisi dan kawalan kendiri yang merupakan ciri penting dalam pembelajaran aras tinggi. Kajian-kajian terdahulu turut menunjukkan bahawa pentaksiran formatif berupaya meningkatkan pencapaian akademik pelajar, khususnya apabila maklum balas yang diberikan bersifat khusus, tepat pada masanya dan berfokus kepada tugasan pembelajaran (Hattie & Clarke, 2020).

***Pentaksiran Sumatif dalam Kalangan Pelajar Berkeupayaan Tinggi***

Pentaksiran sumatif menilai penguasaan kumulatif pelajar pada akhir tempoh pembelajaran dan lazimnya digunakan bagi tujuan pensijilan dan penggredan. Bagi pelajar pintar dan berbakat, pentaksiran sumatif sering menunjukkan prestasi tinggi kerana keupayaan penaakulan dan penguasaan kandungan yang unggul (Shaunessy-Dedrick, 2023). Namun, kebergantungan berlebihan terhadap pentaksiran sumatif berpotensi menutup keperluan pembelajaran individu, khususnya bagi pelajar yang mempunyai perkembangan tidak seimbang.

***Perbezaan Jantina dalam Pencapaian Akademik***

Kajian mengenai perbezaan jantina dalam pencapaian akademik menunjukkan dapatan yang pelbagai. Walaupun terdapat kecenderungan perbezaan prestasi dalam domain tertentu, kajian dalam kalangan pelajar pintar dan berbakat mendapati perbezaan tersebut menjadi minimum apabila persekitaran pembelajaran adalah seimbang dan berkualiti (Putnick & Bornstein, 2023).

***Pentaksiran dalam Pendidikan Islam***

Pendidikan Islam bersifat holistik dan merangkumi pembangunan aspek kognitif, afektif dan psikomotor yang dipandu oleh pembentukan spiritual serta nilai moral. Konsep ini selari dengan pemikiran pendidikan Islam klasik yang menekankan keseimbangan antara penguasaan ilmu, pembinaan akhlak dan pembangunan rohani, sebagaimana dihuraikan dalam analisis kontemporari terhadap pemikiran Imam al-Ghazali (Alavi & Abd Rahman, 2021; Indana & Mustofa, 2024). Dalam amalan pendidikan, pentaksiran dalam Pendidikan Islam lazimnya melibatkan pelbagai bentuk seperti hafazan, interpretasi teks, penaakulan moral, perbincangan reflektif serta tugasan berasaskan prestasi bagi menilai kefahaman dan penghayatan pelajar secara menyeluruh.

Walau bagaimanapun, kajian empirikal yang meneliti corak pencapaian pelajar pintar dan berbakat dalam pelbagai bentuk pentaksiran Pendidikan Islam masih sangat terhad, khususnya kajian yang menggunakan data pencapaian akademik sebenar dan membandingkan prestasi pelajar merentas komponen pentaksiran yang berbeza. Sebahagian besar kajian berkaitan Pendidikan Islam dan pentaksiran lebih cenderung menumpukan perbincangan konseptual, falsafah pendidikan, atau amalan pengajaran secara umum, tanpa memberi penekanan khusus

terhadap analisis pencapaian pelajar pintar dan berbakat berdasarkan data pentaksiran formal (Hashim & Langgulung, 2008; Salleh, 2013). Kekurangan kajian empirikal berasaskan data ini menunjukkan keperluan yang jelas untuk penyelidikan yang menilai bagaimana pelajar pintar dan berbakat menunjukkan prestasi mereka dalam pelbagai komponen pentaksiran Pendidikan Islam, khususnya bagi menyokong pembangunan amalan pentaksiran yang lebih berkesan dan bermakna.

***Jurang Kajian***

Literatur menunjukkan beberapa jurang utama, iaitu kekurangan perbandingan empirikal antara pentaksiran formatif dan sumatif, kajian terhad mengenai perbezaan jantina dalam Pendidikan Islam, serta kekurangan kajian berasaskan data institusi sebenar di Asia Tenggara. Kajian ini bertujuan menangani kesemua jurang tersebut secara serentak.

## Metodologi Kajian

Kajian ini menggunakan reka bentuk kajian kuantitatif dengan kaedah analisis dokumen bagi meneliti pencapaian pentaksiran formatif dan sumatif dalam kalangan pelajar pintar dan berbakat yang mengikuti subjek Pendidikan Islam. Reka bentuk ini membolehkan analisis data pencapaian akademik sebenar yang dijana oleh institusi tanpa bergantung kepada instrumen laporan kendiri, sekali gus meningkatkan kesahan dapatan kajian. Sampel kajian terdiri daripada 91 orang pelajar pintar dan berbakat Tahap 1 yang mengikuti subjek Pendidikan Islam bagi Semester 1 Tahun Akademik 2025. Data kajian diperoleh daripada rekod rasmi pentaksiran akademik yang merangkumi pentaksiran formatif (40%) dan pentaksiran sumatif (60%), serta maklumat jantina bagi tujuan analisis perbandingan. Data dianalisis menggunakan perisian Statistical Package for the Social Sciences (SPSS). Analisis melibatkan statistik deskriptif bagi mengenal pasti tahap pencapaian pelajar, ujian paired sample t-test untuk membandingkan pencapaian pentaksiran formatif dan sumatif, serta ujian independent sample t-test bagi menilai perbezaan pencapaian pentaksiran sumatif berdasarkan jantina. Tahap signifikan statistik ditetapkan pada aras $p < 0.05$, manakala saiz kesan dikira menggunakan nilai Cohen's d bagi menentukan magnitud perbezaan yang dikesan.

## Dapatan Kajian

***Statistik Deskriptif***

Jadual 1 memaparkan statistik deskriptif bagi skor pentaksiran formatif (40%) dan sumatif (60%).

Statistik Deskriptif Pentaksiran Formatif dan Sumatif (N = 91)

| Jenis Pentaksiran | Min | SP | Minimum | Maksimum |
|---|---|---|---|---|
| **Formatif (40%)** | 38.88 | 2.17 | 27 | 40 |
| **Sumatif (60%)** | 53.55 | 7.10 | 27 | 60 |

Interpretasi:
Pelajar pintar dan berbakat menunjukkan pencapaian yang tinggi dalam kedua-dua komponen

pentaksiran. Walau bagaimanapun, skor pentaksiran sumatif menunjukkan variasi yang lebih besar berbanding pentaksiran formatif. Ini menunjukkan bahawa walaupun kebanyakan pelajar mencapai prestasi yang baik dalam tugasan berterusan, pentaksiran sumatif lebih berkesan dalam membezakan tahap pencapaian pelajar.

### *Ujian Paired Sample t-Test: Pentaksiran Formatif dan Sumatif*

Jadual 2 menunjukkan keputusan ujian paired sample t-test bagi perbandingan skor pentaksiran formatif dan sumatif.

**Jadual 2**
Keputusan Ujian *Paired Sample t-Test*

| Perbandingan | Perbezaan Min | t | df | p | Saiz Kesan (d) |
|---|---|---|---|---|---|
| **Formatif – Sumatif** | -14.67 | -21.24 | 90 | < .001*** | 2.23 (Sangat Besar) |

***p < .001

Interpretasi:
Keputusan menunjukkan terdapat perbezaan yang signifikan antara skor pentaksiran formatif dan sumatif, t(90) = –21.24, p < 0.001. Nilai saiz kesan Cohen's d = 2.23 menunjukkan magnitud perbezaan yang sangat besar, menandakan pentaksiran sumatif mempunyai pengaruh yang jauh lebih kuat dalam menentukan pencapaian akademik pelajar pintar dan berbakat.

### Ujian Independent Sample t-Test: Perbezaan Jantina

Jadual 3 memaparkan keputusan ujian independent sample t-test bagi perbezaan pencapaian sumatif berdasarkan jantina.

**Jadual 3**
Keputusan Ujian *Independent Sample t-Test* Mengikut Jantina

| Perbandingan Jantina | t | df | p | Interpretasi |
|---|---|---|---|---|
| **Lelaki vs Perempuan** | -1.49 | — | .141 | Tidak signifikan |

Interpretasi:
Keputusan menunjukkan tiada perbezaan yang signifikan dalam pencapaian sumatif berdasarkan jantina (p = .141 > .05). Ini menunjukkan bahawa pelajar lelaki dan perempuan yang tergolong sebagai pelajar pintar dan berbakat mencapai tahap pencapaian akademik yang setara apabila mengikuti persekitaran pengajaran dan pentaksiran yang sama.

### Rumusan Dapatan Kajian

Secara keseluruhan, dapatan kajian menunjukkan bahawa skor pentaksiran sumatif adalah signifikan lebih tinggi berbanding pentaksiran formatif, dengan perbezaan antara kedua-

duanya menunjukkan saiz kesan yang sangat besar. Selain itu, tiada perbezaan signifikan dalam pencapaian sumatif berdasarkan jantina. Dapatan ini mengukuhkan peranan pentaksiran sumatif sebagai instrumen utama dalam membezakan pencapaian akademik pelajar pintar dan berbakat, serta menunjukkan keadilan pencapaian merentas jantina.

## Perbincangan

Tujuan utama kajian ini adalah untuk meneliti perbandingan pencapaian pentaksiran formatif dan sumatif dalam kalangan pelajar pintar dan berbakat bagi subjek Pendidikan Islam serta mengenal pasti sama ada wujud perbezaan pencapaian berdasarkan jantina. Beberapa dapatan penting telah dikenal pasti dan mempunyai implikasi terhadap amalan pengajaran dan pentaksiran. Pertama, kajian ini mendapati bahawa pelajar pintar dan berbakat mencapai skor yang jauh lebih tinggi dalam pentaksiran sumatif berbanding pentaksiran formatif. Dapatan ini selari dengan kajian lepas yang menyatakan bahawa pelajar pintar cenderung menunjukkan prestasi cemerlang dalam konteks pentaksiran berisiko tinggi yang menuntut pemikiran aras tinggi dan penguasaan kandungan yang mendalam (Peters et al., 2021; Shaunessy-Dedrick, 2023). Nilai saiz kesan yang sangat besar menunjukkan bahawa pentaksiran sumatif merupakan komponen yang dominan dalam menentukan pencapaian akademik pelajar pintar dan berbakat.

Namun demikian, taburan skor pentaksiran formatif yang sempit mencadangkan bahawa tugasan formatif yang digunakan mungkin kurang berupaya membezakan tahap kebolehan sebenar pelajar pintar. Tugasan yang terlalu berstruktur atau kurang mencabar berpotensi menyebabkan variasi skor yang terhad. Keadaan ini menyokong pandangan Tomlinson (2021) dan Wiliam (2022) yang menegaskan keperluan pentaksiran formatif yang bersifat lanjutan, terbuka dan mencabar bagi memaksimumkan potensi pelajar pintar dan berbakat.

Kedua, kajian ini mendapati tiada perbezaan signifikan pencapaian sumatif berdasarkan jantina. Dapatan ini menyokong kajian terdahulu yang menunjukkan bahawa perbezaan jantina dalam kalangan pelajar pintar dan berbakat menjadi tidak ketara apabila persekitaran pembelajaran dan kualiti pengajaran adalah seimbang (Putnick & Bornstein, 2023). Hal ini mencadangkan bahawa faktor kognitif dan motivasi yang berkait dengan kebolehan pintar lebih dominan berbanding faktor jantina.

Secara keseluruhan, dapatan kajian ini menekankan kepentingan penyelarasan antara amalan pentaksiran dengan keperluan pembelajaran pelajar pintar dan berbakat. Walaupun pentaksiran sumatif berkesan dalam membezakan pencapaian, pentaksiran formatif perlu diperkukuh agar dapat menyokong pembelajaran mendalam dan berterusan.

## Implikasi Kajian

Dari sudut pengajaran, dapatan kajian ini menunjukkan keperluan guru Pendidikan Islam merancang pentaksiran formatif yang lebih mencabar dan bersifat aras tinggi seperti aktiviti inkuiri, tugasan analisis mendalam, pembelajaran berasaskan masalah serta pentaksiran berasaskan prestasi. Selain itu, maklum balas formatif yang diberikan kepada pelajar pintar dan berbakat perlu menumpukan kepada pembangunan kemahiran metakognisi, kawalan kendiri dan penguasaan konsep yang kompleks bagi menyokong pembelajaran mendalam dan berterusan.

Dari perspektif pentaksiran, pentaksiran formatif tidak seharusnya terhad kepada latihan rutin atau lembaran kerja semata-mata, sebaliknya perlu digantikan dengan tugasan yang dibezakan mengikut tahap kesediaan, minat dan kebolehan pelajar. Di samping itu, keselarasan antara pentaksiran formatif dan pentaksiran sumatif perlu dipantau secara sistematik bagi memastikan kedua-dua komponen pentaksiran tersebut saling melengkapi dan menyokong pembelajaran yang bermakna dalam kalangan pelajar pintar dan berbakat.

Dari sudut dasar pula, institusi pendidikan yang menempatkan pelajar pintar dan berbakat disarankan menyediakan latihan profesional yang berterusan kepada guru dalam aspek reka bentuk pentaksiran terbeza dan pentaksiran berasaskan pembelajaran. Pembuat dasar pendidikan juga perlu memastikan dasar pentaksiran yang dirangka mengiktiraf peranan penting pentaksiran formatif sebagai mekanisme utama dalam menyokong pembangunan akademik jangka panjang pelajar pintar dan berbakat, khususnya dalam konteks Pendidikan Islam.

## Limitasi Kajian

Walaupun kajian ini menyumbang kepada pemahaman tentang pentaksiran dalam kalangan pelajar pintar dan berbakat, beberapa limitasi perlu diambil kira. Pertama, sampel kajian terhad kepada satu institusi sahaja, justeru kebolehumuman dapatan kajian adalah terhad. Kedua, data kajian hanya melibatkan dokumen pentaksiran akademik tanpa mengambil kira pemboleh ubah lain seperti motivasi, strategi pembelajaran atau faktor sosioemosi pelajar. Ketiga, analisis kajian hanya tertumpu kepada dua komponen pentaksiran, iaitu pentaksiran formatif dan sumatif, tanpa melibatkan bentuk pentaksiran lain seperti tugasan projek atau pembentangan. Selain itu, reka bentuk kajian yang bersifat keratan rentas juga tidak membolehkan penilaian perubahan pencapaian pelajar dalam jangka masa panjang.

## Cadangan Kajian Masa Hadapan

Berdasarkan limitasi kajian ini, beberapa cadangan boleh dipertimbangkan untuk penyelidikan masa hadapan. Kajian lanjutan disarankan untuk dijalankan secara longitudinal merentasi beberapa semester bagi menilai perubahan dan perkembangan pencapaian pelajar pintar dan berbakat secara berterusan. Selain itu, penggabungan pendekatan kualitatif seperti temu bual atau pemerhatian kelas dapat memberikan pemahaman yang lebih mendalam terhadap persepsi pelajar dan guru berkaitan amalan pentaksiran. Kajian masa hadapan juga boleh menilai peranan pengajaran terbeza terhadap pencapaian pentaksiran serta melibatkan perbandingan antara institusi bagi meningkatkan kebolehumuman dapatan. Di samping itu, integrasi pentaksiran kemahiran abad ke-21 seperti kreativiti, kolaborasi dan penyelesaian masalah wajar diteroka bagi menyokong pembangunan holistik pelajar pintar dan berbakat.

## Kesimpulan

Kajian ini membuktikan bahawa pelajar pintar dan berbakat dalam subjek Pendidikan Islam mencapai pencapaian yang jauh lebih tinggi dalam pentaksiran sumatif berbanding pentaksiran formatif, sekali gus menonjolkan peranan dominan pentaksiran sumatif dalam membezakan pencapaian akademik. Ketiadaan perbezaan jantina pula menunjukkan wujudnya keadilan pencapaian dalam kalangan pelajar pintar dan berbakat.

Dapatan kajian ini menyumbang kepada bidang pendidikan pelajar pintar dan berbakat dengan menekankan keperluan memperkukuh reka bentuk pentaksiran formatif agar lebih mencabar dan berkesan. Kajian ini juga mengisi jurang literatur dengan menyediakan bukti empirikal dalam konteks Pendidikan Islam, satu domain yang masih kurang diterokai dalam penyelidikan antarabangsa.

## Penghargaan

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# REKABENTUK DAN PEMBANGUNAN VIDEO ANIMASI 2D (*MUFRADAT AL-MARKABAT*) DALAM PEMBELAJARAN BAHASA ARAB PRASEKOLAH

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***Abstrak:*** *Penguasaan mufradāt merupakan asas penting dalam pembelajaran bahasa Arab, khususnya dalam membantu pelajar prasekolah menguasai kemahiran asas bahasa. Namun, tahap penguasaan mufradāt dalam kalangan pelajar prasekolah di Malaysia masih rendah disebabkan kekurangan pendekatan pembelajaran yang menarik dan interaktif. Sehubungan itu, objektif projek ini bertujuan untuk merekabentuk dan membangunkan video animasi 2D terhadap penguasaan mufradāt al-markabāt bahasa Arab dalam kalangan pelajar prasekolah. Projek ini menggunakan pendekatan reka bentuk dan pembangunan Design and Development Research sebagai metodologi utama bagi menghasilkan produk pembelajaran mufradāt bahasa Arab yang bersesuaian. Proses pembangunan dijalankan mengikut tiga fasa iaitu pra-produksi, produksi dan pasca-produksi. Hasil dapatan utama kajian ini ialah merekabentuk watak (objek), dan storyboard dan seterusnya membangunkan video animasi 2D yang direka khusus sebagai bahan bantu mengajar bagi pembelajaran mufradat al-markabāt dalam bahasa Arab untuk kanak-kanak prasekolah. Secara keseluruhan, projek ini mencadangkan agar penggunaan multimedia seperti animasi 2D diperluaskan dalam pembelajaran awal bahasa Arab kerana pendekatan ini bukan sahaja menyeronokkan, malah mampu meningkatkan keberkesanan dan kefahaman pembelajaran terutamanya untuk pelajar prasekolah 4 hingga 6 tahun.*

***Kata Kunci****: Mufradāt al-Markabāt, Animasi 2D, Bahasa Arab Prasekolah, Reka Bentuk dan Pembangunan.*

## Pendahuluan

Pembelajaran bahasa Arab di peringkat prasekolah memerlukan pendekatan yang interaktif dan menyeronokkan untuk membantu pelajar prasekolah memahami dan menguasai mufradāt dengan berkesan. Mufradāt (kosa kata) membentuk asas penting dalam pembelajaran bahasa, kerana ia membantu kanak-kanak mengembangkan kemahiran komunikasi dan pemahaman yang lebih mendalam.

Penggunaan teknologi dalam pendidikan, seperti video animasi 2D, telah ditunjukkan sebagai alat yang berkesan untuk meningkatkan penguasaan program akademik dalam kalangan pelajar prasekolah. Animasi 2D menggabungkan elemen visual dan audio yang dapat menarik perhatian pelajar prasekolah, merangsang minat mereka untuk belajar dan memudahkan mereka memahami perkataan yang diajar.

Menurut Hambali Jaili (2023), Faktor kelemahan penguasaan *mufradāt* juga mungkin menghalang pelajar prasekolah memahami perkataan atau ayat yang dibaca, kemudian tidak memahami dan membina prosa. Juga, dari sudut *Mahārah al-Kalām* (komunikasi), kelemahan penguasaan *mufradāt* menyebabkan pelajar prasekolah tidak dapat berkomunikasi walaupun dengan ungkapan yang mudah. Banyak faktor yang menyebabkan pelajar prasekolah tidak dapat menguasai *mufradāt* dengan baik, termasuk kelemahan guru dalam memilih kaedah dan kaedah pengajaran yang betul. Manakala, kaedah pembelajaran yang kurang menarik juga menyebabkan pelajar prasekolah kurang belajar. Menurut kajian (Syasya Afiza Razali & Nazita M Nasir, 2022), mendapati pelajar prasekolah ini menghadapi kesukaran untuk memberi perhatian semasa sesi pengajaran dan pembelajaran kerana bosan dengan kaedah pengajaran yang sama, iaitu hanya menggunakan lembaran kerja, buku aktiviti dan belajar menggunakan papan putih.

Objektif projek ini adalah untuk mengenal pasti *mufradāt al-markabāt* dalam pembelajaran bahasa Arab untuk pelajar pra sekolah dan seterusnya merekabentuk dan membangunkan video animasi 2D terhadap penguasaan *mufradāt* bahasa Arab. Pendekatan ini seharusnya membantu pelajar prasekolah menghafal perkataan ini dengan lebih cepat dan lebih berkesan melalui gabungan imej, bunyi dan pergerakan yang menarik.

## Sorotan Literatur

### *Pembelajaran Mufradat Bahasa Arab di Malaysia*

Menurut Hambali Jaili et al. (2023). *Mufradāt* adalah aset penting dalam mempelajari bahasa asing terutamanya bahasa Arab. Bahasa yang baik bergantung kepada *mufradāt* yang baik. Maksud sesuatu perkataan atau ayat hanya akan difahami melalui bahasa yang terkandung dalam *mufradāt*. Tahap penguasaan bahasa kedua diukur dengan penguasaan *mufradāt*. Begitu juga, perbualan dalam bahasa kedua hanya akan dikuasai jika *mufradāt* mencukupi untuk menjelaskan situasi tertentu. Kajian oleh Abu Hasim et al. (2020) mencadangkan, misalnya, penggunaan aspek persekitaran sebagai teknik untuk membantu pelajar prasekolah menguasai *mufradāt* sesuatu bahasa. Cadangan itu disokong oleh Aflisia dan Harahap (2019) yang menggabungkan pemerolehan bahasa dengan teknik pembelajaran bahasa yang inovatif dan berbeza, khususnya melalui pembentukan persekitaran bahasa. Kajian oleh Yusof et al. (2019) juga berpendapat bahawa perkembangan pelajar prasekolah dipengaruhi oleh interaksi dua hala yang diterjemahkan daripada jiwa pelajar prasekolah kepada dunia sekelilingnya. Pembangun terdahulu telah mengkaji dan meneroka persekitaran bahasa Arab.

Kajian Jenita (2021) menunjukkan, misalnya, perubahan dalam persekitaran pembelajaran bahasa Arab membolehkan perubahan dalam kemahiran lisan pelajar prasekolah. Perubahan ini membuktikan bahawa ekologi budaya tempatan mempengaruhi perkembangan dan kejayaan individu. Pandangan ini selaras dengan kajian Shobirin (2021), yang mendapati terdapat pengaruh yang signifikan antara persekitaran linguistik dan kemahiran bahasa Arab. Selain itu, bahan bantu adalah perlu bagi seorang pendidik atau pelajar prasekolah untuk mempelbagaikan kaedah interaksi atau komunikasi menggunakan bahasa tertentu, termasuk persekitaran bahasa. Peranan persekitaran linguistik penting untuk membantu meningkatkan kejayaan pembelajaran bahasa Arab dan pemerolehan bahasa kedua (Nurlaila, 2021). Persekitaran bahasa merupakan pengajaran penting yang sering digunakan oleh para pendidik di sekolah. Hasil kajian beliau menunjukkan bahawa kesan pembentukan *bi'ah lughawiyyah*

mampu mengubah kebolehan pelajar prasekolah bertutur dengan lancar, membantu menyebut *makhraj* huruf dengan betul dan menambah *mufrad* yang mencukupi. (Khairulaizam Abdul Rahman & Harun Baharudin, 2023)

***Pembelajaran Mufradāt Bahasa Arab Dan Perkaitannya Dengan Teknologi Multimedia***

Menurut Lutvi Ali Sahana Anggian (2022). Kebolehan seseorang berbahasa Arab dapat dilihat daripada *mufradāt* bahasa Arabnya. *Mufradāt* adalah salah satu asas untuk menguasai empat kemahiran bahasa, dan merupakan elemen terpenting dalam pembangunan empat kemahiran bahasa yang baik. Langkah pertama dalam pengenalan bahasa Arab ialah pada pengenalan *mufradāt* terlebih dahulu. kemahiran mendengar, kemahiran bertutur, kemahiran membaca dan kemahiran menulis. Empat kemahiran ini akan saling bergantung dan membantu menentukan seseorang untuk mengembangkan kemahiran bahasa Arab. Kedudukan *mufradāt* mempunyai peranan yang paling penting dalam bahasa Arab adalah dalam kecekapan berbahasa Arab.

Pembelajaran berlaku melalui sumber pembelajaran pelajar prasekolah dan dapat mengembangkan pengetahuan mereka dengan lebih berkesan. Secara amnya untuk memudahkan pelajar prasekolah memahami setiap pelajaran bahasa Arab yang didapatkan di sekolah. Guru dianggap sebagai faktor penting yang mampu menyelesaikan masalah ini dan oleh itu, menambah baik pengajaran dan pembelajaran (PdP) Bahasa Arab di Malaysia. Walaupun, tidak semua guru bahasa Arab di Malaysia mempunyai latihan khusus dalam bahasa Arab. Tetapi latihan yang baik boleh menjadikannya berkemahiran dan kreatif dalam penyampaian. Oleh yang demikian, tema pendidikan kajian ini mestilah memfokuskan kepada faktor pengajaran. Kaedah pengajaran bahasa yang lebih interaktif dan kontemporari menggunakan pelbagai kemudahan teknologi laman web dan peranti yang ada dapat meningkatkan minat masyarakat untuk mempelajari bahasa Arab. Kebijaksanaan guru yang mengajar bahasa ini sangat diperlukan supaya pembelajaran bahasa Arab tidak dianggap membuang masa, membosankan dan sangat berkaitan hanya dengan pembelajaran tatabahasa (Abdul Razif Zaini et al, 2019)

Dunia pendidikan kini semakin maju berasaskan sumber manusia, teknologi, serta pembangunan kurikulum yang mana menuntut kepada semua pelajar prasekolah dapat menggunakan alat pembelajaran yang mereka boleh secara aktif dan akses secara bebas. Proses pembelajaran hari ini lebih mementingkan aktiviti pelajar prasekolah itu sendiri berbanding dengan zaman sebelumnya yang lebih banyak ia memberi tumpuan kepada aktiviti seorang guru. Multimedia boleh digunakan sebagai motivasi untuk pelajar prasekolah belajar untuk mengembangkan dan membangkitkan rasa ingin tahu, kerana multimedia mempunyai daya tarikan tersendiri kepada pelajar prasekolah. Dengan penggunaan multimedia pengajaran yang baik, kaedah pembelajaran seorang guru akan menjadi lebih bervariasi (Lutvi Ali Sahana Anggian, 2022).

Antaranya ialah multimedia sebagai alat yang boleh membantu guru menerangkan/menghantar mesej/bahan kepada pelajar prasekolah. Apabila guru menggunakan multimedia dalam proses pembelajaran, Guru menjadi teladan utama yang dilihat dan didengar oleh pelajar prasekolah secara langsung. Sehingga dalam hal ini kebolehan guru menjadi rujukan kejayaan pembelajaran. Multimedia memainkan peranan autonomi dalam proses pengajaran dan pembelajaran, guru hanya menambah penerangan yang tidak disampaikan dan tidak nyata oleh

multimedia. Akhir sekali, multimedia memainkan peranan yang aktif dan merupakan satu-satunya sumber pembelajaran yang sangat relevan pada zaman ini.

### *Animasi Dalam Pembelajaran Multimedia*

Animasi ialah perubahan visual dari semasa ke semasa memberikan kuasa besar kepada projek multimedia. Ciri-ciri filem animasi penting dalam perkembangan pelajar prasekolah. Pelajar prasekolah sangat mengagumi dan menikmati filem animasi, terutamanya filem animasi dengan watak haiwan. Pelajar prasekolah suka filem animasi dengan watak yang bagus dan lucu, dari segi ciri-ciri filem keseronokan yang baik untuk pelajar prasekolah. Tujuan media filem animasi adalah untuk membantu guru menyampaikan mesej dengan mudah supaya pelajar prasekolah menguasai mesej dengan cepat dan tepat dalam proses pengajaran dan pembelajaran apa yang guru lakukan, penggunaan bahan filem animasi adalah bertujuan supaya pelajar prasekolah yang menyertai aktiviti pembelajaran ini dilindungi gejala verbalisme, iaitu pengecaman perkataan yang disampaikan oleh guru tetapi tidak faham maksud atau maknanya. (Ulvia Safratul Ula, 2019).

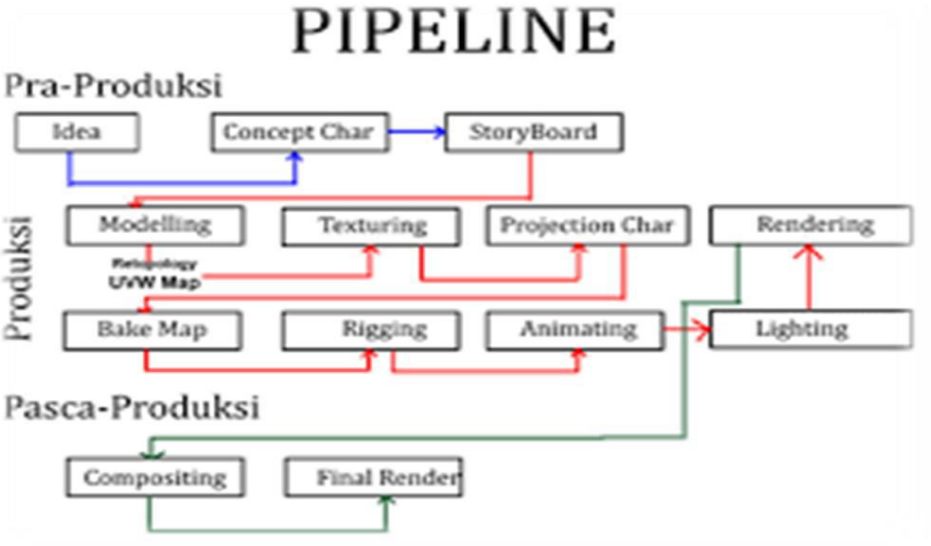
### *Animasi 2D*

Menurut Aura Sabila Putri dan Dewa Sadewa (2023). Animasi ialah aksi animasi atau dianimasikan yang mempunyai kehidupan, keseronokan, kemeriahan dan kegembiraan hidup. Animasi ialah seni yang memberikan pandangan animasi objek pegun. Animasi 2D ini lebih popular dalam kehidupan seharian kita. Ia juga dikenali sebagai filem animasi. Kartun itu sendiri berasal dari perkataan kartun, yang bermaksud gambar yang lucu. Sebenarnya, kebanyakan filem animasi ini adalah filem kelakar. Perisian yang biasa digunakan untuk mencipta Animasi 2D ialah: Macromedia Flash atau Adobe False, animasi GIF dan Corel Rave, Swish Max, After Effects, Moho, CreaToon dan ToonBoo.

Manakala menurut Moch. Yordan Rismarinandyo & Ranesti Damarsuri (2023). Mencipta filem animasi 2D bermula dengan menulis skrip, mencipta key pose, in-between, compositing dan kemudian rendering. Animasi 2D pada asalnya adalah animasi tradisional yang hanya menawarkan ciri-ciri watak dan objek dalam ruang dua dimensi, iaitu, ia hanya mempunyai ketinggian dan lebar, tanpa kedalaman. Animasi 2D moden dilakukan dengan perisian, jadi animator menjalankan proses melukis dan menghidupkan watak digital. Animator hari ini menggunakan software untuk mencipta motion graphics berasaskan komputer dalam persekitaran virtual 2D atau 3D.

## Metodologi

Dalam projek ini, kaedah yang digunakan oleh rekabentuk dan pembangun ialah kaedah membuat filem pendek atau video. Jadi untuk kepastian Projek yang berjaya dibangunkan melalui proses tiga fasa yang berbeza, iaitu Pra-Produksi, Produksi dan Pasca-Produksi.




**Rajah 1: Model Kajian (Asep Gigin Ginanjar, 2015)**

***Pra-Produksi***

Pra-produksi adalah salah satu peringkat proses penciptaan filem atau video. Pada peringkat ini banyak persiapan yang dilakukan termasuk menulis skrip, menetapkan jadual mengambil gambar, mencari lokasi, menyediakan belanjawan, menyelidik/mengaudit pelakon yang berpotensi, menjaga permit, menentukan kakitangan produksi dan peralatan, menjaga sewa peralatan produksi filem, dan juga pra-produksi, pasca-produksi. Namun, dalam proses mencipta bahan pengajaran dengan animasi ini hanya menggunakan konsep cerita, storyline, storyboard dan keperluan peranti. (Agus Sevtiana, 2019). Sebagai pembangun, perkara pertama adalah memulakan proses pra-produksi dengan menjana idea utama yang bertujuan untuk menyampaikan *mufradāt al-markabāt* melalui pendekatan yang interaktif dan menarik untuk pelajar. Konsep watak yang mesra dan mudah dikenali oleh pelajar, dengan watak-watak ini pelajar dapat berinteraksi secara aktif dengan kenderaan yang dipamparkan untuk memudahkan pelajar memahami. Pembangun juga menyediakan storyboard yang menyusun setiap babak mengikut urutan, memastikan pengenalan setiap jenis kenderaan dibangunkan secara sistematik dan mengikut senario pembelajaran.

***Idea:***

Pembangun mempunyai idea untuk mempersembahkan *al-markabāt* (jenis-jenis kenderaan) dalam bahasa Arab dengan cara yang menarik dan interaktif untuk pelajar. Memilih pendekatan visual dan naratif yang mesra pelajar untuk memudahkan mereka mengenali dan mengingati *mufradāt* yang berkaitan dengan kenderaan.

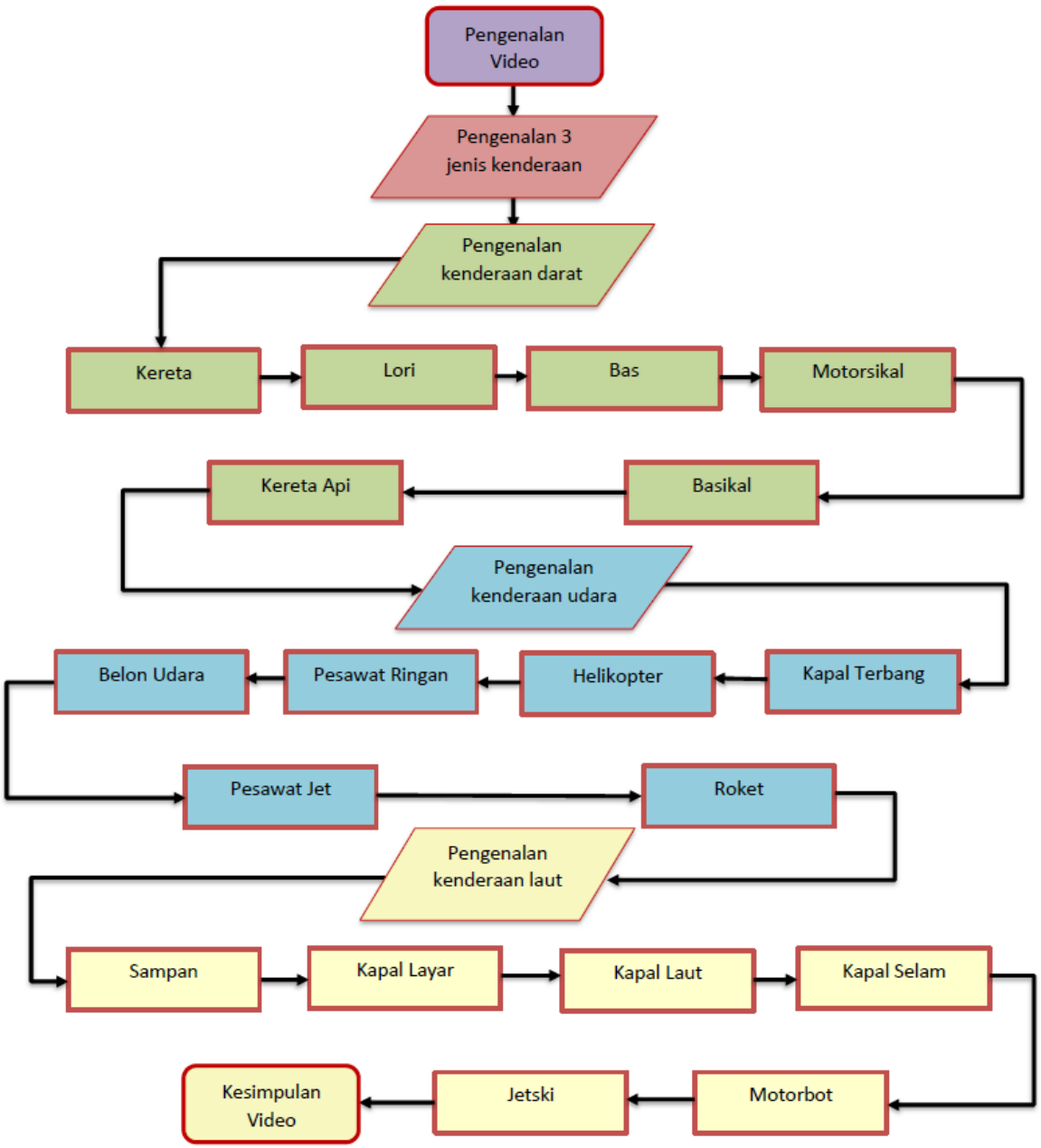
***Konsep Watak:***

Membangunkan konsep watak yang relevan dan sesuai untuk pelajar berinteraksi dengan pelbagai *al-markabāt*, memudahkan pelajar memahami konteks penggunaan *mufradāt*. Mereka setiap watak dengan watak yang sesuai untuk memudahkan pelajar mengikuti cerita.

***Storyboard:***

Menyusun storyboard yang mengandungi skrip untuk setiap adegan, memastikan setiap kenderaan dipersembahkan secara sistematik. Membuat lakaran kasar bagi setiap babak dan tentukan dialog atau teks yang akan digunakan untuk memperkenalkan *mufradāt al-markabāt*.

***Carta Alir***




**Rajah 2: Carta Alir Projek**

***Papan Cerita (Storyboard)***

| SCENE 1 | SCENE 2 | SCENE 5 | SCENE 6 |
|---|---|---|---|
|  |  |  |  |
| **Durasi:** 10 saat<br>**Deskripsi**: Pengenalan tajuk animasi<br>**Animasi**: Kenderaan dan teks bergerak masuk<br>**Musik:** Bunyi kenderaan dan chill pop music<br>**Audio**: Rakaman suara<br>**Text:** Jenis-jenis kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan 3 jenis kenderaan<br>**Animasi:** 3 Bulatan teks bergerak masuk<br>**Musik:** Bunyi kicauan burung dan chill pop music<br>**Audio:** Rakaman suara<br>**Text:** 3 jenis kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan |
| **SCENE 3** | **SCENE 4** | **SCENE 7** | **SCENE 8** |
|  |  |  |  |
| **Durasi:** 20 saat<br>**Deskripsi:** Menerangkan sedikit informasi tentang kenderaan darat<br>**Animasi:** Teks bergerak masuk<br>**Musik:** Bunyi kicauan burung dan chill pop music<br>**Audio:** Rakaman suara<br>**Text:** Informasi tentang kenderaan darat | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan |

| SCENE 9 | SCENE 10 | SCENE 13 | SCENE 14 |
|---|---|---|---|
|  |  |  |  |
| **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 20 saat<br>**Deskripsi:** Menerangkan sedikit informasi tentang kenderaan udara<br>**Animasi:** Teks bergerak masuk<br>**Musik:**<br>**Audio:** Rakaman suara<br>**Text:** Informasi tentang kenderaan udara | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan |
| **SCENE 11** | **SCENE 12** | **SCENE 15** | **SCENE 16** |
|  |  |  |  |
| **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan |

| SCENE 17 | SCENE 18 | SCENE 21 | SCENE 22 |
|---|---|---|---|
|  |  |  |  |
| **Durasi:** 20 saat<br>**Deskripsi:** Menerangkan sedikit informasi tentang kenderaan laut<br>**Animasi:** Teks bergerak masuk<br>**Musik:**<br>**Audio:** Rakaman suara<br>**Text:** Informasi tentang kenderaan laut | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan |
| **SCENE 19** | **SCENE 20** | **SCENE 23** | **SCENE 24** |
|  |  |  |  |
| **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 10 saat<br>**Deskripsi:** Penerangan tentang nama kenderaan<br>**Animasi:** Kenderaan dan teks bergerak<br>**Musik:** Bunyi kenderaan<br>**Audio:** Rakaman suara<br>**Text:** Nama kenderaan | **Durasi:** 40 saat<br>**Deskripsi:** Penutup tajuk jenis kenderaan<br>**Animasi:** Teks bergerak masuk<br>**Musik:** Chill pop music<br>**Audio:** Rakaman suara<br>**Text**: Informasi ringkas tentang 3 jenis kenderaan |

**Rajah 3: Papan Cerita**

***Produksi***

Fasa produksi ialah fasa pelaksanaan pra-produksi di mana semua pembangun multimedia bekerja mengikut fasa pra-produksi yang dijalankan dalam peringkat awal (Agus Sevtiana, 2019). Semasa fasa produksi, pembangun mencipta model asas setiap kenderaan dalam bentuk 2D dengan kontur yang mudah dikenal pasti. Pembangun juga menambah tekstur dan warna terang untuk menarik perhatian dan menjadikan setiap kenderaan lebih hidup. Seterusnya ia juga dapat memastikan perspektif watak dan kenderaan konsisten dalam setiap babak melalui proses *projection character*. Selain itu, menyediakan *rigging* asas kenderaan dan menganimasikan pergerakan mengikut rentak yang sesuai. Proses ini berakhir dengan penambahan *lighting* yang menerangkan objek utama dan *rendering* sementara dilakukan untuk memeriksa kualiti visual keseluruhan.

***Modelling:***

Pembangun membangunkan model asas 2D bagi setiap kenderaan, memfokuskan pada bentuk yang berbeza supaya setiap jenis kenderaan dapat dikenal pasti dengan mudah oleh pelajar.

***Texturing:***

Menambahkan warna dan tekstur yang terang dan menarik pada setiap model kenderaan untuk menjadikannya lebih menarik dan sesuai untuk konsep pembelajaran pelajar prasekolah.

***Projection Character:***

Menyusun perspektif watak dan kenderaan supaya ia kelihatan konsisten dalam setiap adegan, memastikan objek utama mudah dikenali.

***Bake Map:***

Menggunakan bake map untuk menyimpan elemen warna dan bayangan membantu mengoptimumkan prestasi animasi.

***Rigging:***

Membangunkan kerangka asas (rig) untuk watak dan kenderaan, menyediakan elemen pergerakan seperti roda atau interaksi watak dengan kenderaan.

***Animating:***

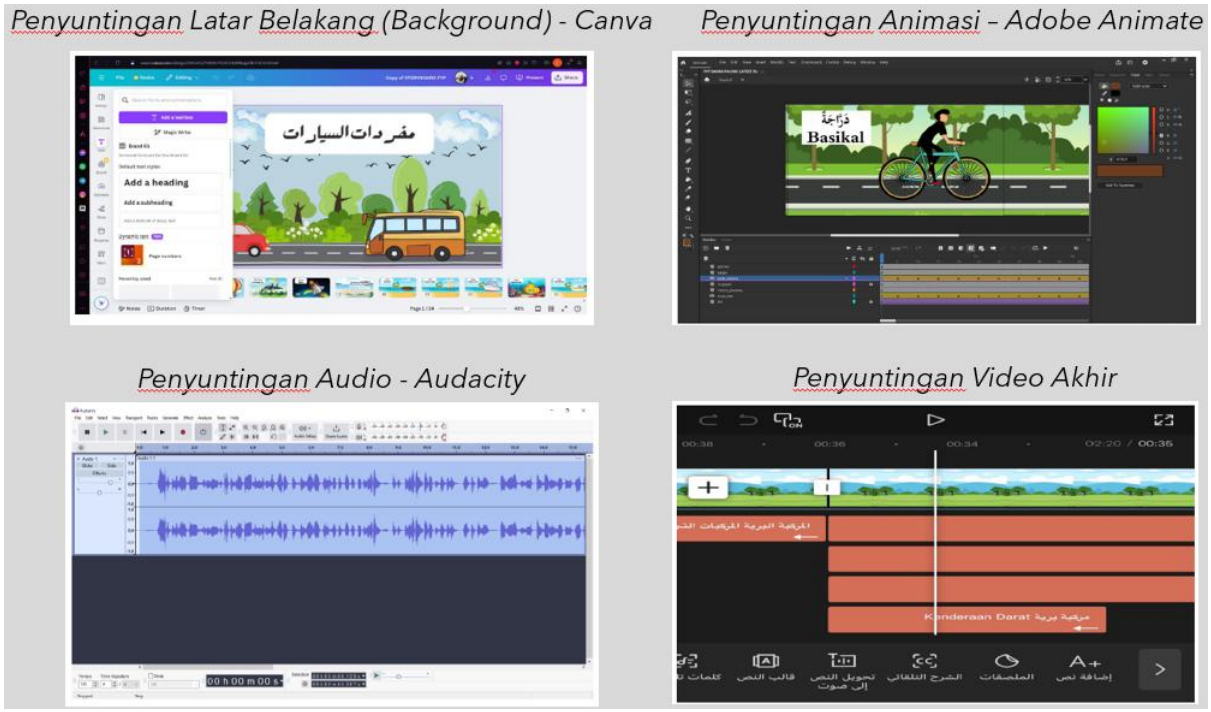
Menganimasikan pergerakan watak dan mana-mana kenderaan dengan kadar yang sesuai agar konsep *mufradāt* dapat disampaikan dengan jelas.

***Lighting:***

Menambahkan pencahayaan latar belakang dan objek utama untuk membantu pelajar prasekolah menumpukan pada elemen penting setiap adegan.

***Rendering:***

Menyediakan video sementara untuk menyemak kualiti animasi dan memastikan pengendalian elemen visual dan audio yang betul.




**Rajah 4: Fasa penyuntingan**

***Pasca Produksi***

Salah satu peringkat proses mencipta filem atau video. Langkah ini dilakukan setelah tahap penghasilan filem atau video selesai. Dalam fasa ini terdapat banyak aktiviti seperti: menyediakan efek khusus, pembetulan warna, menyediakan bunyi latar belakang dan muzik, dan juga penambahan animasi. (Agus Sevtiana, 2019). Dalam pasca produksi, pembangun melakukan proses *compositing* untuk menyatukan setiap elemen animasi, memastikan kelancaran visual dan aliran cerita. Hal ini juga dapat menambah kesan visual kecil dalam beberapa babak untuk menekankan dengan jelas persembahan *mufradāt* kenderaan. Akhir sekali, *final render* untuk memastikan video itu berkualiti dan sedia untuk digunakan sebagai alat pembelajaran yang berkesan.

***Compositing:***

Dengan menggabungkan lapisan animasi, watak dan latar belakang dalam komposisi yang teliti, memastikan setiap visual kelihatan harmoni dan mudah difahami. Menggunakan kesan visual tambahan jika perlu untuk menekankan pengenalpastian kenderaan tertentu apabila ia disebut dalam *mufradāt.*

***Final Render:***

Melakukan render akhir untuk memastikan bahawa video itu berkualiti tinggi dan sesuai untuk pembelajaran, dan menyimpannya dalam format yang memudahkan tontonan di platform pendidikan.

***Dapatan Kajian***

### *Mufradāt Al-Markabāt*

Pencarian data-data *Mufradāt Al-Markabāt* telah dilakukan melalui rujukan kamus bahasa Arab yang muktabar bagi memastikan ketepatan makna dan penggunaannya. Kamus seperti dwibahasa Arab-Melayu digunakan untuk mendapatkan makna yang tepat, serta konteks penggunaan setiap perkataan berkaitan kenderaan. Selain itu, kamus *Glosbe Translate* turut dirujuk bagi memastikan kesesuaian terjemahan dalam konteks pembelajaran bahasa Arab sebagai bahasa kedua.

### *Dapatan Kajian (Video Animasi 2D Mufradat Al-Markabat)*




**Rajah 5: Video Animasi 2D**

### *Kesimpulan*

Pendekatan pembelajaran bahasa Arab melalui video animasi 2D merupakan satu kaedah yang menarik, khususnya untuk pelajar prasekolah berusia 4 hingga 6 tahun, yang cenderung kepada pembelajaran visual dan interaktif. Walaupun kaedah ini sudah memberi impak positif, beberapa cadangan penambahbaikan boleh dipertimbangkan untuk meningkatkan keberkesanannya dalam memperkenalkan *mufradāt* berkaitan *al-markabāt* (kenderaan). Antara cadangan tersebut adalah mempelbagaikan adegan dan suasana dan penambahan elemen multimedia interaktif, Dengan penambahbaikan ini, video animasi 2D akan dapat memberikan pengalaman pembelajaran yang lebih efektif dan menyeronokkan bagi pelajar prasekolah, sambil memperkukuhkan pemahaman mereka terhadap *mufradāt* bahasa Arab yang berkaitan dengan kenderaan.

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# ZAKAT SEBAGAI PEMANGKIN KESEJAHTERAAN ASNAF: PENDEKATAN PROGRAM PEMBANGUNAN KEUSAHAWANAN DI MALAYSIA

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***Abstrak:*** *Malaysia mencatat kemajuan sosio-ekonomi sejak kemerdekaan, namun kemiskinan masih menjejaskan kesejahteraan golongan asnaf. Zakat berperanan sebagai mekanisme pembebasan daripada kemiskinan dan pemangkin pembangunan ekonomi melalui bantuan kewangan, pendidikan, latihan kemahiran, dan sokongan keusahawanan. Program pembangunan keusahawanan asnaf meningkatkan pendapatan serta menyokong kesejahteraan sosial, psikologi, dan rohani peserta. Kajian ini menggunakan pendekatan kualitatif deskriptif bagi menilai menilai peranan zakat sebagai pemangkin kesejahteraan asnaf melalui program pembangunan keusahawanan di Malaysia. Fokus analisis merangkumi bantuan modal, latihan kemahiran, sokongan digital, model mentor-mentee, dan penerapan nilai Islamik. Hasil kajian menunjukkan integrasi sokongan kewangan, latihan praktikal, bimbingan berterusan, dan nilai Islamik meningkatkan kemandirian ekonomi dan kesejahteraan peserta. Kajian ini juga mengenal pasti cabaran serta mencadangkan penambahbaikan program untuk memastikan keberkesanan dan daya tahan jangka panjang.*

***Kata kunci****: zakat, asnaf, kesejahteraan hidup, pembangunan keusahawanan, maqasid syariah*

## Pengenalan

Malaysia telah mencatat kemajuan sosio-ekonomi yang signifikan sejak kemerdekaan yang turut menyumbang kepada peningkatan pembangunan manusia. Walaupun demikian, kemiskinan masih menjadi cabaran utama yang menghalang pencapaian kesejahteraan hidup secara menyeluruh. Menurut World Bank (2024), kemiskinan bukan sekadar kekurangan pendapatan, tetapi juga keterbatasan akses kepada pendidikan, kesihatan dan keperluan asas lain. Sekiranya tidak ditangani secara sistematik, kemiskinan boleh menjejaskan pelbagai dimensi kesejahteraan dan membantutkan pembangunan masyarakat. Dalam konteks Islam, golongan asnaf terdiri daripada individu atau keluarga miskin yang berhak menerima bantuan zakat bagi memenuhi keperluan asas mereka. Walau bagaimanapun, kemiskinan berterusan sering mengekang kemampuan asnaf untuk keluar daripada kitaran ini tanpa intervensi yang bersepadu, justeru di Malaysia, institusi zakat dan Majlis Agama Islam Negeri memainkan peranan penting dalam memperkasa golongan ini secara berterusan.

Islam menekankan kesejahteraan menyeluruh melalui kerangka maqasid syariah yang merangkumi pemeliharaan agama, nyawa, akal, keturunan dan harta (al-Shatibi, 2004). Dalam

hal ini, zakat bukan sekadar agihan kewangan, tetapi mekanisme pembebasan asnaf daripada kemiskinan, sebagaimana dinyatakan dalam Surah al-Baqarah (2:177). Islam juga menggalakkan usaha meningkatkan kedudukan ekonomi melalui pekerjaan dan rezeki yang halal, seperti dalam Surah al-Mulk (67:15). Pendekatan ini menunjukkan bahawa pemberdayaan ekonomi asnaf adalah sebahagian daripada tuntutan syariah untuk mencapai kesejahteraan yang seimbang antara aspek material dan spiritual.

Program pembangunan keusahawanan muncul sebagai salah satu pendekatan strategik bagi memperkasa asnaf melalui peningkatan kemahiran, pendapatan dan peluang ekonomi. Dalam konteks ini, keusahawanan bukan sekadar mekanisme ekonomi, tetapi turut berpotensi menyumbang kepada kesejahteraan secara menyeluruh, merangkumi aspek sosial, psikologi dan pembangunan diri. Walau bagaimanapun, keberkesanan program keusahawanan asnaf masih perlu dinilai secara lebih holistik. Banyak kajian menumpukan kepada hasil ekonomi seperti pendapatan dan keberhasilan perniagaan semata-mata, sedangkan kesejahteraan hidup manusia bersifat multidimensi. Artikel ini bertujuan menilai peranan zakat sebagai pemangkin kesejahteraan asnaf melalui program pembangunan keusahawanan di Malaysia dengan menekankan integrasi sokongan kewangan, latihan kemahiran, bimbingan, dan nilai Islam untuk meningkatkan kualiti hidup peserta secara menyeluruh.

## Metodologi

Kajian ini menggunakan pendekatan kualitatif deskriptif dan analisis dokumen untuk menilai keberkesanan program pembangunan keusahawanan asnaf di Malaysia. Data diperoleh daripada artikel jurnal, dokumen akademik, dan sumber literatur berkaitan. Analisis menumpukan pada elemen utama program, termasuk bantuan modal, latihan kemahiran, sokongan digital, model mentor-mentee, serta penerapan nilai Islamik, bagi menilai kesan program terhadap kesejahteraan ekonomi, sosial, dan rohani peserta. Kajian ini juga meneliti cabaran dan faktor kejayaan program, selaras dengan konsep kesejahteraan multidimensi dan prinsip maqasid syariah.

## Konsep Kesejahteraan Hidup

Kesejahteraan hidup merupakan konsep multidimensi yang mendapat perhatian dalam beberapa dekad terakhir kerana peranannya dalam mewujudkan masyarakat yang sihat, produktif dan berdaya tahan (Das et al., 2020). Ia merangkumi penilaian subjektif terhadap kepuasan hidup individu atau masyarakat serta kemampuan memenuhi keperluan asas dan mencapai potensi diri (Shir Nikolaev & Wincent, 2019). Secara umum, kesejahteraan melibatkan keseimbangan antara dimensi fizikal, mental, sosial dan ekonomi (Rusk, 2022; Seligman, 2011), termasuk aspek kebahagiaan, kepuasan hidup serta kualiti hidup yang baik (Böhnke & Kohler, 2008).

Dalam perspektif Islam, kesejahteraan atau al-falah merangkumi keseimbangan antara rohani, material dan sosial serta keberhasilan di dunia dan akhirat (Rizvi & Pasha-Zaidi, 2021). Konsep ini berpaksikan maqasid syariah, iaitu pemeliharaan agama, nyawa, akal, keturunan dan harta (al-Ghazali, 1993). Islam menekankan pemenuhan keperluan spiritual melalui ibadah dan hubungan dengan Allah SWT serta keperluan material secara sederhana, termasuk keadilan

pengagihan zakat bagi mengurangkan jurang ekonomi dan meningkatkan kesejahteraan golongan asnaf (Amirus Sodiq, 2015; Rizvi & Pasha-Zaidi, 2021).

Kesejahteraan dalam Islam turut merangkumi keharmonian keluarga, tanggungjawab bersama, dan hubungan sosial yang baik, seperti ditegaskan dalam hadis Rasulullah SAW Sabda Rasulullah SAW yang bermaksud: "Daripada Muhammad bin Sa'ad bin Abi Waqqas daripada ayahnya berkata: Rasulullah SAW bersabda: Sesungguhnya antara perkara yang membahagiakan itu ialah tunggangan yang baik, tempat tinggal yang selesa dan isteri yang solehah. Antara perkara yang menyeksakan ialah kenderaan yang buruk, tempat tinggal yang tidak selesa dan isteri yang buruk (perangainya)"(Riwayat Tabrani). Melalui pendekatan ini, kesejahteraan hidup bukan sahaja menekankan kebahagiaan dan kepuasan duniawi, tetapi juga kesejahteraan rohani, sosial, dan ekonomi, yang memberi panduan penting dalam merangka program pembangunan, termasuk keusahawanan pertanian untuk asnaf.

**Peranan Zakat dalam Meningkatkan Kesejahteraan Hidup Asnaf**

Zakat memainkan peranan penting dalam meningkatkan kesejahteraan hidup golongan asnaf dengan menangani kemiskinan, memperkukuh ekonomi, dan menyokong pembangunan sosial serta spiritual. Pengagihan zakat dilakukan dalam pelbagai bentuk, termasuk bantuan kewangan, pendidikan, latihan kemahiran, sokongan keusahawanan, dan bantuan kesihatan, yang secara kolektif membantu asnaf menjadi lebih berdikari dan meningkatkan kualiti hidup mereka.

1. Pembasmian Kemiskinan

Bantuan zakat dalam bentuk kewangan membantu asnaf memenuhi keperluan asas seperti makanan, pakaian, tempat tinggal dan pendidikan, serta melindungi mereka daripada risiko kewangan akibat bencana atau kecemasan (Hanita, Adilah & Nazliatul Aniza, 2022). Pengagihan zakat yang lebih berkesan dan holistik dapat mengurangkan kebergantungan asnaf terhadap bantuan kebajikan dan menyediakan jalan keluar daripada kitaran kemiskinan (Fadhilah et al., 2022).

2. Pemerkasaan Ekonomi dan Keusahawanan

Zakat bukan sahaja membantu memenuhi keperluan asas, tetapi juga memperkasakan ekonomi melalui sokongan keusahawanan dan program produktif. Bantuan modal, projek pertanian, dan skim mikrotakaful membolehkan asnaf memulakan perniagaan kecil, meningkatkan pendapatan, serta mengurangkan kebergantungan jangka panjang terhadap bantuan (Suraini et al., 2021; Hanita et al., 2022; Siti Nadiah et al., 2023). Pendekatan ini turut menyokong penyertaan asnaf dalam ekonomi digital dan memperkukuh daya tahan kewangan mereka.

3. Pendidikan, Latihan dan Kemahiran

Dana zakat digunakan untuk membiayai pendidikan dan program latihan kemahiran, termasuk pertanian, teknologi, dan keusahawanan. Latihan ini membuka peluang pekerjaan dan perniagaan bagi asnaf, meningkatkan kemahiran serta minda mereka, sekaligus menyokong

transformasi jangka panjang dan kemandirian ekonomi (Muhammad Firdaus et al., 2021; Nurul Azma et al., 2022).

4. Kesejahteraan Sosial dan Kesihatan

Zakat memperkukuh integrasi sosial dengan mengurangkan rasa terpinggir, membiayai projek komuniti dan meningkatkan hubungan sosial serta perpaduan masyarakat (Siti Nadiah et al., 2023; Meraj, 2019). Selain itu, bantuan perubatan melalui zakat meningkatkan akses kesihatan, memperbaiki kesejahteraan fizikal dan mental, serta mengurangkan tekanan akibat kekangan kewangan (Hassan & Selamat, 2018; Mohd Nasir, Wan Mohd Azam & Miftachul Huda, 2020).

5. Peningkatan Ketakwaan dan Spiritual

Selain aspek material, zakat menyumbang kepada kesejahteraan rohani dengan mendidik asnaf untuk bersyukur, menjaga hati dan harta, serta memupuk ketenangan jiwa. Zakat membantu membersihkan diri daripada sifat negatif seperti iri hati dan dendam serta memberi motivasi untuk berusaha meningkatkan kualiti hidup (Samsul, 2020).
Secara keseluruhannya, zakat berfungsi sebagai mekanisme menyeluruh dalam Islam yang menyokong kesejahteraan hidup asnaf melalui pembasmian kemiskinan, pemerkasaan ekonomi, pendidikan, kesihatan, integrasi sosial, dan pembangunan rohani. Pelaksanaan zakat yang strategik, telus, dan berfokus kepada keperluan asnaf mampu meningkatkan taraf hidup mereka secara menyeluruh, sejajar dengan prinsip maqasid syariah.

**Program Pembangunan Keusahawanan Asnaf**

Program pembangunan keusahawanan bagi golongan asnaf di Malaysia merupakan inisiatif utama institusi zakat untuk membantu mereka keluar daripada kemiskinan melalui pendekatan holistik. Program ini menggabungkan bantuan modal, latihan kemahiran, bimbingan berterusan serta sokongan digital dengan matlamat membina keupayaan peserta menjadi usahawan berdikari, berdaya saing dan mampu meningkatkan taraf hidup secara menyeluruh. Pendekatan ini turut menekankan pembentukan nilai keusahawanan, etika kerja dan pemupukan sikap berdaya tahan dalam kalangan asnaf.

Pelaksanaan program merangkumi beberapa elemen utama. Pertama, bantuan modal dan latihan yang disediakan oleh institusi zakat dan Majlis Agama Islam Negeri (MAIN) meliputi pemberian tunai atau peralatan, kursus kemahiran, latihan pengurusan kewangan, pemasaran dan teknik pertanian moden, disertai bimbingan berterusan untuk meningkatkan keupayaan perniagaan peserta (Yusof et al., 2025; Maymunah et al., 2021; Dayang Shobihah et al., 2020). Kedua, sokongan digital seperti program AsnafTech 4.0 menekankan latihan pemasaran digital, subsidi pengiklanan dan penggunaan peralatan teknologi untuk memperkukuh daya saing peserta dalam ekonomi digital (Asni et al., 2025; Ismail et al., 2023). Ketiga, model mentor-mentee dan komuniti memperkukuh jaringan sokongan melalui komuniti keusahawanan dan koperasi asnaf, membolehkan pertukaran ilmu, pengalaman, dan bimbingan secara berterusan (Sharipah Amirah & Mohd Faizal, 2023). Keempat, penekanan nilai Islam seperti Al-Qawiyy (kuat) dan Al-Amin (amanah), bersama prinsip maqasid syariah, membentuk peserta yang beretika, cekap, dan bertanggungjawab dalam perniagaan (Shiyuti et al., 2021).

Program-program negeri seperti Skim Bantuan Jayadiri di bawah Lembaga Zakat Negeri Kedah (LZNK), Program Pembangunan Sosio-Ekonomi (PSEA) di bawah Lembaga Zakat Selangor (LZS) serta inisiatif atau program pertanian antaranya oleh Majlis Agama Islam dan Adat Istiadat Perlis (MAIPs), Majlis Agama Islam dan Adat Istiadat Melayu Kelantan (MAIK) dan Majlis Agama Islam dan Adat Melayu Perak (MAIPk) yang mana program tersebut untuk membantu golongan asnaf menjadi usahawan berjaya melalui menyediakan dana, latihan dan bimbingan untuk memulakan atau mengembangkan perniagaan, menjadikan mereka pembayar zakat dan bukan lagi penerima (Hamdino et al., 2013; Hashim & Syed Musa, 2018; Sharipah Amirah & Mohd Faizal, 2023). Namun, kejayaan program bergantung dan dipengaruhi oleh ciri peribadi peserta, akses kepada modal, sokongan berterusan dan integrasi prinsip Islam dalam strategi pembangunan keusahawanan (Hashim et al., 2020).

Walaupun pelbagai program yang dijalankan menunjukkan peningkatan pendapatan, kadar penglibatan aktif dan kemampuan peserta keluar sepenuhnya daripada kemiskinan masih menghadapi cabaran. Faktor utama termasuk kekurangan modal, kemahiran pemasaran, motivasi peserta dan ketahanan perniagaan. Cabaran ini ditangani melalui latihan intensif, bimbingan mentor, sokongan komuniti dan penekanan nilai Islam dalam pembangunan keusahawanan (Abdullah et al., 2025; Shiyuti & Ishak, 2025).

Terdapat kajian menunjukkan impak program menunjukkan perkembangan positif, dengan kadar graduasi asnaf menjadi muzaki antara 30–60% dan peningkatan pendapatan peserta sehingga RM8,000–RM30,000 sebulan antaranya melalui program digital dan pertanian khusus yang terbukti meningkatkan daya saing dan pendapatan peserta, menandakan keberkesanan pendekatan yang bersasar dan inovatif (Ismail et al., 2023; Meerangani et al., 2024). Pendekatan inovatif lain, termasuk penggabungan wakaf dan zakat serta Model Kewangan Inovatif (pinjaman kebajikan), turut diterokai untuk meningkatkan keberlanjutan program dan membolehkan peserta menjadi pembayar zakat, seterusnya meningkatkan daya tahan ekonomi jangka panjang (Siti Nadiah et al., 2023).

Secara keseluruhannya, pembangunan keusahawanan asnaf di Malaysia memerlukan gabungan sokongan modal, latihan, bimbingan dan penerapan nilai Islam secara holistik. Program yang berintegrasi dan berterusan bukan sahaja meningkatkan pendapatan dan kemandirian ekonomi peserta, tetapi juga menyumbang kepada pengurangan kemiskinan dan pembangunan sosioekonomi yang mampan.

## Cadangan Penambahbaikan Program

Cadangan polisi dan penambahbaikan program pembangunan keusahawanan asnaf di Malaysia menekankan pendekatan holistik yang selaras dengan cabaran semasa dan potensi asnaf untuk keluar daripada kemiskinan. Sokongan pemasaran digital adalah satu langkah penting, termasuk skim subsidi pengiklanan, latihan pemasaran, bimbingan berterusan, dan pembangunan komuniti digital asnaf, yang dapat meningkatkan daya saing dalam ekonomi digital (Asni et al., 2025; Meerangani et al., 2024; Ismail et al., 2023). Integrasi mikro-kewangan dan latihan pula melibatkan gabungan bantuan modal, latihan pengurusan, dan dana kecemasan untuk memastikan kelestarian perniagaan peserta (Yusof et al., 2025; Aris et al., 2021). Pemilihan peserta berpotensi tinggi disarankan melalui indeks keusahawanan, saringan

motivasi, dan pengesahan komuniti oleh ketua kampung atau imam bagi memastikan program disasarkan kepada individu yang mampu memanfaatkan peluang keusahawanan (Mahmood et al., 2021; Hamid et al., 2024).

Pembangunan nilai dan motivasi Islamik turut penting dengan penekanan pada nilai Al-Qawiyy (kuat), Al-Amin (amanah), dan tasawwur Islam dalam latihan keusahawanan, membentuk peserta yang beretika, cekap, dan bertanggungjawab (Khalil & Saniff, 2023; Shiyuti & Ishak, 2025). Pemantauan dan bimbingan berstruktur diperlukan melalui penilaian prestasi, bimbingan berterusan, dan pengiktirafan pencapaian, bagi memastikan keberkesanan dan impak program (Asni et al., 2025; Meerangani et al., 2024). Selain itu, pembangunan rangkaian dan komuniti usahawan, termasuk platform mentor-mentee dan koperasi asnaf, dapat memperkukuh sokongan berterusan dan pertukaran pengalaman (Ismail et al., 2023). Fokus kepada sektor berpotensi tinggi, seperti pertanian dan digital, melalui program agropreneur dan digitalpreneur, latihan kemahiran, dan bantuan peralatan turut dicadangkan untuk meningkatkan daya saing dan pendapatan asnaf (Yusof et al., 2025; Meerangani et al., 2024; Aris et al., 2021; Ismail et al., 2023).

Bagi penambahbaikan program, latihan berasaskan pendidikan dan praktikal termasuk kursus kemahiran, latihan digital dan praktikal terbukti meningkatkan kemahiran dan daya saing peserta (Shiyuti, 2023; Ismail et al., 2023). Pemantauan dan penilaian berterusan dengan pengiktirafan pencapaian juga diperlukan bagi memastikan keberkesanan program (Asni et al., 2025). Peningkatan akses modal dan infrastruktur, seperti penyaluran modal secara berperingkat, bantuan peralatan, serta akses kepada infrastruktur digital dan pertanian, penting untuk kelestarian perniagaan asnaf (Yusof et al., 2025; Saad et al., 2025). Selain itu, kerjasama strategik dengan agensi kerajaan, swasta, NGO, dan institusi pendidikan dapat memperluas peluang latihan, pemasaran, dan jaringan bagi menyokong pembangunan usahawan asnaf (Meerangani et al., 2024).

Secara keseluruhannya, penambahbaikan program pembangunan keusahawanan asnaf di Malaysia memerlukan gabungan integrasi latihan, sokongan digital, pemilihan peserta berpotensi, penekanan nilai Islamik, pemantauan berstruktur, serta kerjasama strategik. Polisi yang inklusif dan responsif terhadap cabaran semasa dapat meningkatkan kadar kejayaan asnaf keluar dari kemiskinan serta menyumbang kepada pembangunan sosioekonomi yang mampan. Ringkasannya ditunjukkan dalam Jadual 1.

**Jadual 1: Cadangan Penambahbaikan Program Pembangunan Usahawan Asnaf**

| Cadangan | Penjelasan & Justifikasi |
|---|---|
| Sokongan Pemasaran Digital | Skim subsidi pengiklanan digital, latihan pemasaran, bimbingan berterusan, dan komuniti digital asnaf |
| Integrasi Mikro-Kewangan & Latihan | Gabungan bantuan modal, latihan pengurusan, dan dana kecemasan untuk kelestarian perniagaan |
| Pemilihan Asnaf Berpotensi Tinggi | Gunakan indeks keusahawanan, saringan motivasi, dan pengesahan komuniti (ketua kampung/imam) |
| Pembangunan Nilai & Motivasi Islamik | Penekanan pada nilai Al-Qawiyy (kuat), Al-Amin (amanah), dan tasawwur Islam dalam latihan keusahawanan |

| Cadangan | Penjelasan & Justifikasi |
|---|---|
| Pemantauan & Bimbingan Berstruktur | Pemantauan prestasi, bimbingan berterusan, dan pengiktirafan pencapaian asnaf |
| Pembangunan Rangkaian & Komuniti Usahawan | Platform jaringan, mentor-mentee, dan koperasi asnaf untuk sokongan berterusan |
| Fokus Sektor Potensi Tinggi (Pertanian/Digital) | Program khusus agropreneur dan digitalpreneur, latihan kemahiran, dan bantuan peralatan |

## Kesimpulan

Program pembangunan keusahawanan asnaf di Malaysia penting untuk meningkatkan ekonomi dan kesejahteraan sosial, sejajar dengan prinsip zakat dan maqasid syariah. Program yang menggabungkan bantuan modal, latihan kemahiran, bimbingan, sokongan digital, dan nilai Islamik dapat meningkatkan kualiti hidup peserta. Walaupun begitu, cabaran seperti kekurangan modal, kemahiran pemasaran, dan motivasi peserta masih wujud. Penambahbaikan melalui sokongan pemasaran digital, mikro-kewangan, pemilihan peserta berpotensi, pemantauan berstruktur, dan pembangunan rangkaian usahawan adalah penting. Untuk kajian akan datang, disarankan menilai impak jangka panjang program, keberkesanan latihan digital, dan peranan zakat dalam kesejahteraan multidimensi peserta. Kajian perbandingan antara negeri dan sektor pertanian atau digital juga boleh membantu membangunkan model keusahawanan asnaf yang lebih berkesan. Secara keseluruhan, pendekatan kewangan, latihan, bimbingan, dan nilai Islamik bukan sahaja menyokong kesejahteraan ekonomi dan sosial, tetapi juga membantu mengurangkan kemiskinan di Malaysia.

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# KESEDARAN KESELAMATAN DAN KESIHATAN SEBAGAI MEKANISME PENGANTARA BAHAYA PSIKOSOSIAL DAN PELANGGARAN KONTRAK PSIKOLOGIKAL DALAM KALANGAN PEKERJA

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***Abstrak***: *Kesedaran keselamatan dan kesihatan berupaya memainkan peranan penting sebagai mekanisme pengantara antara bahaya psikososial dengan pelanggaran kontrak psikologikal. Pendedahan kepada bahaya psikososial berpotensi menurunkan tahap kesedaran keselamatan dan kesihatan, dan pada waktu yang sama peningkatan pelanggaran kontrak psikologikal. Objektif kertas kerja ini mengkaji peranan kesedaran keselamatan dan kesihatan, sebagai mekanisme pengantara dalam hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal dalam kalangan pekerja. Selain daripada itu, kertas kerja ini juga bertujuan mengkaji hubungan kesedaran keselamatan dan kesihatan, bahaya psikososial dengan pelanggaran kontrak psikologikal. Kajian ini menggunakan reka bentuk kuantitatif melalui kaedah tinjauan terhadap 136 pekerja. Data dianalisis menggunakan analisis korelasi dan pemodelan persamaan berstruktur (PLS-SEM). Soal-selidik yang digunakan ialah Amick Qustionnaire yang mengukur kesedaran keselamatan dan kesihatan, Job Content Questionnaire mengukur pembolehubah bahaya psikososial. Sementara itu, Psychological Contract Breach mengukur pelanggaran kontrak psikologikal. Nilai kebolehpercayaan alat ujian Amick Qustionnaire ialah (α = .97) Job Content Questionnaire (α = .93) dan Psychological Contract Breach (α = .68). Analisis pekali korelasi menunjukkan terdapat perhubungan yang siginifikan antara kesedaran keselamatan dengan bahaya psikososial (r=.261** , k < .05), dan pelanggaran kontrak psikologi (r=. 205**,k < .05). Namun, hasil kajian mendapati tidak terdapat hubungan yang signifikan antara bahaya psikososial dengan pelanggaran kontrak psikologikal (r= 122, k > .05). Dapatan kajian menunjukkan bahawa kesedaran keselamatan dan kesihatan mengantara secara signifikan hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal(β = -0.129, t = 3.072, p = 0.002). Dapatan ini*

*menyokong Model Job Demands–Resources (JD-R). Kertas kerja ini juga membincangkan limitasi kajian, kepentingan kajian kepada teori, amalan dan organisasi. Di samping itu, kajian ini juga memberi cadangan umum dalam merangka intervensi peningkatan kesedaran keselamatan dan kesihatan dan penurunan bahaya psikososial dan pelanggran kontrak psikologikal.*

***Katakunci**: Kesedaran Keselamatan Dan Kesihatan, Bahaya Psikososial Dan Pelanggaran Kontrak Psikologikal*

## Pengenalan

Persekitaran kerja berhadapan dengan pelbagai cabaran bahaya psikososial seperti peningkatan beban tugas, kekangan sumber, tekanan masa, kekaburan peranan serta tuntutan daripada pihak berkepentingan. Dollard et al. (2019) berpendapat pendedahan berterusan kepada bahaya psikososial berpotensi menjejaskan kesejahteraan psikologikal pekerja dan seterusnya mempengaruhi persepsi mereka terhadap hubungan pekerjaan dengan organisasi. Sehubungan itu, Deng et al. (2018) menjelaskan antara salah satu implikasi utama bahaya psikososial ialah pelanggaran kontrak psikologikal. Apa yang dimaksudkan dengan pelanggaran kontrak psikologikal ialah persepsi pekerja bahawa organisasi gagal memenuhi janji, tanggungjawab atau jangkaan tidak bertulis yang terbentuk sepanjang hubungan pekerjaan. Mengikut Deng et al. (2018) lagi, apabila pelanggaran kontrak psikologikal berlaku, pekerja cenderung menunjukkan sikap negatif seperti penurunan komitmen, kepuasan kerja dan kepercayaan terhadap organisasi yang berkurangan.

Topa et al. (2022) melihat kesedaran keselamatan dan kesihatan sebagai satu sumber yang berpotensi memainkan peranan perlindungan apabila bahaya psikososial dan pelanggaran kontrak psikologikal meningkat. Seterusnya, Cheung et al. (2021) berpandangan kesedaran keselamatan dan kesihatan merangkumi tahap pengetahuan, sikap dan keprihatinan pekerja terhadap aspek keselamatan, kesihatan dan kesejahteraan di tempat kerja. Namun demikian, bahaya psikososial yang tinggi boleh menghakis tahap kesedaran ini dan seterusnya meningkatkan risiko pelanggaran kontrak psikologikal.

Kajian terdahulu seperti Clarke (2020), Aslani et al. (2015) dan Vinokumar & Bhasi (2021) banyak meneliti hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal. Namun kajian yang mengintegrasikan kesedaran keselamatan dan kesihatan sebagai mekanisme pengantara dalam hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal masih terhad. Oleh itu, kajian ini dijalankan bagi mengisi jurang literatur tersebut dalam konteks pekerja di Malaysia.

## Permasalahan Kajian

Salah satu permasalahan yang mendorong pelaksanaan kajian ini ialah peningkatan bahaya psikososial dalam kalangan pekerja seperti mana yang diperkatakan oleh Restubog et. al (2015). Ramai pekerja melaporkan tekanan kerja yang tinggi akibat bahaya psikososial seperti beban tugas yang kompleks, tekanan politik, serta perubahan dalam dasar dan peraturan kerja. Keadaan ini boleh menyumbang kepada peningkatan stres pekerjaan dan keletihan emosi**.** Selain itu, permasalahan kajian terdiri dari implikasi pelanggaran kontrak psikologi terhadap

kesedaran keselamatan dan kesihatan. Artar & Adigüzel (2017) menjelaskan apabila pekerja merasakan bahawa organisasi tidak memenuhi janji mereka, mereka cenderung untuk mengalami kekecewaan, kurang kepuasan kerja, dan hilang motivasi. Selain daripada permasalahan kajian yang telah dibincangkan**,** faktor kurangnya kajian mengenai kesedaran keselamatan sebagai faktor perlindungan juga merupakan permasalahan kajian seterusnya. Walaupun banyak kajian telah meneliti kesan bahaya psikososial terhadap pelanggaran kontrak psikologikal, masih kurang kajian yang meneliti peranan kesedaran keselamatan sebagai mekanisme perlindungan dalam mengurangkan kesan negatif tersebut.

## Objektif Kajian

1. Mengkaji hubungan antara bahaya psikososial dengan kesedaran keselamatan dan kesihatan dalam kalangan pekerja.
2. Meneliti hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal dalam kalangan pekerja.
3. Mengkaji hubungan antara kesedaran keselamatan dan kesihatan dengan pelanggaran kontrak psikologikal dalam kalangan pekerja.
4. Menentukan peranan kesedaran keselamatan dan kesihatan sebagai pemboleh ubah pengantara dalam hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal dalam kalangan pekerja.

## Hipotesis Kajian

Berdasarkan sorotan literatur, hipotesis berikut dicadangkan:

H1: Terdapat hubungan yang signifikan antara bahaya psikososial dengan kesedaran keselamatan dan kesihatan.
H2: Terdapat hubungan yang signifikan antara bahaya psikososial dengan pelanggaran kontrak psikologikal.
H3: Terdapat hubungan yang signifikan antara kesedaran keselamatan dengan kesihatan dengan pelanggaran kontrak psikologikal.
H4: Kesedaran keselamatan dan kesihatan mengantara hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal.

## Sorotan Literatur dan Asas Teori

Zadow et al. (2023) menjelaskan bahaya psikososial di tempat kerja merangkumi aspek reka bentuk dan konteks kerja yang berupaya menjejaskan kesejahteraan psikologikal pekerja. Ini antara lainnya melibatkan faktor seperti tuntutan kerja yang tinggi, kekurangan kawalan kerja, sokongan sosial yang lemah, konflik peranan dan ketidakadilan organisasi. Kajian terkini seperti De Clercq et al. (2021) menunjukkan bahawa pendedahan berterusan kepada bahaya psikososial meningkatkan tekanan emosi, keletihan mental dan ketidakpuasan kerja, serta melemahkan hubungan psikologi antara pekerja dan organisasi (Karatepe et al. 2022). Dalam konteks pekerja, kekangan sumber, struktur birokrasi dan beban tugas yang kompleks menjadikan bahaya psikososial sebagai isu kritikal yang mempengaruhi persepsi pekerja terhadap keprihatinan organisasi terhadap kesejahteraan mereka seperti yang diperkatakan oleh Breevart & Bakker (2018).

Leka & Coke (2008) menjelaskan kesedaran keselamatan dan kesihatan merupakan konstruk penting yang menunjukkan setakat mana pekerja menyedari, menghargai dan mempercayai komitmen organisasi terhadap amalan keselamatan dan kesihatan di tempat kerja. Kajian dalam bidang keselamatan dan kesihatan pekerjaan seperti Clarke (2020), Fadillah Ismail et al. (2022) dan Grip & Bankins (2020) menunjukkan bahawa persekitaran kerja yang dicirikan oleh bahaya psikososial yang tinggi sering dikaitkan dengan tahap kesedaran keselamatan dan kesihatan yang rendah. Ini berlaku kerana pekerja merasakan aspek keselamatan dan kesihatan tidak diberi keutamaan oleh pihak pengurusan (Vinodkumar & Bhasi, 2021). Penurunan tahap kesedaran keselamatan dan kesihatan ini bukan sahaja menjejaskan pematuhan terhadap amalan keselamatan, malah turut mempengaruhi cara pekerja menilai keadilan dan tanggungjawab organisasi (Bal et al. 2020).

Dalam melihat hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal, kesedaran keselamatan dan kesihatan berpotensi berfungsi sebagai mekanisme pengantara yang penting. Apabila pekerja terdedah kepada bahaya psikososial yang tinggi, tahap kesedaran keselamatan dan kesihatan yang rendah mencerminkan persepsi bahawa organisasi gagal memenuhi tanggungjawabnya dalam menyediakan persekitaran kerja yang selamat dan sihat. Persepsi ini seterusnya meningkatkan kecenderungan pekerja untuk mentafsir pengalaman kerja mereka sebagai pelanggaran kontrak psikologikal. Kajian Hofmann et al. (2022) dan Lee et al. (2024) menyokong peranan pengantara ini dengan menunjukkan bahawa amalan keselamatan dan kesihatan yang kukuh dapat melemahkan kesan negatif tuntutan kerja terhadap sikap dan persepsi pekerja, termasuk persepsi pelanggaran kontrak psikologikal

Selari dengan *Model Job Demands–Resources (JD-R),* bahaya psikososial diklasifikasikan sebagai tuntutan kerja yang menghakis sumber pekerjaan dan peribadi, manakala kesedaran keselamatan dan kesihatan boleh dianggap sebagai sumber organisasi dan psikologi yang membantu pekerja menilai persekitaran kerja secara lebih positif (Bakker & Demerouti, 2017). Dalam keadaan kesedaran keselamatan dan kesihatan yang tinggi, pekerja lebih cenderung menilai organisasi sebagai prihatin dan bertanggungjawab, sekali gus mengurangkan kemungkinan berlakunya persepsi pelanggaran kontrak psikologikal walaupun berhadapan dengan tuntutan kerja yang tinggi. Sebaliknya, apabila kesedaran keselamatan dan kesihatan berada pada tahap yang rendah, kesan bahaya psikososial terhadap pelanggaran kontrak psikologikal menjadi lebih ketara. Oleh itu, literatur secara konsisten menunjukkan bahawa kesedaran keselamatan dan kesihatan memainkan peranan pengantara yang kritikal dalam hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal, khususnya dalam konteks sektor awam

**Asas Teori**

Kajian ini menggunakan model *Job Demands-Resources (JD-R)* dan teori Pealnggaran Kontrak Psikologikal.

Model *Job Demands-Resources (JD-R)*

Model *JD-R* mengikut Bakker & Demerouti (2008) merupakan alat yang bernilai untuk memahami kesan tuntutan kerja dan sumber kerja terhadap kesejahteraan serta prestasi pekerja.

Model ini mengikut Da Yee Lee & Yun Seong Jo (2023) membantu mengenal pasti keseimbangan antara tuntutan kerja dan sumber kerja yang boleh membawa sama ada kepada tekanan kerja atau peningkatan motivasi kerja. Dalam konteks bahaya psikososial, model *JD-R* boleh digunakan untuk menilai potensi risiko yang berkaitan dengan tuntutan kerja serta melaksanakan strategi bagi mengurangkan risiko tersebut. Dengan memahami hubungan antara tuntutan kerja dan sumber kerja, organisasi dapat mewujudkan persekitaran kerja yang lebih selamat dan menyokong, seterusnya mengurangkan kebarangkalian berlakunya bahaya psikososial serta menggalakkan kesihatan dan produktiviti pekerja.

## Teori Pelanggaran Kontrak Psikologikal

Conway & Briner (2005) menjelaskan teori Pelanggaran Kontrak Psikologikal berlaku apabila salah satu pihak dalam hubungan pertukaran gagal memenuhi kewajipan dan janji yang telah dipersetujui, keadaan ini boleh membawa kepada berlakunya pelanggaran kontrak. Dollard et al. (2019) seterusnya menjelaskan pelanggaran ini boleh mengakibatkan pelbagai kesan negatif terhadap pekerja, termasuk penurunan kepuasan kerja, peningkatan niat untuk berhenti kerja, serta kemerosotan kesihatan mental. Teori ini menekankan kepentingan kefahaman bersama dan prinsip timbal balik dalam hubungan pekerjaan. Teori ini juga mencadangkan bahawa kedua-dua pihak perlu menyedari kewajipan masing-masing serta akibat yang mungkin timbul sekiranya kewajipan tersebut gagal dipenuhi. Teori ini mengikut De Cuyper et al. (2008) telah diaplikasikan dalam pelbagai konteks, termasuk hubungan pekerjaan, dan disokong oleh peningkatan jumlah kajian empirikal. Walau bagaimanapun, masih terdapat beberapa ketidakpastian dan perbahasan dalam literatur, terutamanya berkaitan kekuatan hubungan antara pelanggaran kontrak psikologikal dengan hasil-hasil tertentu, serta faktor perantara atau pemoderasi yang berpotensi menjadikan hubungan tersebut lebih atau kurang signifikan.Secara keseluruhannya, teori pelanggaran kontrak psikologikal merupakan satu kerangka yang bernilai untuk memahami dinamika hubungan pekerjaan. Selain itu, ia juga melihat kesan pelanggaran terhadap tingkah laku dan kesihatan mental pekerja (Rousseau (1995). Teori ini juga menjadi peringatan tentang kepentingan mengekalkan komunikasi yang jelas dan telus, di samping amalan pengurusan sumber manusia yang berkesan, bagi memelihara hubungan pekerjaan dan mengurangkan kesan negatif akibat pelanggaran kontrak.

## Reka Bentuk Kajian dan Peserta

Kajian ini menggunakan reka bentuk kuantitatif berbentuk keratan rentas yang melibatkan seramai 136 orang responden daripada sektor awam dan swasta. Responden dipilih menggunakan kaedah pensampelan bertujuan (*purposive sampling*). Kaedah pensampelan bertujuan dipilih bagi menyasarkan pekerja yang berkemungkinan terdedah kepada bahaya psikososial dan pelanggaran kontrak psikologikal. Teknik ini juga memastikan responden yang dipilih adalah relevan secara khusus dengan objektif kajian. Selain itu, kaedah ini membolehkan pengkaji memilih peserta secara sengaja yang mempunyai pengalaman langsung terhadap pembolehubah yang dikaji. Secara umumnya, dengan memfokuskan kepada individu yang mempunyai pengalaman kerja serta pendedahan kepada bahaya psikososial di tempat kerja, kajian ini bertujuan untuk memperoleh data yang mencerminkan fenomena yang sedang diselidiki secara tepat. Kriteria kemasukan bagi kajian ini adalah pekerja sepenuh masa berumur 19 tahun dan ke atas, serta mempunyai sekurang-kurangnya satu tahun pengalaman kerja dalam organisasi semasa. Peserta yang mempunyai pengalaman kerja kurang daripada

satu tahun atau sedang bercuti panjang dikecualikan bagi mengekalkan keseragaman pendedahan terhadap faktor-faktor di tempat kerja.

## Instrumen Kajian

Tiga instrumen digunakan dalam kajian ini, iaitu *Job Content Questionnaire (JCQ)*, *Psychological Contract Violation Questionnaire* dan *Amick Questionnaire*.

*Job Content Questionnaire (JCQ)*

*Job Content Questionnaire (JCQ*) digunakan untuk mengukur tahap keseluruhan bahaya psikososial di tempat kerja. Instrumen ini menilai pelbagai dimensi faktor tekanan berkaitan pekerjaan. Soal selidik ini mengandungi beberapa item yang dinilai menggunakan skala Likert lima mata, bermula daripada "sangat tidak bersetuju" hingga "sangat bersetuju". Skor yang lebih tinggi menunjukkan tahap bahaya psikososial yang lebih tinggi. Dalam kajian ini, skor keseluruhan bahaya psikososial diperoleh melalui penggabungan skor subskala bagi menggambarkan tahap risiko psikososial secara menyeluruh yang dialami oleh pekerja.

*Psychological Contract Violation Questionnaire*

Persepsi responden terhadap pelanggaran kontrak psikologikal diukur menggunakan *Psychological Contract Violation Questionnaire*. Instrumen ini mengukur sejauh mana pekerja merasakan bahawa organisasi gagal memenuhi janji, kewajipan dan jangkaan yang telah dipersetujui. Instrumen ini merangkumi tindak balas kognitif dan emosi terhadap pelanggaran yang dirasai. Soal selidik ini terdiri daripada beberapa item yang dinilai menggunakan skala Likert lima mata daripada "sangat tidak bersetuju" hingga "sangat bersetuju", di mana skor yang lebih tinggi menunjukkan tahap pelanggaran kontrak psikologikal yang lebih tinggi.

*Amick Questionnaire*

*Amick Questionnaire* digunakan untuk mengukur kesedaran keselamatan dan kesihatan. Amalan keselamatan dan kesihatan diukur menggunakan enam item yang dibangunkan oleh Amick (2000). Keenam-enam item ini digunakan untuk mengukur amalan keselamatan dan kesihatan, yang telah digunakan secara empirikal dalam kajian-kajian terdahulu dengan kebolehpercayaan sebanyak 0.95 dalam kajian oleh Amick et al. (2000) serta Habeck dan rakan-rakan (1998). Skala Likert yang digunakan adalah daripada 0 = tidak pernah hingga 4-selalu. Dengan penggunaan ketiga-tiga instrumen ini secara serentak, kajian ini dapat menyediakan penilaian yang mantap dan pelbagai dimensi terhadap pengalaman pekerja, khususnya dalam memahami interaksi antara bahaya psikososial, pelanggaran kontrak psikologikal dan kesedaran keselamatan dan kesihatan. Pendekatan metodologi ini memastikan tahap kebolehpercayaan dan kesahan yang tinggi, serta memudahkan pemeriksaan hubungan antara pembolehubah kajian dengan lebih tepat.

## Analisis Data

Data dianalisis menggunakan perisian *Statistical Package for the Social Sciences (SPSS).* Statistik deskriptif digunakan untuk meringkaskan profil responden serta tahap pembolehubah

kajian. Pekali *Cronbach Alpha* digunakan untuk menguji kebolehpercayaan setiap instrumen. Pemodelan Persamaan Berstruktur (PLS-SEM) menguji hubungan langsung dan kesan pengantaraan. Data dianalisis untuk mengkaji objektif kajian. Secara umum objektif kajian ialah melihat peranan kesedaran keselamatan dan kesihatan, sebagai mekanisme pengantara hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal dalam kalangan pekerja. Selain daripada itu, objektif kajian juga bertujuan mengkaji hubungan antara kesedaran keselamatan dan kesihatan, bahaya psikososial dengan pelanggaran kontrak psikologikal

**Pertimbangan Etika**

Responden dimaklumkan tentang tujuan kajian, diberi jaminan kerahsiaan maklumat serta diminta memberikan persetujuan bermaklumat sebelum penyertaan, selaras dengan garis panduan etika penyelidikan psikososial

Profil Demografi Responden

Daripada keseluruhan 136 orang responden, seramai 35 orang (26%) adalah lelaki manakala 101 orang (74%) adalah perempuan, menunjukkan bahawa majoriti peserta kajian terdiri daripada wanita. Dari segi status perkahwinan, seramai 33 orang responden (23%) telah berkahwin, 103 orang (76%) belum berkahwin, dan seorang responden (1%) bercerai atau balu/duda. Dapatan ini menunjukkan bahawa sebahagian besar sampel kajian terdiri daripada pekerja yang belum berkahwin. Dari segi umur, seramai 94 orang responden (70%) berada dalam lingkungan umur 19 hingga 26 tahun, 7 orang (5%) berumur antara 27 hingga 32 tahun, 12 orang (9%) berumur antara 33 hingga 39 tahun, 18 orang (13%) berumur antara 40 hingga 49 tahun, dan 4 orang (3%) berumur antara 50 hingga 60 tahun. Ini menunjukkan bahawa majoriti peserta kajian merupakan golongan dewasa muda berusia bawah 30 tahun. Sementara itu, dari aspek latar belakang pendidikan, seramai 19 orang responden (15%) memiliki kelayakan Sijil Pelajaran Malaysia (SPM), seorang responden (1%) mempunyai Sijil Tinggi Persekolahan Malaysia (STPM), 79 orang (58%) memiliki Diploma, 18 orang (13%) berkelulusan Ijazah Sarjana Muda, 15 orang (11%) berkelulusan Ijazah Sarjana, 2 orang (2%) memiliki Ijazah Doktor Falsafah (PhD), dan seorang responden (1%) melaporkan kelayakan lain. Dapatan kajian ini menunjukkan bahawa kebanyakan responden mempunyai tahap pendidikan Diploma.

**Kebolehpercayaan Instrumen Kajian**

**Kebolehpercayaan instrument kajian ialah *Amick Questionnaire* (α = .97), *Job Content Questionnaire* (α = .93) dan *Psychological Contract Breach Scale* (α = .68).**

**Dapatan Kajian**

Analisis korelasi menunjukkan hubungan yang signifikan antara kesedaran keselamatan dan kesihatan dengan bahaya psikososial ($r = .261$, $p < .05$) serta pelanggaran kontrak psikologikal ($r = .205$, $p < .05$). Keputusan PLS-SEM pula menunjukkan bahawa kesedaran keselamatan dan kesihatan mengantara secara signifikan hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal ($\beta = -0.129$, $t = 3.072$, $p = 0.002$). Namun, hasil kajian

mendapati tidak terdapat hubungan yang signifikan antara bahaya psikososial dengan pelanggaran kontrak psikologikal (r= 122, k > .05).

## Perbincangan Dapatan Kajian

Analisis korelasi Pearson menunjukkan bahawa kesedaran keselamatan dan kesihatan mempunyai hubungan yang signifikan dengan bahaya psikososial *(r = .261, p < .05)* serta pelanggaran kontrak psikologikal *(r = .205, p < .05)*. Hubungan positif ini menunjukkan bahawa perubahan dalam tahap bahaya psikososial dan pelanggaran kontrak psikologikal berkait secara signifikan dengan tahap kesedaran keselamatan dan kesihatan pekerja. Walaupun kekuatan hubungan adalah pada tahap rendah hingga sederhana, dapatan ini tetap bermakna secara statistik dan menyokong kepentingan sebagai pemboleh ubah psikososial yang relevan dalam konteks pekerjaan. Dapatan kajian ini menjawab objektif kajian 1 iaitu mengkaji hubungan antara bahaya psikososial dengan kesedaran keselamatan dan kesihatan pekerja. Ia juga menerima hipotesis 1 iaitu terdapat hubungan yang signifikan antara bahaya psikososial dengan kesedaran keselamatan dan kesihatan. Hasil dapatan kajian menyokong pandangan Clarke (2020), Fadillah Ismail et al. (2022) dan Grip & Bankins (2020) yang menjelaskan bahaya psikososial yang tinggi sering dikaitkan dengan tahap kesedaran keselamatan dan kesihatan yang rendah. Perkara ini berlaku kerana pekerja merasakan aspek keselamatan dan kesihatan tidak diberi keutamaan oleh pihak pengurusan (Vinodkumar & Bhasi, 2021).

Dari perspektif *Model Job Demands–Resources (JD-R),* bahaya psikososial seperti tuntutan kerja yang tinggi, kawalan kerja yang rendah dan kekurangan sokongan sosial berfungsi sebagai *job demands* yang boleh menghakis sumber psikologi pekerja. Dalam keadaan ini, tahap kesedaran keselamatan dan kesihatan pekerja berpotensi terjejas kerana fokus utama pekerja tertumpu kepada pemenuhan tuntutan kerja dan pengurusan tekanan segera. Dapatan korelasi yang signifikan ini menyokong hujah bahawa persekitaran kerja yang berisiko dari segi psikososial berkait dengan perubahan dalam kepekaan dan keutamaan pekerja terhadap aspek keselamatan dan kesihatan di tempat kerja (Morrison & Robinson; 1997) dan (Piccoli & De White, 2021).

Selain itu, hubungan signifikan antara kesedaran keselamatan dan kesihatan dan pelanggaran kontrak psikologikal menunjukkan bahawa tahap kesedaran keselamatan dan kesihatan juga berkait dengan persepsi pekerja terhadap keadilan dan pemenuhan janji organisasi**.** Dapatan kajian ini memenuhi objektif 3 iaitu mengkaji hubungan antara kesedaran keselamatan dan kesihatan dengan pelanggaran kontrak psikologikal. Ia juga menyokong hipotesis 3 iaitu terdapat hubungan yang signifikan antara kesedaran keselamatan dengan kesihatan dengan pelanggaran kontrak psikologikal. Berdasarkan *Psychological Contract Theory***,** apabila organisasi gagal menyediakan persekitaran kerja yang selamat, menyokong kesejahteraan psikologi, atau mengurus bahaya psikososial dengan berkesan, pekerja cenderung mentafsir keadaan tersebut sebagai satu bentuk pelanggaran kontrak psikologikal. Oleh itu, kesedaran keselamatan dan kesihatan boleh dianggap sebagai isyarat sejauh mana organisasi komited terhadap tanggungjawab tersiratnya terhadap pekerja.

Namun, hasil kajian mendapati tidak terdapat hubungan yang signifikan antara bahaya psikososial dengan pelanggaran kontrak psikologikal (r= 122, k > .05). Dapatan kajian ini

menjawab objektif kajian 2 iaitu meneliti hubungan antara bahaya psikososial dengan pelanggaran kontrak psikologikal dalam kalangan pekerja. Ia menolak hipotesis 2 yang mengatakan terdapat hubungan yang signifikan antara bahaya psikososial dengan pelanggaran kontrak psikologikal. Hal ini berkemungkinan kerana pelanggaran kontrak psikologikal lebih berkait dengan isu janji, keadilan dan sokongan organisasi berbanding keadaan atau tuntutan kerja semata-mata. Selain itu, pekerja yang terdedah secara berterusan kepada bahaya psikososial mungkin telah menormalkan tekanan kerja sebagai sebahagian daripada realiti pekerjaan dan tidak menafsirkannya sebagai kegagalan organisasi memenuhi tanggungjawabnya. Faktor perantara seperti stres kerja atau kesedaran keselamatan dan kesihatan juga berkemungkinan memainkan peranan dalam menjelaskan hubungan ini, khususnya dalam konteks pekerja awam yang mempunyai jangkaan kerja lebih stabil dan realistik terhadap organisasi.

Keputusan analisis PLS-SEM seterusnya mengukuhkan peranan strategik kesedaran keselamatan dan kesihatan apabila didapati kesedaran keselamatan dan kesihatan mengantara secara signifikan hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal *($\beta = -0.129$, $t = 3.072$, $p = 0.002$)*. Nilai pekali laluan yang negatif menunjukkan bahawa peningkatan bahaya psikososial cenderung menurunkan tahap kesedaran keselamatan dan kesihatan, yang seterusnya meningkatkan persepsi pelanggaran kontrak psikologikal dalam kalangan pekerja. Dengan kata lain, kesedaran keselamatan dan kesihatan bertindak sebagai mekanisme psikologi yang menjelaskan bagaimana dan mengapa bahaya psikososial membawa kepada pelanggaran kontrak psikologikal (Restubog, 2015). Dapatan kajian juga memenuhi objektif 4 iaitu nenentukan peranan kesedaran keselamatan dan kesihatan sebagai pemboleh ubah pengantara dalam hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal dalam kalangan pekerja. Ia juga menerima hipotesis 4 iaitu kesedaran keselamatan dan kesihatan mengantara hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal. Dapatan ini mencadangkan bahawa kesedaran keselamatan dan kesihatan bukan sekadar pemboleh ubah hasil, tetapi berfungsi sebagai sumber psikologi pelindung (protective resource)**.** Apabila kesedaran keselamatan kesihatan berada pada tahap yang tinggi, kesan negatif bahaya psikososial terhadap persepsi pelanggaran kontrak psikologikal dapat dikurangkan. Sebaliknya, tahap kesedaran keselamatan kesihatan yang rendah akan memperkukuh kesan negatif bahaya psikososial, sekali gus meningkatkan rasa ketidakadilan, kekecewaan dan ketidakpercayaan terhadap organisasi.

Secara keseluruhannya, dapatan kajian ini menyumbang kepada literatur dengan menonjolkan peranan pengantaraan kesedaran keselamatan dan kesihatan dalam hubungan antara faktor persekitaran kerja (bahaya psikososial) dan reaksi psikologi pekerja (pelanggaran kontrak psikologikal)**.** Implikasi praktikalnya ialah organisasi, khususnya dalam sektor awam. Organisasi perlu memberi tumpuan bukan sahaja kepada pengurangan bahaya psikososial, tetapi juga kepada pembangunan dan pengukuhan kesedaran keselamatan dan kesihatan. Ini boleh dilakukan melalui dasar, latihan, komunikasi risiko serta sokongan pengurusan. Pendekatan ini juga berpotensi mengurangkan persepsi pelanggaran kontrak psikologikal serta meningkatkan kepercayaan dan kesejahteraan pekerja dalam jangka masa panjang.

## Limitasi dan Cadangan Kajian Masa Hadapan

Kajian ini mempunyai beberapa limitasi. Ia termasuk penggunaan reka bentuk keratan rentas yang membatasi penilaian hubungan sebab-akibat. Di samping itu saiz sampel yang terhad mungkin menjejaskan kebolehjangkaan dapatan. Sehubungan itu, kajian masa hadapan disarankan menggunakan reka bentuk *longitudinal*, dengan menggunakan sampel yang lebih besar. Integrasi pembolehubah psikologi tambahan seperti sokongan organisasi dan kesejahteraan mental untuk memberikan gambaran yang lebih menyeluruh tentang mekanisme hubungan antara bahaya psikososial, kesedaran keselamatan dan kesihatan, dan pelanggaran kontrak psikologikal turut dicadangkan.

## Sumbangan Kajian

Kajian ini memberi beberapa sumbangan. Ia termasuk sumbangan kepada literatur psikologi organisasi dan keselamatan serta kesihatan pekerjaan dengan menjelaskan mekanisme bagaimana bahaya psikososial mempengaruhi pelanggaran kontrak psikologikal melalui peranan pengantara kesedaran keselamatan dan kesihatan. Integrasi teori Kontrak Psikologikal dan *Model Job Demands–Resources (JD-R*) meletakkan kesedaran keselamatan dan kesihatan sebagai sumber organisasi yang penting dalam membentuk penilaian pekerja terhadap keprihatinan dan tanggungjawab organisasi. Selain itu, dapatan kajian memperluas teori sedia ada dengan menunjukkan bahawa kegagalan mengurus risiko psikososial bukan sahaja meningkatkan tekanan kerja, malah melemahkan asas hubungan psikologi antara pekerja dan organisasi. Ini terutamanya berlaku dalam konteks sektor awam yang masih kurang diterokai. Sumbangan yang diberikan dari sudut praktikal ialah kajian ini menekankan kepentingan pengurusan risiko psikososial secara sistematik dan pengukuhan kesedaran keselamatan dan kesihatan sebagai strategi pencegahan untuk mengurangkan persepsi pelanggaran kontrak psikologikal serta meningkatkan kesejahteraan pekerja.

## Kesimpulan

Secara kesimpulannya, kajian ini membuktikan bahawa kesedaran keselamatan dan kesihatan memainkan peranan penting sebagai mekanisme pengantara dalam hubungan antara bahaya psikososial dan pelanggaran kontrak psikologikal dalam kalangan pekerja. Ini menjelaskan dapatan ini mengukuhkan aplikasi *Model Job Demands–Resources (JD-R)* dengan menegaskan kepentingan sumber pekerjaan dalam mengurangkan kesan negatif tuntutan kerja terhadap hasil psikologi pekerja. Pendekatan intervensi yang menumpukan kepada peningkatan kesedaran keselamatan dan kesihatan serta pengurusan bahaya psikososial secara sistematik dilihat berpotensi meningkatkan kesejahteraan psikososial pekerja dan memperkukuh hubungan pekerjaan dalam organisasi sektor awam dan swasta.

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# INTERPRETASI KEWUJUDAN DAN KEPERIBADIAN WANITA MELAYU DARI PERSPEKTIF PEMIKIRAN ZAINUN SULAIMAN (1903-1989)

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***Abstrak:*** *Kewujudan wanita Melayu merupakan suatu realiti kehidupan yang tidak hanya difahami melalui kerangka biologi dan sosial semata-mata, sebaliknya perlu diteliti secara mendalam berasaskan kerangka falsafah pemikiran yang menekankan makna penciptaan insan, tujuan hidup dan pembentukan keperibadian. Isu utama yang melatari kertas kerja ini bertitik tolak daripada realiti semasa yang menyaksikan identiti dan keperibadian wanita Melayu cenderung diinterpretasi melalui kerangka liberalisme dan relativisme nilai. Keadaan ini di satu tahap boleh menyebabkan asas falsafah sebenar diabaikan. Justeru itu, kertas kerja ini diketengahkan berasaskan dua objektif utama: (i) meneliti konsep kewujudan wanita Melayu, dan (ii) menganalisis hakikat kewujudan dan keperibadian wanita Melayu menurut kerangka fikir Zainun Sulaiman. Metode kertas kerja ini berteraskan metode kualitatif dengan menggunakan kajian kepustakaan dalam kaedah pengumpulan data. Dari sudut analisis data menggunakan analisis tematik dan interpretatif terhadap data dan fakta berkaitan. Dapatan awal kertas kerja ini menunjukkan bahawa wanita Melayu seperti mana tegas Zainun merupakan insan bermaruah, berilmu dan berperanan aktif dalam pembangunan masyarakat tanpa menafikan asas nilai tradisi dan agama Islam. Implikasi kajian ini diteliti dapat menyumbang kepada penggayaan wacana falsafah pemikiran dengan penumpuan khusus terhadap kewujudan dan keperibadian wanita Melayu, selain dapat menjadi rujukan dalam pembinaan identiti wanita yang seimbang antara tradisi dan tuntutan moden.*

***Kata kunci:*** *Hakikat Kewujudan, Keperibadian, Wanita Melayu, Zainun Sulaiman, Falsafah Pemikiran*

***Abstract:*** *The existence of Malay women is a lived reality that should not be understood solely through biological and social frameworks; rather, it requires in-depth examination based on a philosophical framework of thought that emphasizes the meaning of human creation, the purpose of life, and the formation of personality. The main issue underlying this paper arises from contemporary realities in which the identity, and personality of Malay women tend to be interpreted through the lenses of liberalism and value relativism. At a certain level, this condition may lead to the neglect of fundamental philosophical foundations. Accordingly, this paper is presented with two primary objectives: (i) to examine the concept of the existence of Malay women, and (ii) to analyse the nature of the existence and personality of Malay women according to the intellectual framework of Zainun Sulaiman. Methodologically, this paper adopts a qualitative approach, employing library research as the main method of data collection. Data analysis is conducted through thematic and interpretative analyses of relevant data and sources. The preliminary findings indicate that, as firmly emphasized by Zainun, Malay women are dignified, knowledgeable individuals who play active roles in societal development without denying the foundational values of tradition and Islam. The implications*

*of this study are expected to contribute to the enrichment of philosophical discourse, with particular focus on the existence and personality of Malay women, and to serve as a reference for the construction of a balanced female identity that harmonizes tradition with modern demands.*

***Keywords:*** *Nature of Existence, Personality, Malay Women, Zainun Sulaiman, Philosophy of Thought*

## Pengenalan

Falsafah identiti wanita Melayu diperhalusi melalui tiga cabang utama iaitu ontologi, epistemologi dan aksiologi. Penelitian identiti dari kerangka falsafah ditanggapi signifikan kerana dapat merungkai secara tuntas asal usul dan hakikat kewujudannya, keberadaan dan kewujudannya sama ada secara biologi mahupun budaya, dan nilai di sebalik penciptaannya sama ada sebagai seorang individu, ahli masyarakat mahupun entiti bangsa.

Kupasan pada kertas kerja ini berfokus tentang kerangka falsafah identiti dari sudut ontologi. Ontologi merupakan persoalan pokok atau objek falsafah yang utama. Ia merangkumi persoalan dalam alam fizikal dan alam metafizikal. Plato menggagaskan bahawa dunia terbahagi kepada dua iaitu inderawi dan idea (Reeve, 2004). Inderawi merupakan alam bersifat material dan berubah yang dapat difahami melalui sumber empirikal. Manakala idea tegas Abdul Rahman (2016), merupakan alam bersifat spiritual dan abadi yang dapat difahami melalui sumber rasional.

Persoalan ontologi wanita Melayu signifikan diterokai berpaksikan pendirian berikut. Pertamanya, penelitian tentang manusia dari sudut kewujudannya perlu terus dipelajari sebagaimana saranan Socrates agar mempelajari manusia supaya dapat mengetahui asal usul siapa dirinya sendiri. Keduanya ialah berpaksikan pandangan Zainun Sulaiman (seorang pemikir dan pendidik yang gigih memperjuangkan hak wanita Melayu sekitar abad ke-20) iaitu penelitian terhadap hakikat kewujudan diri dapat menyedarkan kewajipan diri untuk menggunakan akal fikiran dalam memelihara maruah seterusnya menjadi bangsa berguna kepada masyarakat seantero dunia.

Penulisan ini meneliti secara mendalam hakikat kewujudan wanita Melayu yang mendiami wilayah Nusantara termasuk Semenanjung Malaysia, Borneo, Brunei serta kawasan sekitarnya sebagai bangsa peribumi yang pernah mengalami tempoh penjajahan Barat yang sangat panjang. Penelitian ini terarah kepada ideologi pemikiran Zainun Sulaiman (atau lebih dikenali sebagai Ibu Zain) yang ditelusuri daripada pelbagai sumber penulisan. Untuk itu, kertas kerja ini mengemukakan dua objektif utama, iaitu meneliti konsep kewujudan wanita Melayu dari perspektif ontologi. Seterusnya, menganalisis hakikat kewujudan dan keperibadian wanita Melayu menurut kerangka pemikiran Zainun Sulaiman.

## Metode Kajian

Kajian ini menggunakan pendekatan kualitatif berasaskan kaedah kajian kepustakaan dan kaedah analisis dokumen. Data dan fakta diteliti berdasarkan penelitian terhadap sumber primer dan sekunder yang berkaitan pemikiran Zainun Sulaiman tentang wanita Melayu.

Sumber primer merangkumi penulisan beliau seperti rencana dan artikel dalam majalah Bulan Melayu, Lembaga Malaya, serta karya dan dokumen yang diterbitkan sekitar dekad 1920-an hingga 1930-an. Sumber sekunder pula terdiri daripada buku ilmiah, artikel jurnal, tesis, kertas persidangan, serta kajian lepas yang membincangkan identiti wanita Melayu, pemikiran tokoh wanita Melayu, dan falsafah identiti berteraskan Melayu-Islam. Selain itu, teks klasik Melayu, dokumen sejarah, serta rujukan berkaitan budaya dan adat resam Melayu turut digunakan bagi memperkukuh kefahaman konteks sosio-sejarah pemikiran Zainun dan kedudukan wanita Melayu dalam masyarakat Alam Melayu.

Setiap data dan fakta tersebut dianalisis menggunakan kaedah analisis kandungan berasaskan pendekatan tematik dan interpretatif. Analisis dilakukan dengan mengenal pasti tema utama berkaitan konsep kewujudan, peribadi dan keperibadian wanita Melayu sebagaimana yang digagaskan oleh Zainun Sulaiman, khususnya merangkumi aspek ontologi (termasuk hakikat kewujudan dan keperibadian wanita Melayu). Seterusnya tema tersebut dianalisis secara falsafah dengan memadankan pandangan Zainun Sulaiman dengan konteks sejarah, budaya dan pemikiran Melayu-Islam bagi menyingkap makna tersirat di sebalik gagasan beliau. Pendekatan ini membolehkan penilaian yang lebih mendalam terhadap keperibadian wanita Melayu sebagai entiti individu, sosial dan bangsa, serta menilai kerelevanan pemikiran Zainun dalam memahami identiti wanita Melayu dalam konteks kontemporari.

## Ulasan Karya

Karya dan kajian terdahulu yang memfokuskan hakikat kewujudan dan keperibadian wanita Melayu menurut pemikiran Zainun Sulaiman diperhalusi diusahakan beberapa pengkaji terdahulu. Sebelum itu, dikemukakan makna secara konseptual dua tema utama penulisan kertas kerja ini iaitu kewujudan dan keperibadian wanita Melayu.

### *Definisi Kewujudan Wanita Melayu*

Kewujudan merujuk kepada keadaan “ada” atau “wujud” seseorang sebagai entiti manusia yang mempunyai asal-usul, keberadaan dan peranan dalam alam kehidupan. Berdasarkan penulisan ini, hakikat kewujudan wanita Melayu difahami sebagai suatu kewujudan yang terbentuk daripada gabungan unsur biologi, agama Islam, budaya Melayu dan nilai ketimuran yang berkembang dalam konteks sejarah Alam Melayu. Kewujudan mereka bersifat bermakna dan bernilai kerana ia berpaksikan akal, budi dan tanggungjawab sosial yang menjadikan wanita Melayu tonggak kepada kelangsungan identiti Melayu-Islam-Timur dalam masyarakat dan negara.

### *Definisi Keperibadian Wanita Melayu*

Keperibadian merujuk kepada himpunan sifat dalaman, sikap, akhlak dan watak yang membentuk identiti diri seseorang. Konsep keperibadian wanita Melayu dalam penulisan ini difahami sebagai manifestasi nilai budi pekerti, akidah Islam, adab ketimuran dan kebijaksanaan budaya yang sebati dalam diri mereka. Keperibadian mereka terzahir melalui keupayaan memelihara maruah diri, mengamalkan kesopanan, menunaikan tanggungjawab agama, serta mengekalkan adat dan budaya Timur tanpa meniru secara membuta tuli budaya luar. Keperibadian ini bukan sahaja mencerminkan kecantikan luaran, tetapi turut menggambarkan kekuatan dalaman dan kebijaksanaan moral yang menjadikan wanita Melayu simbol keutuhan keluarga, masyarakat dan bangsa.

Berdasarkan kerangka konseptual di atas, terdapat beberapa kajian lepas yang meneliti tentang kewujudan dan keperibadian wanita Melayu menurut kerangka fikir tokoh termaklum. Justeru itu, berikut dikemukakan huraian ringkas berkenaan kajian lepas bertemakan (1) konsep kewujudan dan keperibadian wanita Melayu, dan (2) wanita Melayu menurut Zainun.

***Kajian Lepas Tentang Konsep Kewujudan dan Keperibadian Wanita Melayu***

Wanita Melayu dinilai mempunyai keperibadian mereka yang tersendiri. Mereka wujud kerana identiti mereka yang menginterpretasi identiti bangsa Melayu (Abdul Razak & Wan Mohamad Mukmin, 2025). Antara identiti utama mereka ialah sebagai wanita dan ibu (Noraisah, 2024) yang berperanan menjaga dan mendidik anak-anak pada peringkat awal lagi. Identiti sebagai bukti kewujudan mereka banyak diinterpretasi dalam penulisan berbentuk karya sastera seperti novel Melayu (Abdul Halim & Ida Roziana, 2018; Norazimah & Mazarul Hasan, 2022).

***Kajian Lepas Tentang Wanita Melayu Menurut Zainun Sulaiman***

Apabila meneliti kajian lepas terdapat beberapa kajian berkaitan dengan pemikiran Zainun Sulaiman tentang wanita Melayu. Misalnya, Hasnah Hussiin (2009; 2011) menjelaskan bahawa pemikiran Zainun Sulaiman meletakkan wanita Melayu sebagai tonggak pembinaan bangsa melalui pendidikan dan pembentukan akhlak. Muhammad Ridzuan (2016) juga senada dengan meletakkan Zainun antara tokoh wanita yang tegas memperjuangkan hak wanita Melayu terhadap pendidikan. Asyiqah & Asilatul (2022) pula meneliti pemikiran Zainun Sulaiman dalam konteks emansipasi wanita Melayu dan mendapati gagasan beliau berbeza daripada feminisme Barat.

Berdasarkan kajian lepas di atas, jelas bahawa kebanyakan kajian tentang wanita Melayu lebih tertumpu kepada aspek sosiologi, budaya dan gender sahaja. Manakala kajian pemikiran Zainun Sulaiman pula lebih bersifat sejarah, pendidikan dan nasionalisme. Ini bermakna, kajian yang memfokuskan kepada konsep kewujudan dan keperibadian mereka dari sudut falsafah pemikiran masih belum banyak dilakukan. Oleh itu, penelitian falsafah pemikiran dalam merungkai konsep dan hakikat kewujudan wanita Melayu serta keperibadian mereka begitu signifikan untuk diterokai dan ditelurusi dalam kertas kerja ini.

**Dapatan Kajian**

Wanita Melayu ditakrifkan sebagai golongan perempuan dalam kelompok etnik Melayu iaitu suatu komuniti bangsa yang terbentuk melalui gabungan di antara sejarah, bahasa, budaya, sistem sosial dan agama di Alam Melayu. Mereka ialah orang Melayu dari kelompok Austronesia yang berasal daripada Kepulauan Nusantara mencakupi wilayah Semenanjung Tanah Melayu (kini Semenanjung Malaysia), Kepulauan Borneo, Brunei, Indonesia, Singapura, Selatan Filipina dan Selatan Thailand. Mereka lahir daripada tamadun Melayu purba seperti kerajaan Funan, Srivijaya, Majapahit, Kedah Tua, Melaka, Johor-Riau, Brunei dan kerajaan di sekitar Kepulauan Melayu.

Merujuk kepada identiti wanita Melayu, mereka ditentukan oleh beberapa faktor seperti biologi, budaya dan nilai masyarakat Melayu. Dari sudut falsafah dan keagamaan pula wanita Melayu dikaitkan dengan citra budi seumpama penuh dengan kelembutan, memiliki kesabaran

diri, bersopan santun, serta bijaksana yang ditonjolkan selaras dengan prinsip agama Islam dan adat resam Melayu.

Menurut Zainun, wanita Melayu dari dahulu lagi wujud sebagai sebahagian daripada rakyat Tanah Melayu (Zainun Sulaiman, 1937). Ada dalam kalangan mereka yang menjadi permaisuri, srikandi (pejuang), cendekiawan, bidan, mahupun tokoh politik. Walau bagaimanapun, wanita Melayu tetap berperanan penting dalam menguruskan hal ehwal keluarga, rumah tangga dan pendidikan anak-anak.

***Konsep Kewujudan Wanita Melayu***

Kerangka utama dalam merungkai hakikat di sebalik kewujudan wanita Melayu sebagai salah satu entiti manusia dan alam ialah dengan meneliti karakteristik yang dapat menghuraikan hakikat sebenar di sebalik kewujudannya sebagai bangsa asal di Kepulauan Melayu. Karakteristik wanita Melayu dapat dihuraikan berasaskan aspek utama berikut, iaitu biologi, budi pekerti, budaya, kepercayaan agama, ahli masyarakat, serta sejarah dan politik, seperti mana huraian rinci di bawah.

***Pertama, Biologi***

Berdasarkan biologi wanita Melayu, mereka berasal daripada rumpun Austronesia yang mendiami rantau Alam Melayu daripada dahulu sehingga ke hari ini. Mereka berkembang biak di wilayah yang luas merangkumi Tanah Semenanjung (Malaysia, Selatan Thailand dan Singapura), Kepulauan Indonesia (Sumatera, Jawa, Kalimantan, Sulawesi, Riau-Lingga, Lombok), Kepulauan Borneo (termasuk Brunei Darussalam), sebahagian Filipina Selatan (Mindanao, Sulu, Palawan), dan sebahagian Kemboja dan Champa (Vietnam Selatan, masyarakat Cham).

Ini bermakna, wanita Melayu berkembang biak di seluruh Alam Melayu yang menjadi penyambung zuriat (melahirkan keturunan) bangsa Melayu sehingga ke hari ini. Walaupun begitu, generasi Melayu yang ada pada hari ini turut mempunyai kepelbagaian genetik akibat sejarah perkahwinan silang nenek moyang mereka (seperti dengan orang Arab, India, Cina dan Eropah) terutamanya sejak zaman perdagangan dan penjajahan.

Jelas Zainun “bangsa Melayu kita ini telah ditakdirkan Tuhan...kehidupannya mestilah bercampur gaul dengan beberapa jenis bangsa” (Zainun Sulaiman, 1937:33). Percampuran dan pergaulan tersebut menyebabkan berlakunya perkahwinan campur dengan bangsa selain Melayu, sehingga melahirkan generasi Melayu campuran genetik dan budaya.

Pada Ibu Zain, wanita Melayu mempunyai “kelopak mata yang manis” (Zainun Sulaiman, 1930c:146), kekuatan fizikal yang “lemah upaya ini” berbanding dengan orang lelaki, serta mempunyai gaya tersendiri “perempuan gaya perempuan” seperti mana “yang telah ditentukan oleh Tuhan kita [Allah SWT] yang mentadbirkan seru sekalian alam” (Zainun Sulaiman, 1930d:178).

Selain itu, wanita Melayu secara fizikal mempunyai tubuh yang genit iaitu lebih kecil berbanding lelaki Melayu, mempunyai warna kulit dari cerah langsat sehingga sawo matang (yang dipengaruhi oleh faktor iklim tropika dan variasi genetik), berambut lurus atau sedikit berombak yang berwarna hitam ataupun coklat gelap. Wajah mereka memiliki hidung yang

tidak terlalu mancung atau pesek, mata bersaiz sederhana (tidak sepet atau terlalu bulat), serta bentuk muka oval atau bulat.

***Kedua, Budi Pekerti***

Wanita Melayu juga dikenali sebagai orang yang berbudi pekerti. Ini kerana budi merupakan penekanan dalam hidup orang Melayu iaitu hidup berbudi, bertanam budi, membalas budi dan menabur budi dalam lingkungan mereka zaman berzaman. Pengamalan budi ini menjadikan Melayu sebagai sebuah bangsa yang dihormati serta disanjung tinggi oleh bangsa lain di seluruh dunia.

Zainun dalam *Lembaga Malaya* menegaskan bahawa budi pekerti ialah "tingkah laku atau bawaan diri seseorang yang ada suatu lapisan yang tertinggi daripada tingkah laku yang biasa". Tingkah laku tersebut turut "mengandungi suatu tujuan yang lebih tinggi, lebih besar dan lebih memberi bekas sama ada yang baiknya atau yang jahatnya" (Zainun Sulaiman, 1937:4, 33).

Budi juga perlu dimahirkan dan ditambah baik dari masa ke masa kerana pada beliau "budi yang tidak dimahirkan itu seumpama gulai yang tiada garam" (Zainun Sulaiman, 1930d:205).

Selain itu, Zainun menjelaskan bahawa budi pekerti tinggi dalam kalangan bangsa Melayu dapat dibuktikan dalam dokumen sejarah seperti Sejarah Melayu. Terdapat beberapa petikan dalam Sejarah Melayu (A. Samad Ahmad, 2015) yang dipetik Zainun sebagai contoh budi pekerti dalam kalangan orang Melayu, seperti:

a. "kerana adat Melayu tiada pernah derhaka" (halaman 257)
b. Budi pekerti Hang Nadim hulubalang Melaka yang digambarkan Tun Teja kepada Sultan Melaka: "Tuanku, jikalau Hang Nadim tuanku, jangankan dia hampir kepada patik, memandang legat pun ia tiada, sedang patik ke perahu, menyambut patik lagi tangannya di alas dengan kain dua tiga lapis" (halaman 231).

Selanjutnya Zainun berpandangan bahawa budi pekerti yang baik "mengandungi timbang rasa, adil saksama, adab sopan" (Zainun Sulaiman, 1937:33) dan sebagainya yang menjadi suatu pengamalan dalam kalangan wanita Melayu. Zainun menjelaskan kewujudan budi pekerti dalam kalangan orang Melayu (termasuk para wanitanya) sudah wujud "sebelum Melaka bernama Melaka dan Temasik bernama Temasik" (Zainun Sulaiman, 1937:33) – maknanya sebelum kemunculan kesultanan Melayu Melaka lagi iaitu pada zaman Melayu lama ketika masyarakatnya mengamalkan sara hidup berasaskan agraria-pertanian.

Asasnya timbang rasa dalam kalangan wanita Melayu dapat diperhalusi melalui sikap mereka semasa bergaul dengan orang dan masyarakat sekeliling. Wanita Melayu mudah memahami keadaan persekitaran mereka dan bertindak mengikut keadaan dan budaya Melayu. Zainun mempersonafikasikan mereka sebagai "perempuan2 Melayu yang bijaksana dan rajin" (Zainun Sulaiman, 1930a:242).

Adil saksama ialah meletakkan sesuatu pada tempat yang sepatutnya. Tegas Zainun "yang menimbang dengan insaf dan adil", "menunjukkan contoh tauladan" serta menunjukkan "perangai mulia" (Zainun Sulaiman, 1930b:130) kepada orang lain terutamanya masyarakat sekeliling. Dalam konteks ini, wanita Melayu dinilai adil dan saksama dalam menguruskan hal ehwal rumah tangga dan keluarga mereka (khususnya semasa awal abad ke-20) dan tetap wujud sehingga kini.

Adab sopan merupakan sikap yang menggambarkan keperibadian wanita Melayu zaman berzaman dan dari satu generasi ke generasi seterusnya. Wanita Melayu sememangnya memiliki budi pekerti yang bersopan santun, lemah lembut, dan memilik rasa malu yang tinggi. Tegas Ibu Zain, "kamu itu perempuan dan hendaklah jaga kewajipan dan santun kamu" (Zainun Sulaiman, 1930e:221) kerana ia merupakan hakikat di sebalik kewujudan sebagai seorang wanita berbangsa Melayu.

***Ketiga, Budaya Hidup***

Karakteristik wanita Melayu seterusnya ialah budaya hidup. Ia merujuk kepada cara hidup mereka merangkumi cara berfikir dan bertingkah laku sebagai ahli dalam masyarakat Melayu. Cara berfikir dan bertingkah laku wanita Melayu tegas Zainun dibentuk antaranya daripada pergaulan antara sesama mereka ataupun dengan lawan jenis, ataupun dengan bangsa yang lain, iaitu suatu "perkara yang diatur dengan akal fikiran yang sempurna bertujuan yang baik" (Zainun Sulaiman, 1937:33).

Selain itu, budaya wanita Melayu berasaskan cara hidup mereka yang berpaksikan agama Islam dan adat resam Melayu. Agama Islam merupakan suatu ajaran yang mendasari budaya hidup wanita Melayu zaman berzaman. Walaupun sebelum Islam tersebar di Alam Melayu, masyarakat Melayu berpegang kepada fahaman animisme dan dinamisme, sebelum berubah kepercayaan ke agama Hindu-Buddha.

Zainun menegaskan bahawa, "setengah daripada adat orang Melayu kita ini dibangunkan di atas asas budi pekerti yang tinggi hingga sebab tetap percayanya akan keelokan adat itu" dan kemudiannya menjadi budaya yang diwarisi dari satu generasi ke satu generasi seumpama bidalan Melayu "biar mati anak, jangan mati adat"(Zainun Sulaiman, 1937:33).

Budaya Melayu pada pandangan Zainun ialah seperti mana contoh berikut:

a. "di dalam masa sesak sukar, sakit, pening, hidup mati, bolehlah dilihat anak-anak Melayu memberi pertolongan kepada jirannya dengan hati yang tulus ikhlas" (Zainun Sulaiman, 1937:33),
b. "sentiasa bersatu" dalam kehidupan orang Melayu termasuk dalam kalangan kaum wanitanya (Zainun Sulaiman, 1937:33),
c. menjaga kerukunan hidup sehingga "tidaklah terbit pertelingkahan adat dan resam" (Zainun Sulaiman, 1937:34),

***Keempat, Kepercayaan Dan Pegangan Agama***

Zainun menegaskan bahawa "kemuliaan manusia itu agamanya" (Zainun Sulaiman, 1930a:246), kerana dengan agama manusia mempunyai kepercayaan dan pegangan dalam hidup. Ia juga menyebabkan manusia semakin terarah dan mempunyai tujuan untuk meneruskan kehidupan.

Apabila merujuk kepada wanita Melayu, Zainun menjelaskan bahawa mereka mempunyai kepercayaan agama yang kuat dan utuh. Kekuatan dan keutuhan tersebut dibuktikan melalui pegangan mereka yang bersandarkan ajaran agama Islam dan diterapkan dalam kehidupan seharian mereka. Ini kerana mereka menganut agama Islam dan menjadikan ajaran agama sebagai teras kehidupan.

Buktinya, wanita Melayu sebagaimana lelaki Melayu digambarkan sebagai sekelompok masyarakat yang patuh kepada tuntutan agama, menjaga solat, berpegang kepada hukum halal dan haram, serta menjadikan syariah Islam sebagai panduan hidup.

Zainun menegaskan bahawa wanita Melayu berpegang teguh kepada ajaran Islam. Buktinya diinterpretasi dalam kehidupan mereka termasuk dalam konteks berpakaian. Tegas Ibu Zain, wanita Melayu "bersandar kepada kebenaran agama [Islam] yang maha suci" (Zainun Sulaiman, 1930b:130) termasuk cara pakaian. Ini kerana mereka mempunyai penghayatan agama yang mendalam sehingga menyatu dengan adat resam Melayu.

***Kelima, Ahli Dalam Sebuah Masyarakat Bernama Melayu***

Wanita Melayu merupakan sebahagian daripada ahli dalam masyarakat Melayu. Mereka merupakan tulang belakang kepada pembinaan masyarakat Melayu daripada zaman dahulu sehingga ke hari ini. Ini kerana daripada rahim mereka lahirnya generasi Melayu, dan daripada mereka orang Melayu terus ada sehingga ke hari ini.

Sebagai ahli sebuah masyarakat, wanita Melayu dinilai sebagai antara penggerak utama kepada institusi kekeluargaan dan kemasyarakatan di Alam Melayu. Mereka juga dinilai berperanan sebagai penyeimbang terhadap sebarang bentuk perubahan yang berlaku dalam kalangan masyarakat Melayu dan Malaysia (dalam konteks semasa).

Kewujudan mereka pada Zainun dinilai berasaskan kepada keupayaan mereka dalam memelihara adat resam bangsa, mendidik generasi Melayu, membantu dalam sektor perekonomian keluarga mahupun masyarakat, serta menegakkan ajaran agama Islam serta prinsip moral dalam kalangan orang Melayu. Mereka ini merupakan nadi yang menggerakkan kelestarian identiti wanita Melayu dan bangsa Melayu itu sendiri dari satu generasi ke satu generasi.

***Keenam, Sejarah Dan Politik***

Karakteristik seterusnya berkait rapat dengan sejarah dan politik. Dalam kerangka sejarah Melayu, golongan wanita sejak zaman dahulu sehingga kini menjadi sebahagian daripada sejarah bangsa. Ia berasaskan peranan wanita Melayu dalam institusi kekeluargaan masyarakat dan institusi kesultanan.

Peranan mereka begitu penting sebagai tonggak kepada keluarga termasuk dalam urusan membantu memantapkan ekonomi keluarga dengan pelbagai cara seperti bercucuk tanam, bertani, mengurus perniagaan kecil-kecilan, menenun dan menganyam kraf tangan, dan aktiviti ekonomi lainnya. Tegas Zainun, "perempuan2 Melayu yang berusaha dengan pekerjaan di huma atau di sawah atau di kebun2 sayur atau dimana2 sahaja mereka itu menjalankan perusahaan yang berguna" (Zainun Sulaiman, 1930a:242) merupakan sebahagian daripada pekerjaan yang dilaksanakan oleh mereka berdasarkan catatan dan rekod pensejarahan bangsa.

Peranan wanita Melayu dalam institusi kesultanan dan pemerintahan sememangnya sudah bermula sejak kewujudan kerajaan Melayu awal lagi. Ada dalam kalangan mereka berperanan sebagai permaisuri, puteri, ataupun pembesar wanita seperti Tun Teja, Tun Fatimah dan Puteri Gunung Ledang – yang turut mempengaruhi pembuatan keputusan dalam pentadbiran istana.

Mereka merupakan antara contoh wanita Melayu yang membawa simbol kesopanan, keanggunan, dan kecerdikan (seperti yang diriwayatkan dalam teks sejarah dan hikayat Melayu).

Dalam konteks politik, ciri wanita Melayu dinilai berdasarkan keterlibatan mereka yang bergiat aktif ataupun sebaliknya dalam arena politik. Buktinya ialah wanita Melayu terkenal sebagai ahli politik dan pejuang tanah air dari satu zaman ke satu zaman, dan sehingga ke hari ini. Antara dasar utama yang sering diperjuangkan oleh pemimpin wanita Melayu ialah:

a. perlindungan wanita dan kanak-kanak (termasuk daripada kes keganasan rumah tangga, gangguan seksual),
b. hak dan kebajikan golongan wanita (seperti cuti bersalin, pusat jagaan kanak-kanak),
c. peluang pendidikan yang sama rata dengan golongan lelaki seperti hak ke sekolah dan mendapatkan ilmu,
d. peluang ekonomi yang adil seperti hak bekerja, berniaga ataupun profesion lainnya seperti mana yang diperolehi golongan lelaki, dan
e. peluang sebagai pemimpin iaitu menerajui organisasi ataupun institusi di wilayah Kepulauan Melayu termasuk Malaysia pada hari ini.

**Analisis Kajian**

Berdasarkan analisis yang dijalankan, didapati bahawa Zainun menyediakan suatu kerangka signifikan dalam memahami kewujudan dan keperibadian wanita Melayu secara menyeluruh dan berimbang. Asas pemikiran beliau berpaksikan kefahaman tentang manusia sebagai insan bermaruah yang perlu mengimbangi tuntutan agama, budaya dan kemajuan. Pendekatan ini bersifat inklusif dan realistik kerana ia tidak menolak perubahan dan kemodenan, namun pada masa menegaskan kepentingan nilai tradisi dan akidah Islam sebagai asas pembentukan identiti wanita Melayu. Sehubungan itu, dikemukakan analisis lanjut berkaitan interpretasi hakikat kewujudan dan keperibadian wanita Melayu dalam konteks masyarakat Melayu dan Malaysia secara keseluruhan.

Hakikat kewujudan wanita Melayu menurut kerangka fikir Zainun berpaksikan kefahaman bahawa manusia diciptakan dengan tujuan dan tanggungjawab tertentu dalam kehidupan. Wanita Melayu tegas Zainun bukan sekadar wujud secara biologi ataupun sosial, tetapi merupakan insan yang mempunyai nilai, maruah dan peranan bermakna dalam pembinaan diri, keluarga dan masyarakat. kewujudan wanita Melayu difahami sebagai suatu amanah Ilahi yang menuntut penggunaan akal fikiran, penghayatan agama, dan pemeliharaan maruah diri agar mereka mampu menyumbang secara positif kepada kehidupan bermasyarakat dan pembinaan bangsa.

Zainun Sulaiman turut meneliti wanita Melayu sebagai suatu entiti yang terbentuk melalui sejarah panjang Alam Melayu yang berakar dalam agama Islam dan adat resam Melayu. Kewujudan mereka tidak terpisah daripada komuniti, sebaliknya sentiasa berkait rapat dengan institusi keluarga dan masyarakat. Melalui peranan sebagai ibu, pendidik awal dan penjaga nilai, wanita Melayu menjadi penghubung antara generasi dan penyambung kelangsungan identiti Melayu-Islam-Timur. Oleh itu, kewujudan wanita Melayu bersifat kolektif dan berterusan, bukan bersifat individualistik atau terasing daripada masyarakat sekeliling.

Dalam konteks keperibadian wanita Melayu menurut kerangka fikir Zainun merupakan interpretasi implisit terhadap hakikat kewujudan tersebut. Asasnya ialah keperibadian tidak

hanya dinilai melalui penampilan luaran atau kebebasan bertindak, tetapi melalui ketinggian budi pekerti, kesedaran akhlak dan tanggungjawab diri. Wanita Melayu yang berkeperibadian baik ialah mereka yang memelihara maruah, mengamalkan adab sopan, bersifat sederhana dan berpegang teguh kepada ajaran agama Islam. Dalam konteks ini, keperibadian menjadi ukuran nilai kepada kewujudan seseorang wanita sebagai individu dan ahli masyarakat.

Analisis pemikiran Zainun juga memperlihatkan pendirian beliau yang menolak penafsiran keperibadian wanita berasaskan liberalisme dan relativisme nilai. Walaupun beliau menggalakkan wanita menuntut ilmu, berusaha dan berperanan aktif dalam masyarakat, kemajuan tersebut mestilah berpaksikan nilai agama dan budaya mereka sendiri. Keperibadian wanita Melayu yang ideal menurut Zainun ialah keperibadian yang seimbang antara kemajuan dan tradisi, antara kebebasan bertindak dan kesedaran batas, serta antara tuntutan duniawi dan ukhrawi.

Secara keseluruhannya, hakikat kewujudan dan keperibadian wanita Melayu menurut kerangka fikir Zainun Sulaiman membentuk suatu pandangan hidup yang holisitik dan berteraskan nilai. Wanita Melayu difahami sebagai insan bermaruah, berilmu dan berperanan aktif dalam pembangunan masyarakat tanpa menafikan asas agama dan tradisi. Analisis ini menegaskan bahawa kekuatan wanita Melayu terletak pada keseimbangan antara kewujudan yang bermakna dan keperibadian berakhlak, seterusnya menjadikan mereka tonggak penting dalam pembinaan keluarga, masyarakat dan bangsa.

## Kesimpulan

Secara rangkumannya dapat dirumuskan bahawa kerja kerja ini meneliti konsep kewujudan dan keperibadian wanita Melayu melalui kerangka falsafah pemikiran Zainun Sulaiman dengan tumpuan khusus terhadap dimensi ontologi – hakikat kewujudan. Dapatan kajian menunjukkan bahawa wanita Melayu tidak boleh difahami secara terpisah daripada agama Islam, adat resam Melayu dan sejarah Alam Melayu. Kewujudan wanita Melayu menurut Zainun merupakan suatu amanah Ilahi yang bermakna dan bernilai, manakala keperibadian mereka terzahir melalui budi pekerti, kesedaran akhlak dan tanggungjawab sosial. Wanita Melayu jelas merupakan sebahagian daripada bangsa Melayu yang bermaruah, berimu dan berperanan penting terhadap pembangunan bangsa, agama dan negara.

Berdasarkan dapatan kajian, kertas kerja ini mencadangkan agar kajian lanjutan tentang wanita Melayu diperluas dengan pendekatan falsafah pemikiran merangkumi dimensi lainnya seperti epistemologi dan aksiologi. Tujuannya ialah untuk mengimbangi kecenderungan kajian sedia ada yang lebih menumpukan aspek sosiologi dan gender. Selain itu, pemikiran tokoh tempatan seperti Zainun Sulaiman wajar digarap dan diterokai dengan lebih mendalam serta sistematik dalam kajian akademik agar wacana identiti wanita Melayu tidak bergantung sepenuhnya kepada kerangka pemikiran Barat. Pendekatan interdisiplin yang menggabungkan falsafah, sejarah dan kajian budaya juga disarankan bagi memperkaya kefahaman tentang keperibadian wanita Melayu dalam konteks kontemporari.

Akhirnya, impak kertas kerja ini diinterpretasi daripada sumbangan signifikan terhadap penggayaan wacana falsafah pemikiran Melayu-Islam, khususnya dalam memahami identiti dan keperibadian wanita Melayu secara seimbang antara tradisi dan kemodenan. Selain itu, dapatan kertas kerja ini sesuai digunakan sebagai rujukan dalam pembinaan dasar berkaitan wanita, pendidikan dan pembangunan modal insan yang mengambil kira nilai agama dan

budaya tempatan. Di samping itu, penulisan ini jelas signifikan terhadap pembinaan kerangka identiti wanita berteraskan maruah, ilmu dan tanggungjawab sosial, sekali gus memperkukuh jati diri bangsa dalam menghadapi cabaran globalisasi dan perubahan nilai semasa.

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# KAJIAN TINDAKAN BERASASKAN GAMIFIKASI MENGGUNAKAN *FLASH CARD QC*.

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***Abstrak:*** *Kajian tindakan ini bertujuan untuk meningkatkan penguasaan pelajar dalam topik Carta Kawalan Pembolehubah melalui pendekatan gamifikasi berasaskan cabaran Flash Card QC. Didapati pada semester II 2024/2025, purata markah kuiz iaitu 56.8%. Masalah utama yang dikenal pasti ialah kelemahan pelajar dalam penguasaan teori dalam topik ini Kajian ini melibatkan seramai 34 orang pelajar semester 5 Diploma Kejuruteraan Mekanikal (Pembuatan). Intervensi kajian merangkumi aktiviti Flash Card QC secara berkumpulan dan sistem pemberian markah. Data diambil daripada markah kuiz yang dijalankan pada sesi I 2025/ 2026. Dapatan kajian menunjukkan peningkatan markah bagi sesi 1 2025/2026 berbanding sesi II 2024/2025. Komponen kuiz menunjukkan kenaikan 22.4% Kajian ini membuktikan bahawa pendekatan gamifikasi berkesan dalam meningkatkan kualiti pembelajaran topik carta kawalan dalam pendidikan TVET.*

*Kata kunci: Kajian tindakan, gamifikasi, flash card QC, carta kawalan pembolehubah, TVET*

## 1. Pengenalan

Dalam bidang pendidikan teknikal dan vokasional (TVET), penguasaan konsep statistik dan kawalan kualiti merupakan kemahiran penting yang perlu dikuasai oleh pelajar bagi memenuhi keperluan industri pembuatan. Topik carta kawalan pembolehubah, seperti carta $\bar{X}$-R dan $\bar{X}$-s digunakan secara meluas dalam industri untuk memantau kestabilan proses dan mengesan variasi yang tidak terkawal. Oleh itu, kefahaman yang kukuh terhadap konsep ini amat penting bagi memastikan pelajar bersedia menghadapi cabaran di tempat kerja.

Walau bagaimanapun, pengalaman pengajaran menunjukkan topik carta kawalan pembolehubah sering dianggap sukar oleh pelajar kerana melibatkan teori, pengiraan statistik, penggunaan rumus kawalan kualiti dan pembinaan carta kawalan. Kaedah pengajaran konvensional yang berfokus kepada syarahan dan latihan bertulis didapati masih belum dapat menarik minat pelajar sepenuhnya.

Kelemahan dalam penguasaan topik ini bukan sahaja memberi kesan terhadap pencapaian akademik pelajar, malah menjejaskan motivasi, keyakinan diri dan penyertaan aktif mereka dalam proses pembelajaran. Pelajar yang gagal memahami teori dan pengiraan seperti penentuan nilai purata (CL), had kawalan atas (UCL) dan had kawalan bawah (LCL) cenderung untuk menghafal tanpa memahami konsep sebenar, seterusnya menyukarkan mereka dalam situasi penilaian formal.

Sehubungan itu, pendekatan pengajaran berasaskan gamifikasi diperkenalkan sebagai satu strategi inovatif bagi mewujudkan suasana pembelajaran yang lebih interaktif,

menyeronokkan dan bermakna. Gamifikasi mengintegrasikan elemen permainan seperti cabaran, ganjaran, sistem mata dan persaingan sihat ke dalam aktiviti pembelajaran. Pendekatan ini diyakini mampu meningkatkan penglibatan pelajar secara aktif serta membantu mereka membina kefahaman konsep secara berperingkat.

Dalam kajian ini, gamifikasi diaplikasikan melalui cabaran *Flash Card QC* yang direka khusus untuk topik Carta Kawalan Pembolehubah. *Flash card QC* digunakan sebagai medium pembelajaran visual dan interaktif yang membolehkan pelajar mengulang kaji konsep, rumus dan langkah pengiraan secara sistematik. Dengan sokongan sistem markah, pendekatan ini diharapkan dapat meningkatkan motivasi dan penguasaan pelajar terhadap topik yang bersifat abstrak dan teknikal.

## 2. Kajian Literatur

### *2.1 Gamifikasi dalam Pendidikan*

Gamifikasi merujuk kepada penggunaan elemen permainan dalam konteks bukan permainan, termasuk dalam pendidikan, bagi meningkatkan motivasi dan penglibatan pengguna. Menurut Rosmawati Jaafar (2023), penggunaan gamifikasi *Quizizz* memberi kesan yang baik terhadap motivasi pelajar. Elemen seperti sistem poin, lencana, tahap pencapaian dan papan skor (*leaderboard*) telah digunakan secara meluas dalam pelbagai bidang pendidikan dan menunjukkan kesan positif terhadap pembelajaran pelajar.
Menurut Mohd Syaubari Othman et.all (2021), kebanyakan kajian empirikal mendapati bahawa gamifikasi berpotensi meningkatkan motivasi, penglibatan dan kepuasan pelajar, terutamanya dalam pembelajaran yang memerlukan latihan berulang. Dalam konteks pendidikan tinggi, gamifikasi juga didapati mampu meningkatkan kehadiran dan penyertaan aktif pelajar dalam kelas.

### *2.2 Gamifikasi dalam Pendidikan Teknikal dan Vokasional (TVET)*

Dalam pendidikan TVET, pembelajaran yang bersifat praktikal, visual dan berasaskan masalah adalah lebih berkesan berbanding pendekatan teori semata-mata. Biggs dan Tang (2011) menekankan kepentingan pembelajaran aktif yang selari dengan prinsip *constructive alignment* bagi memastikan hasil pembelajaran dapat dicapai dengan berkesan.

Beberapa kajian menunjukkan bahawa penggunaan aktiviti interaktif seperti permainan, simulasi dan pembelajaran berasaskan cabaran dapat membantu pelajar TVET memahami konsep teknikal yang kompleks dengan lebih mudah. Pendekatan ini bukan sahaja meningkatkan kefahaman kognitif, malah menyokong perkembangan kemahiran insaniah seperti kerjasama dan komunikasi. Selaras itu, kajian oleh Ali, Jat, dan Naaz (2025) mendapati bahawa penggunaan elemen permainan dalam pembelajaran formal membantu meningkatkan skor kuiz dan prestasi pelajar, walaupun variasi kesan masih berlaku bergantung kepada reka bentuk aktiviti gamifikasi itu sendiri.

### *2.3 Penggunaan Flash Card sebagai Bahan Bantu Mengajar*

*Flash card* merupakan bahan bantu mengajar yang berkesan dalam meningkatkan daya ingatan dan kefahaman konsep melalui kaedah pengulangan aktif (*active recall*). Kajian oleh Rahimah Wahid (2021) mendapati bahawa penggunaan bahan visual dan kad pembelajaran membantu pelajar mengingati konsep teknikal dengan lebih baik berbanding kaedah pembelajaran pasif. Selain itu, kajian eksperimen oleh Hamid dan Barzenji (2025) dalam pendidikan digital menunjukkan bahawa gamifikasi yang dirangka dengan objektif yang jelas dan maklum balas segera meningkatkan aktiviti pembelajaran berbanding kaedah tradisional. Kajian ini menekankan pentingnya struktur permainan yang konsisten dan mesra pelajar bagi mencapai hasil pembelajaran yang dikehendaki. Ahmad Farouq et.all (2021) pula mendapati bahawa media pembelajaran yang menggunakan strategi gamifikasi seperti papan skor dan sistem poin boleh meningkatkan penglibatan pelajar kerana pelajar lebih terdorong untuk menyertai aktiviti interaktif dan memberi respon aktif terhadap tugasan.

### *2.4 Jurang Kajian*

Walaupun terdapat banyak kajian berkaitan gamifikasi dan penggunaan *flash card* dalam pendidikan, kajian yang mengintegrasikan gamifikasi berasaskan *flash card* secara khusus dalam topik Carta Kawalan Pembolehubah dalam konteks TVET masih terhad. Kebanyakan kajian tertumpu kepada subjek umum atau pembelajaran berasaskan teknologi digital sepenuhnya.

Oleh itu, kajian tindakan ini dijalankan bagi mengisi jurang kajian dengan meneroka keberkesanan gamifikasi berasaskan cabaran *Flash Card* QC dalam meningkatkan penyertaan, motivasi dan penguasaan pelajar terhadap topik Carta Kawalan Pembolehubah dalam program Diploma Kejuruteraan Mekanikal (Pembuatan).

## 3. Refleksi Pengajaran dan Pembelajaran

Berdasarkan pemerhatian semasa pengajaran dan pembelajaran, pelajar Diploma Kejuruteraan Mekanikal (Pembuatan) Semester 5 didapati kurang mahir dalam menggunakan rumus statistik, khususnya dalam pengiraan nilai UCL, LCL dan CL. Pelajar juga menghadapi kesukaran melukis graf carta kawalan dengan tepat, seterusnya menyebabkan pencapaian markah ujian berada pada tahap yang rendah. Keadaan ini memberi kesan negatif terhadap motivasi dan penyertaan aktif pelajar dalam kelas.

## 4. Objektif Kajian

Kajian ini memfokuskan kepada penggunaan gamifikasi berasaskan cabaran *Flash Card QC* bagi meningkatkan penyertaan pelajar, motivasi pembelajaran dan penguasaan konsep Carta Kawalan Pembolehubah.
Objektif kajian adalah untuk:

i. Meningkatkan penglibatan pelajar dalam aktiviti pembelajaran secara berkumpulan.
ii. Meningkatkan pencapaian markah kuiz dan ujian selepas intervensi.

## 5. Metodologi Kajian

### *5.1 Reka Bentuk Kajian*

Kajian ini menggunakan pendekatan kajian tindakan yang melibatkan proses refleksi, perancangan, pelaksanaan intervensi dan penilaian.

### *5.2 Kumpulan Sasaran*

Kajian ini melibatkan seramai 34 orang pelajar Diploma Kejuruteraan Mekanikal (Pembuatan) Semester 5.

### *5.3 Pelaksanaan Intervensi*

Intervensi dilaksanakan melalui aktiviti cabaran *Flash Card* QC secara berkumpulan. Pelajar menjawab soalan berkaitan *QC Tools* dan Carta Kawalan Pembolehubah secara bergilir. Sistem markah digunakan bagi memupuk persaingan sihat dan meningkatkan motivasi pelajar. Proses intervensi ini dilakukan pada setiap kali pelajar telah menamatkan pengajaran satu subtopik Carta Kawalan Pembolehubah, sebagai aktiviti pengukuhan dan penilaian formatif.

### *5.4 Instrumen Pengumpulan Data*

Data kajian dikumpulkan melalui kuiz dan ujian bagi sesi II 2024/2025 dan sesi I 2025/2026.

## 6. Dapatan Kajian

### *6.1 Perbandingan Markah Kuiz dan Ujian*

**Jadual 1: Perbandingan Markah Kuiz dan Ujian Mengikut Sesi.**

| Sesi Akademik | Purata Markah Kuiz (%) | Purata Markah Ujian (%) |
|---|---|---|
| Sesi II 2024/2025 | 56.8 | 67.1 |
| Sesi I 2025/2026 | 79.2 | 69.2 |

Berdasarkan jadual 1 tersebut, purata markah kuiz menunjukkan peningkatan yang sebanyak 22.4 mata peratus, daripada 56.8% pada sesi II 2024/2025 kepada 79.2% pada sesi I 2025/2026 selepas pelaksanaan gamifikasi. Peningkatan ini mencerminkan tahap penglibatan dan kefahaman pelajar yang lebih baik semasa aktiviti pembelajaran berasaskan kuiz interaktif. Selain itu, purata markah ujian juga menunjukkan peningkatan, walaupun pada kadar yang lebih sederhana, iaitu daripada 67.1% kepada 69.2%. Peningkatan ini menunjukkan bahawa kesan gamifikasi bukan sahaja terhad kepada penilaian formatif, malah turut menyumbang kepada penguasaan pelajar dalam penilaian formal yang bersifat sumatif.

Secara keseluruhan, dapatan ini menunjukkan bahawa penggunaan elemen gamifikasi berpotensi meningkatkan motivasi, fokus, dan kefahaman pelajar, seterusnya memberi kesan positif terhadap prestasi akademik mereka.

## 7. Perbincangan

Dapatan kajian menunjukkan bahawa pelaksanaan gamifikasi berasaskan cabaran *Flash Card QC* memberikan kesan positif yang ketara terhadap penyertaan dan penguasaan pelajar dalam topik Carta Kawalan Pembolehubah. Peningkatan signifikan dalam markah kuiz selepas intervensi menunjukkan bahawa pendekatan ini berkesan sebagai strategi pembelajaran formatif yang menekankan pengulangan, pengukuhan konsep dan pembelajaran aktif.

Ini selaras dengan dapatan Siti Zakiah (2024) bahawa elemen gamifikasi seperti poin dan papan skor boleh membangkitkan motivasi intrinsik pelajar untuk berdaya saing secara sihat dan terus menyertai aktiviti pembelajaran. Dalam kajian ini, penggunaan markah berjaya mewujudkan suasana persaingan sihat, seterusnya menggalakkan pelajar untuk terlibat secara aktif dalam aktiviti pembelajaran. Pelajar bukan sahaja terdorong untuk menjawab soalan dengan betul, malah lebih berani berbincang dan mencuba menyelesaikan masalah secara kolaboratif.

Selain itu, penggunaan *flash card* sebagai medium pembelajaran visual membantu pelajar mengingat teori dan rumus dengan lebih sistematik. Pendekatan ini menyokong teori *active recall* dan *retrieval practice* yang menekankan kepentingan pengulangan aktif dalam meningkatkan daya ingatan jangka panjang Pelajar tidak lagi bergantung sepenuhnya kepada hafalan, sebaliknya membina kefahaman secara berperingkat melalui perbincangan kumpulan dan refleksi segera selepas setiap cabaran.

Walaupun peningkatan markah ujian adalah lebih sederhana berbanding kuiz, trend peningkatan yang direkodkan menunjukkan bahawa gamifikasi mempunyai potensi untuk meningkatkan prestasi pelajar dalam penilaian formal. Keadaan ini berkemungkinan disebabkan oleh perbezaan sifat penilaian, di mana ujian memerlukan pemindahan pembelajaran ke situasi yang lebih kompleks dan individu. Namun demikian, latihan berulang melalui *flash card* membantu mengurangkan kesilapan pengiraan dan meningkatkan keyakinan pelajar dalam menjawab soalan berbentuk analitikal.

Selain itu, penggunaan strategi gamifikasi dalam konteks *flash card* dan aktiviti kumpulan dapat memupuk pembelajaran kolaboratif, di mana pelajar saling membantu dan berkongsi pemahaman semasa menjawab soalan. Nazihah Shaari dan Zuraini Ramli (2025) menunjukkan bahawa media pembelajaran yang menggunakan elemen permainan mampu meningkatkan interaksi sosial dalam kalangan pelajar, yang seterusnya memberi impak positif kepada motivasi mereka. Aktiviti gamifikasi yang dilaksanakan sejajar dengan hasil pembelajaran kursus, kaedah pengajaran dan penilaian, sekali gus menyumbang kepada peningkatan keberkesanan pengajaran dan pembelajaran.

Dapatan ini juga menunjukkan bahawa gamifikasi turut memberi impak positif terhadap pembelajaran berteraskan tugasan formal seperti ujian, walaupun peningkatannya tidak setinggi kuiz. Ini mungkin kerana ujian formal memerlukan kognisi yang lebih tinggi dan pemindahan pembelajaran daripada konteks interaktif ke situasi penilaian individu. Walau bagaimanapun, peningkatan purata markah ujian selepas intervensi menunjukkan bahawa gamifikasi dapat membantu memupuk kefahaman konseptual pelajar dalam jangka sederhana. Secara keseluruhan, dapatan kajian ini menyokong pandangan bahawa gamifikasi merupakan satu pendekatan pedagogi yang berpotensi dalam pembelajaran teknikal, selaras dengan teori motivasi dan pembelajaran aktif yang dibincangkan dalam literatur terkini (Ali et al., 2025; Rahmi et al., 2025). Pendekatan gamifikasi bukan sahaja meningkatkan motivasi dan penglibatan pelajar, tetapi juga memberi peluang kepada pensyarah untuk merangka aktiviti pembelajaran yang lebih bermakna dan berstruktur.

## 8. Implikasi Kajian

Kajian ini mempunyai beberapa implikasi penting terhadap amalan pengajaran dalam pendidikan TVET. Pertama, gamifikasi berasaskan cabaran *Flash Card* QC boleh dijadikan

sebagai alternatif atau pelengkap kepada kaedah pengajaran konvensional bagi topik yang bersifat teknikal dan abstrak. Kedua, pendekatan ini membantu meningkatkan motivasi dan keyakinan pelajar, khususnya pelajar yang lemah dalam teori dan juga pengiraan. Ketiga, penggunaan bahan bantu mengajar yang mudah dan murah seperti *flash card* dan perisian Excel menjadikan kaedah ini praktikal dan mudah diaplikasikan oleh pensyarah.

## 9. Kesimpulan

Kesimpulannya, kajian tindakan ini membuktikan bahawa gamifikasi berasaskan cabaran *Flash Card* QC merupakan satu pendekatan pengajaran yang berkesan dalam meningkatkan penyertaan, motivasi dan penguasaan pelajar terhadap topik Carta Kawalan Pembolehubah. Peningkatan ketara dalam markah kuiz serta peningkatan konsisten dalam markah ujian menunjukkan keberkesanan intervensi yang dilaksanakan. Pendekatan ini berpotensi untuk diperluaskan kepada topik kawalan kualiti yang lain serta subjek teknikal dalam pendidikan TVET bagi menyokong pembelajaran yang lebih bermakna dan berpusatkan pelajar.

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# ANALISIS KEBERKESANAN PLATFORM QALBU VERSE SEBAGAI MEDIUM PEMBELAJARAN AL-QURAN ABAD KE-21

*(Analysis Of the Effectiveness of The Qalbu Verse Platform as A Medium for Learning the Quran in the 21st Century)*

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***Abstrak:*** *Kajian ini dijalankan bagi menilai keberkesanan platform Qalbu Verse sebagai medium pembelajaran al-Quran yang selaras dengan keperluan pendidikan abad ke-21 dalam membentuk pemahaman terhadap nilai-nilai al-Quran, penguasaan bacaan al-Quran dan hukum tajwid, motivasi pembelajaran serta pengalaman pengguna dalam kalangan pelajar Tingkatan 2. Kajian kuantitatif melibatkan 112 responden iaitu 88 orang pelajar dan 24 orang guru/ibu bapa. Data dikumpul melalui borang soal selidik berstruktur, rekod gamifikasi dan pemerhatian fasilitator. Analisis mendapati bahawa platform ini memberi kesan positif yang konsisten terhadap beberapa aspek pembelajaran. Berdasarkan data pelajar, keseluruhan 87.9% menilai laman web Qalbu Verse dari segi kebolehcapaian maklumat, reka bentuk visual, kemudahan navigasi, pautan video dan bahan pembelajaran sebagai sangat baik dan baik, manakala 12.1% menilai sederhana. Dari aspek kefahaman ayat al-Quran, kesedaran pengamalan ajaran Islam, pemahaman adab dan akhlak serta pengaitan ayat dengan kehidupan sebenar, purata 86.3% responden memberi penilaian positif. Aktiviti interaktif dan kemudahan mengulangkaji membantu meningkatkan minat belajar dan pemahaman pelajar dengan 85.8% menilai sangat baik dan baik, manakala aspek kemahiran analisis, menjawab soalan KBAT dan refleksi diri memperoleh purata 84.1% penilaian positif. Bagi perspektif guru*

*dan ibu bapa, 85.4% menilai kebolehgunaan, reka bentuk, susun atur dan bahan pembelajaran sebagai berkesan dan sangat berkesan. Kefahaman maksud ayat al-Quran, kesedaran nilai Islam, serta pengaitan situasi kehidupan sebenar mendapat purata 86.5% penilaian positif, menunjukkan sokongan yang kuat terhadap keberkesanan platform ini. Secara keseluruhan Qalbu Verse terbukti meningkatkan penghayatan nilai-nilai al-Quran, minat dan motivasi pembelajaran, penguasaan bacaan serta hukum tajwid di samping menyediakan pengalaman pembelajaran berpusatkan pelajar melalui ciri interaktif dan gamifikasi. Kesimpulannya, Qalbu Verse berpotensi sebagai medium pelengkap bagi proses Pengajaran dan Pembelajaran (PdP). Penggunaan platform ini disarankan untuk diselaraskan secara pedagogi, dipantau oleh guru dan disertai dengan pemilihan kandungan beretika bagi meningkatkan penghayatan nilai-nilai Islam dalam kalangan pelajar.*

***Kata Kunci:*** *Pembelajaran al-Quran, pendidikan abad ke-21, gamifikasi, pedagogi, nilai-nilai Islam.*

***Abstract:*** *This study was conducted to evaluate the effectiveness of the Qalbu Verse platform as a Quranic learning medium aligned with the requirements of 21st century education in fostering understanding of Quranic values, mastery of Quranic recitation and tajwid rules, learning motivation and user experience among Form 2 students. The quantitative study involved 112 respondents, comprising 88 students and 24 teachers/parents. Data were collected through structured questionnaires, gamification records and facilitator observations. The analysis revealed that the platform consistently produced positive impacts across multiple learning dimensions. Based on student data, a total of 87.9% rated the website highly in terms of accessibility of information, visual design, navigation ease, video links and learning materials, with 12.1% giving moderate ratings. Regarding understanding of Quranic verses, awareness of Islamic teachings, comprehension of adab and akhlaq and application of verses to real-life situations, an average of 86.3% of respondents provided positive ratings. Interactive activities and revision tools enhanced students' learning interest and comprehension, with 85.8% rating them very good or good, while skills in analytical thinking, answering higher-order thinking questions and self-reflection received 84.1% positive ratings. From the perspective of teachers and parents, 85.4% considered the platform effective in terms of usability, design, layout and learning materials. Understanding of Quranic verses, awareness of Islamic values and application of real-life scenarios received an average of 86.5% positive ratings, indicating strong support for the platform's effectiveness. Overall, Qalbu Verse has been shown to enhance students' understanding of Quranic values, learning motivation, mastery of recitation and tajwid, while providing a learner-centered experience through interactive features and gamification. In conclusion, the platform has potential as a complementary tool for the teaching and learning (T&L) process. Its use is recommended to be pedagogy aligned, monitored by teachers, and accompanied by ethically selected content to further promote Islamic values among students.*

***Keywords:*** *Quranic learning, 21st century education, gamification, pedagogy, Islamic values.*

## Pengenalan

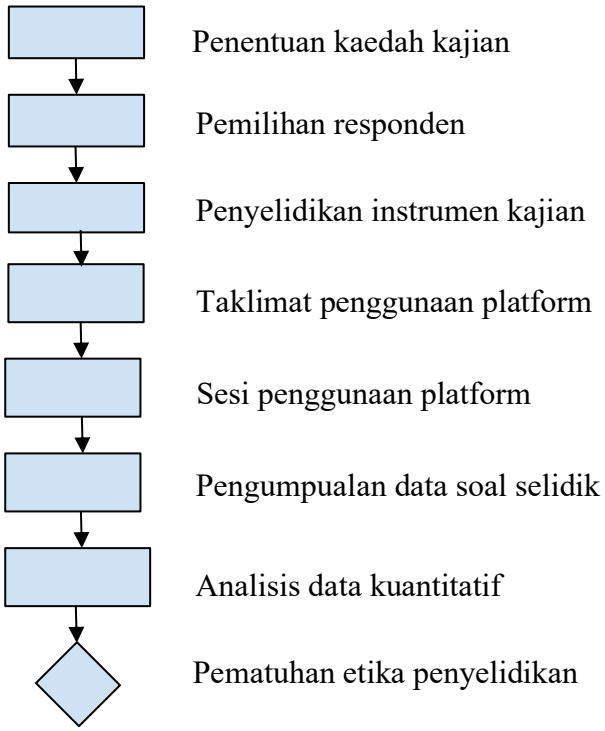
Perkembangan teknologi digital dalam era pembelajaran abad ke-21 memberi impak besar terhadap kaedah pengajaran dan pembelajaran di sekolah, termasuk Pendidikan Islam khususnya bidang al-Quran. Platform digital seperti aplikasi al-Quran interaktif, kelas dalam talian dan sistem pengurusan pembelajaran (LMS) semakin meluas digunakan bagi memperkukuh PdP (Mim Fadhli Rabbi et al., 2025). Berdasarkan sejarah peradaban Islam, teknologi merupakan proses berterusan yang menjadi pencetus kejayaan tamadun Islam pada masa itu (Muhammad Zulazizi Mohd Nawi, 2020). Kehadiran platform digital membuka akses pembelajaran al-Quran yang lebih luas terutamanya bagi masyarakat di daerah dengan keterbatasan guru al-Quran berkualiti (Mim Fadhli Rabbi et al., 2025). Keupayaan teknologi menyediakan persekitaran pembelajaran yang interaktif, fleksibel dan berpusatkan pelajar menjadikannya relevan dalam meningkatkan kualiti PdP (Marlya Fatira et al., 2021). Penggunaan platform digital dalam pendidikan al-Quran dilihat sebagai pelengkap kaedah tradisional seperti talaqqi dan musyafahah, terutama bagi pelajar sekolah menengah yang cenderung menggunakan gajet dalam kehidupan seharian (Yusof, 2021). Hal ini selaras dengan pernyataan bahawa kemajuan teknologi memberi kesan signifikan terhadap metodologi pendidikan Islam dan berperanan penting dalam menyesuaikan pendekatan pengajaran dengan keperluan pendidikan moden (Norliza Ab Halim et al., 2025). Integrasi media digital diyakini mampu meningkatkan kefahaman, penguasaan bacaan dan motivasi murid dalam topik al-Quran serta membuka peluang luas dalam pengajaran al-Quran (Mustapa & Arishin, 2024). Tambahan pula, ianya perlu disepadukan untuk melahirkan masyarakat seperti yang dihasratkan dalam Falsafah Pendidikan Kebangsaan dengan penekanan kepada penerapan nilai dan pembentukan kemenjadian murid (Maimun Aqsha Lubis et al., 2022).

Walaupun pelbagai platform digital berkaitan pembelajaran al-Quran telah dibangunkan, keberkesanan penggunaannya dalam konteks bilik darjah Pendidikan Islam khususnya di peringkat sekolah menengah masih memerlukan penelitian yang lebih mendalam (Norliza Ab Halim et al., 2025). Kajian literatur menunjukkan bahawa integrasi teknologi dalam pendidikan Islam memerlukan penilaian yang teliti terhadap impaknya terhadap PdP kerana faktor seperti pembangunan kemahiran pedagogi, kesediaan guru dan infrastruktur teknologi memberi kesan kepada proses pembelajaran (Norasmahani Nor & Fariza Md Sham, 2018). Di samping itu, kaedah pengajaran al-Quran yang bersifat konvensional didapati kurang menarik minat sebahagian pelajar terutamanya dalam aspek penguasaan hukum tajwid, pemahaman maksud ayat al-Quran dan penghayatan nilai-nilai Islam dalam kehidupan seharian (Heni Jusuf, 2016). Situasi ini menjadi lebih mencabar apabila pelajar berhadapan dengan gaya pembelajaran abad ke-21 yang menuntut pendekatan lebih interaktif, fleksibel dan berpusatkan pelajar (Kementerian Pendidikan Malaysia, 2017). Selain itu, penggunaan teknologi dalam pendidikan al-Quran sering kali dilaksanakan tanpa penilaian empirik yang sistematik terhadap kesannya terhadap kefahaman, motivasi pembelajaran dan pengalaman pengguna (Siti Rosilawati Ramlan et al., 2018). Oleh itu, kajian yang menilai secara khusus keberkesanan platform digital seperti Qalbu Verse amat diperlukan bagi memastikan integrasi teknologi dalam PdP Pendidikan Islam benar-benar menyokong objektif pembelajaran dan keperluan pelajar masa kini.

Sehubungan itu, kajian ini bertujuan adalah untuk: i. Menilai keberkesanan platform *Qalbu Verse* sebagai medium pembelajaran al-Quran yang selaras dengan keperluan pendidikan abad ke-21 dalam kalangan pelajar Tingkatan 2; ii. Menganalisis kesan penggunaan platform *Qalbu Verse* terhadap tahap kefahaman ayat al-Quran, penguasaan hukum tajwid, penghayatan nilai-

nilai Islam serta pengaitan kandungan al-Quran dengan kehidupan sebenar; dan iii. Menentukan pengaruh penggunaan platform *Qalbu Verse* terhadap minat, motivasi pembelajaran dan perkembangan kemahiran berfikir aras tinggi (KBAT) pelajar berdasarkan persepsi pelajar, guru dan ibu bapa.

## Metodologi




**Rajah 1. Carta Alir Intervensi dan Penilaian Platform *Qalbu Verse*.**

Rajah 1 merangkumi keseluruhan proses penyelidikan secara berstruktur. Kajian ini menggunakan kaedah kajian kuantitatif bagi menilai keberkesanan platform *Qalbu Verse* sebagai medium pembelajaran al-Quran dalam kalangan pelajar Tingkatan 2 di sebuah Sekolah Menengah Harian di daerah Kuala Nerus (Suraini Saufi et al., 2023). Kaedah ini dipilih kerana ia membolehkan pengumpulan data yang objektif dan berangka serta membolehkan penyelidik menilai perbezaan skor, tahap pencapaian dan pola peningkatan pengguna selepas menggunakan platform tersebut. Pendekatan kuantitatif juga selaras dengan keperluan kajian yang menumpukan kepada keberkesanan laman web secara sistematik melalui data berangka (Suraini Saufi et al., 2023). Penggunaan elemen interaktif seperti audio, video dan latihan berstruktur dalam pembelajaran digital dapat meningkatkan minat dan penglibatan pelajar, selaras dengan dapatan kajian Zalizan et al. (2024). Pemilihan responden dalam kajian ini melibatkan seramai 88 pelajar Tingkatan 2 serta 24 orang daripada kalangan guru dan ibu bapa, yang dipilih melalui kaedah soal selidik (A., Amirul & Noorhazila, 2021). Guru Pendidikan Islam turut terlibat sebagai pemerhati dan penilai kompetensi bacaan pelajar sepanjang intervensi dijalankan. Berdasarkan Jadual Penentuan Saiz Sampel oleh Krejcie dan Morgan (1970), bagi anggaran populasi sekitar 160 orang, saiz sampel yang dicadangkan ialah 113

responden. Oleh itu, pemilihan 112 responden dalam kajian ini adalah mencukupi dan memenuhi keperluan statistik untuk mewakili populasi kajian (Raja, 2018).

Bagi penyediaan instrumen kajian, borang soal selidik direka bentuk secara berstruktur dan disesuaikan mengikut kategori responden, iaitu pelajar serta guru dan ibu bapa. Instrumen untuk pelajar terbahagi kepada lima bahagian, iaitu Bahagian A (persepsi terhadap platform, 4 soalan), Bahagian B (kefahaman ayat al-Quran, 6 soalan), Bahagian C (pembelajaran dan minat, 4 soalan), Bahagian D (kemahiran, 3 soalan) dan Bahagian E: (elemen interaktif, 1 soalan). Skala Likert 5 mata digunakan bagi menunjukkan tahap penilaian, iaitu 1 = Sangat tidak baik, 2 = Tidak baik, 3 = Sederhana, 4 = Baik dan 5 = Sangat baik. Bagi guru dan ibu bapa pula, instrumen soal selidik direka untuk menilai kebolehgunaan, keberkesanan pembelajaran serta tahap kefahaman ayat al-Quran pelajar melalui penggunaan platform *Qalbu Verse*. Instrumen ini merangkumi dua bahagian utama, iaitu persepsi terhadap kebolehgunaan dan keberkesanan pembelajaran serta persepsi terhadap kefahaman ayat al-Quran seperti yang ditunjukkan dalam Jadual 5 dan Jadual 6. Instrumen ini bertujuan memperoleh penilaian profesional dan sokongan luar bilik darjah terhadap keberkesanan platform sebagai medium pembelajaran al-Quran (Heni Jusuf, 2016). Selain soal selidik, data kuantitatif turut diperoleh melalui elemen gamifikasi dalam platform, di mana bilangan pelajar yang berjaya menyelesaikan permainan, tahap pencapaian tugasan serta jumlah percubaan direkodkan secara automatik sekali gus memberikan indikator jelas tentang tahap penguasaan hukum asas tajwid dan penghayatan kandungan al-Quran (Suhaila Zailani et al., 2019).

Sebelum penggunaan platform dijalankan, sesi taklimat telah diadakan oleh fasilitator untuk memperkenalkan objektif kajian dan cara penggunaan platform *Qalbu Verse* kepada para pelajar (Marlya Fatira et al., 2021). Sesi ini membolehkan pelajar memahami setiap fungsi dan ciri dalam platform serta mengetahui bagaimana cara memanfaatkan setiap elemen untuk meningkatkan penguasaan dan penghayatan mereka terhadap kandungan al-Quran.

Dari sesi penggunaan platform, pelajar diberi peluang untuk meneroka setiap sudut halaman secara kendiri sebelum menyertai aktiviti pembelajaran yang interaktif. Mereka menggunakan platform untuk membaca nota pembelajaran, mengikuti aktiviti interaktif serta menyertai permainan berunsur gamifikasi yang direka untuk menilai dan mengukuhkan penguasaan tajwid dan penghayatan kandungan al-Quran (Permana et al., 2018). Sepanjang sesi, fasilitator memantau perkembangan pelajar bagi memastikan setiap tugasan dapat diakses dan dilengkapkan dengan betul.

Selepas sesi pembelajaran selesai, pengumpulan data soal selidik dijalankan. Borang soal selidik diedarkan kepada pelajar secara bersemuka, manakala responden daripada kalangan guru dan ibu bapa pula mengisi soal selidik secara dalam talian melalui *Google Form* yang dikongsi melalui e-mel, *WhatsApp* atau *Telegram* bagi memudahkan pengumpulan data secara cepat dan maksimum (Raja, 2018). Soal selidik ini bagi memperoleh maklum balas berstruktur mengenai keberkesanan platform, tahap kefahaman pelajar terhadap kandungan pembelajaran dan penilaian kendiri terhadap pencapaian masing-masing.

Analisis data kuantitatif dilakukan menggunakan statistik asas bagi menilai tahap keberkesanan platform. Data prestasi gamifikasi ditunjukkan dalam bentuk jadual yang menunjukkan bilangan pengguna bagi setiap tahap pencapaian, manakala data soal selidik dianalisis menggunakan pengiraan frekuensi dan peratusan bagi setiap kategori (Saufi et al., 2023). Kaedah ini membolehkan penyelidik mengenal pasti pola kecenderungan pelajar secara jelas

dan terukur, serta membuat perbandingan pencapaian antara pelajar dengan sistematik dan berasaskan bukti.

Keseluruhan kajian dilaksanakan dengan pematuhan etika penyelidikan yang ketat. Ini termasuk memastikan kerahsiaan identiti peserta, memperoleh persetujuan untuk menggunakan maklumat sebagai data dan memastikan semua data dikumpul serta digunakan hanya untuk tujuan akademik (Etikan & Bala, 2017).

## Dapatan kajian dan perbincangan

Laman web *Qalbu Verse* digunakan sebagai medium pengajaran bagi membantu pengguna dalam memahami ayat al-Quran dengan lebih jelas. Kajian ini melibatkan 88 orang pelajar dan 24 orang guru/ibu bapa bagi melihat tahap keberkesanan laman web dari aspek reka bentuk, kandungan, navigasi dan impak pembelajaran. Semua dapatan diperoleh melalui borang soal selidik dan dianalisis secara deskriptif mengikut kaedah penyelidikan kua.

### *Dapatan Pelajar*

Analisis dapatan pelajar menunjukkan kecenderungan respons yang sangat positif terhadap penggunaan laman web *Qalbu Verse*. Jumlah pelajar seramai 88 orang dan data ditunjukkan dalam 5 kategori berikut:

Bahagian A: Persepsi Pengguna Terhadap Laman Web

**Jadual 1. Persepsi Responden Terhadap Laman Web *Qalbu Verse*.**

| Item | Pernyataan | Sangat Tidak Baik | Tidak Baik | Sederhana | Baik | Sangat Baik |
|---|---|---|---|---|---|---|
| 1 | Laman web ini membantu anda dalam mengakses maklumat berkaitan bidang al-Quran bagi tingkatan 2 | | | | 28 (31.8%) | 60 (68.2%) |
| 2 | Penggunaan warna, ikon dan susun atur dalam laman web ini membantu anda fokus pada pembelajaran | | | 4 (4.5%) | 36 (40.9%) | 48 (54.5%) |
| 3 | Panduan laman web ini sangat baik dan penggunaan butang yang mudah | | | 8 (9.1%) | 34 (38.6%) | 46 (52.3%) |
| 4 | Pautan video dan bahan dalam laman web dapat diakses dengan lancar | | | 16 (18.2%) | 28 (31.8%) | 44 (50.0%) |

Berdasarkan Jadual 1, dapatan menunjukkan bahawa persepsi pengguna terhadap laman web *Qalbu Verse* adalah amat positif. Bagi aspek pertama, majoriti pengguna menilai bahawa laman web ini membantu mereka mengakses maklumat berkaitan bidang al-Quran bagi tingkatan masing-masing dengan tahap sangat baik (68.2%), manakala 31.8% menilainya sebagai baik dan tiada pengguna memilih kategori sangat tidak baik atau tidak baik. Dari segi reka bentuk visual, penggunaan warna, ikon dan susun atur juga dinilai memuaskan, di mana

54.5% pengguna memilih sangat baik, 40.9% baik dan 4.5% sederhana. Begitu juga, panduan dan kemudahan penggunaan butang menerima penilaian tinggi dengan 52.3% pengguna menandakan sangat baik, 38.6% baik dan 9.1% sederhana. Bagi aspek akses kepada pautan video dan bahan pembelajaran, 50% pengguna menilainya sangat baik, 31.8% baik dan 18.2% sederhana.

Secara keseluruhan, ini menunjukkan bahawa pelajar memberikan penilaian sangat positif terhadap reka bentuk, akses maklumat dan kemudahan navigasi *Qalbu Verse*. Hasil ini selari dengan pandangan Mim Fadhli Rabbi et al. (2024) yang menegaskan bahawa platform digital yang mudah diakses mampu memperluas peluang pembelajaran al-Quran termasuk di kawasan yang kekurangan guru berkualiti. Penilaian majoriti pelajar dalam kategori sangat baik dan baik membuktikan bahawa ciri visual serta susun atur laman web memenuhi keperluan pembelajaran abad ke-21 yang menekankan interaktiviti dan fleksibiliti. Ini menunjukkan bahawa *Qalbu Verse* berfungsi sebagai pelengkap yang efektif kepada PdP al-Quran di sekolah.

Bahagian B: Kefahaman Ayat Al-Quran

**Jadual 2. Kefahaman Pengguna Terhadap Ayat Al-Quran.**

| Item | Pernyataan | Sangat Tidak Baik | Tidak Baik | Sederhana | Baik | Sangat Baik |
|---|---|---|---|---|---|---|
| 1 | Ayat al-Quran yang dipaparkan dalam laman web ini membantu anda memahami maksud ayat tersebut | | | 8 (9.1%) | 26 (29.5%) | 54 (61.4%) |
| 2 | Ayat al-Quran ini dapat memberi kesedaran tentang kepentingan mengamalkan ajaran Islam dalam kehidupan seharian | | | 2 (2.3%) | 22 (25.0%) | 64 (72.7%) |
| 3 | Ayat al-Quran ini membantu anda memahami adab dan akhlak sebagai seorang pelajar muslim | | | | 26 (29.5%) | 62 (70.5%) |
| 4 | Penerangan maksud ayat dalam laman web memudahkan anda mengingati isi penting yang terdapat dalam pelajaran bidang al-Quran Tingkatan 2 | | | 6 (6.8%) | 34 (38.6%) | 48 (54.5%) |
| 5 | Ayat Al-Quran yang disertakan membantu anda mengaitkan pengajarannya dengan kehidupan sebenar | | | 6 (6.8%) | 24 (27.3%) | 58 (65.9%) |
| 6 | Audio bacaan ayat Al-Quran dalam laman web membantu anda memperbetulkan bacaan | | | 12 (13.6%) | 42 (47.7%) | 34 (38.6%) |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Paparan warna ayat (tajwid) membantu anda mengenali hukum tajwid | | 6 (6.8%) | 36 (40.9%) | 46 (52.3%) |

Berdasarkan Jadual 2, dapatan menunjukkan bahawa kefahaman pengguna terhadap ayat al-Quran melalui laman web *Qalbu Verse* adalah sangat positif. Untuk aspek pemahaman maksud ayat, majoriti responden menilai sangat baik (61.4%), manakala 29.5% baik dan 9.1% sederhana, tanpa sebarang penilaian negatif. Dari segi kesedaran mengamalkan ajaran Islam, 72.7% pengguna menilai sangat baik, 25% baik dan 2.3% sederhana. Kefahaman mengenai adab dan akhlak sebagai pelajar muslim pula mendapat penilaian sangat baik daripada 70.5% pengguna dan baik 29.5%. Penerangan maksud ayat membantu mengingat isi penting pelajaran mendapat 54.5% sangat baik, 38.6% baik dan 6.8% sederhana. Aspek pengaitan pengajaran ayat dengan kehidupan sebenar pula dinilai sangat baik oleh 65.9% pengguna, baik 27.3% dan sederhana 6.8%. Bagi audio bacaan, 47.7% menilai baik, 38.6% sangat baik dan 13.6% sederhana, manakala paparan warna tajwid membantu mengenal hukum tajwid mendapat 52.3% sangat baik, 40.9% baik dan 6.8% sederhana.

Secara keseluruhannya, dapatan membuktikan bahawa *Qalbu Verse* membantu meningkatkan kefahaman pelajar terhadap maksud ayat al-Quran, penghayatan nilai Islam dan pemahaman akhlak. Penemuan ini bertepatan dengan pandangan Mustapa & Arishin (2024) bahawa integrasi teknologi dapat mempertingkatkan kefahaman pelajar melalui bahan pembelajaran yang pelbagai dan interaktif. Penilaian tinggi terhadap fungsi penerangan maksud ayat, pengaitan dengan kehidupan sebenar serta paparan tajwid menunjukkan bahawa teknologi mampu menyokong objektif pembelajaran al-Quran secara lebih berkesan berbanding kaedah tradisional semata-mata.

Bahagian C: Pembelajaran dan Minat

**Jadual 3. Pembelajaran Dan Minat Responden Terhadap Laman Web *Qalbu Verse*.**

| Item | Pernyataan | Sangat Tidak Baik | Tidak Baik | Sederhana | Baik | Sangat Baik |
|---|---|---|---|---|---|---|
| 1 | Laman web ini meningkatkan minat anda untuk belajar Al-Quran | | | | 28 (31.8%) | 58 (65.9%) |
| 2 | Aktiviti interaktif dalam laman web (nota, kuiz, animasi, grafik) membantu anda mengingati isi pelajaran | | | 2 (2.3%) | 34 (38.6%) | 52 (59.1%) |
| 3 | Laman web ini memudahkan anda untuk mengulangkaji pelajaran | | | | 34 (38.6%) | 54 (61.4%) |
| 4 | Laman web ini membantu dalam memahami kandungan buku teks | | | 4 (4.5%) | 32 (36.4%) | 52 (59.1%) |

Berdasarkan Jadual 3, dapatan menunjukkan bahawa laman web *Qalbu Verse* secara keseluruhan meningkatkan pembelajaran dan minat pengguna terhadap al-Quran. Bagi aspek minat belajar, majoriti responden menilai sangat baik (65.9%) dan 31.8% menilai baik,

menunjukkan laman web ini berkesan menarik minat pelajar. Aktiviti interaktif seperti nota, kuiz, animasi dan grafik turut membantu pelajar mengingati isi pelajaran dengan 59.1% menilai sangat baik, 38.6% baik dan hanya 2.3% sederhana. Kemudahan untuk mengulangkaji pelajaran juga mendapat penilaian positif dengan 61.4% sangat baik dan 38.6% baik. Selain itu, laman web ini membantu pelajar memahami kandungan buku teks, di mana 59.1% pengguna menilai sangat baik, 36.4% baik dan 4.5% sederhana.

Secara keseluruhannya, dapatan ini menunjukkan peningkatan ketara dalam aspek minat belajar, motivasi dan kemampuan pelajar mengulangkaji pelajaran melalui ciri interaktif seperti kuiz, animasi dan nota. Dapatan ini turut mengukuhkan pandangan Muhammad Zulazizi Mohd Nawi (2020) bahawa teknologi bukan sekadar alat moden tetapi kesinambungan kepada perkembangan ilmu dalam peradaban Islam sejak awal lagi. Dengan gamifikasi dan visual yang menarik, *Qalbu Verse* berjaya mewujudkan suasana pembelajaran berpusatkan pelajar selaras dengan prinsip pendidikan abad ke-21 dan Falsafah Pendidikan Kebangsaan yang menekankan kemenjadian murid.

Bahagian D: Kemahiran Penggunaan Laman Web

**Jadual 4. Kemahiran Responden Menggunakan Laman Web *Qalbu Verse*.**

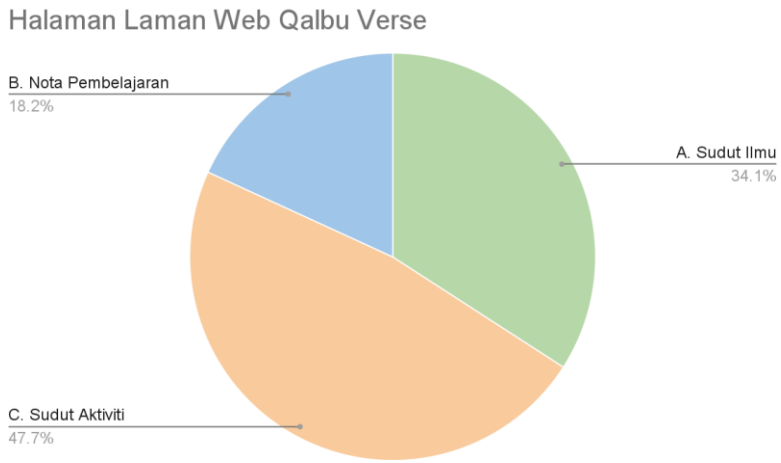
| Item | Pernyataan | Sangat Tidak Baik | Tidak Baik | Sederhana | Baik | Sangat Baik |
|---|---|---|---|---|---|---|
| 1 | Laman web ini membantu anda memahami ayat al-Quran dengan lebih terperinci | | | 10 (11.4%) | 30 (34.1%) | 48 (54.5%) |
| 2 | Laman web ini membantu anda meningkatkan kemahiran menjawab soalan KBAT berdasarkan ayat al-Quran | | | 12 (13.6%) | 32 (36.4%) | 44 (50.0%) |
| 3 | Contoh situasi dalam laman web ini membantu anda membuat refleksi diri berdasarkan pengajaran ayat | | | 12 (13.6%) | 36 (40.9%) | 40 (45.5%) |

Berdasarkan Jadual 4, dapatan menunjukkan bahawa penggunaan laman web *Qalbu Verse* memberi impak positif terhadap kemahiran pengguna dalam memanfaatkan kandungan Al-Quran. Untuk pemahaman ayat secara terperinci, 54.5% pengguna menilai sangat baik. 34.1% baik dan 11.4% sederhana, menunjukkan laman web ini membantu pelajar memahami setiap ayat dengan lebih mendalam. Bagi peningkatan kemahiran menjawab soalan KBAT berdasarkan ayat al-Quran, 50% pengguna menilai sangat baik, 36.4% baik dan 13.6% sederhana, menandakan laman web ini berkesan dalam melatih pemikiran kritis pelajar. Selain itu, contoh situasi yang disediakan membantu pengguna membuat refleksi diri dengan 45.5% menilai sangat baik, 40.9% baik dan 13.6% sederhana.

Secara keseluruhannya, dapatan ini menunjukkan bahawa *Qalbu Verse* bukan sahaja meningkatkan kefahaman ayat, tetapi turut menyumbang kepada kemahiran KBAT dan keupayaan pelajar membuat refleksi diri. Dapatan ini menyokong pandangan Maimun Aqsha Lubis et al. (2022) bahawa teknologi pendidikan perlu membantu membentuk nilai dan

pemikiran pelajar secara holistik. Penilaian positif terhadap item seperti analisis ayat, kemahiran menjawab soalan KBAT dan contoh situasi kehidupan sebenar menunjukkan bahawa platform ini mampu menghasilkan pembelajaran yang lebih bermakna dan kontekstual, sesuai dengan keperluan murid sekolah menengah.

Bahagian E: Elemen Interaktif




**Rajah 2. Kecenderungan Responden Terhadap Elemen Interaktif dalam Laman Web *Qalbu Verse*.**

Berdasarkan Rajah 2 yang menunjukkan halaman paling membantu pengguna dalam laman web *Qalbu Verse*, dapatan menunjukkan perbezaan ketara antara tiga halaman yang disediakan. Halaman sudut aktiviti menerima penilaian tertinggi iaitu sebanyak 47.7% menunjukkan majoriti pengguna merasakan aktiviti interaktif dalam halaman ini paling berkesan untuk menyokong pembelajaran mereka. Halaman sudut ilmu pula mengekalkan minat dan kefahaman pengguna dengan 34.1%, manakala halaman nota pembelajaran menerima penilaian terendah iaitu 18.2% menunjukkan ia kurang menarik perhatian pelajar berbanding dua halaman lain.

Secara keseluruhannya, berdasarkan carta pai mengikut pilihan jawapan A, B dan C. Sudut Ilmu (A) memperoleh 34.1% menunjukkan peranan penting halaman ini dalam memberikan kefahaman asas dan pengukuhan ilmu. Nota Pembelajaran (B) mencatatkan 18.2% menandakan penyampaian nota statik kurang menarik perhatian pelajar. Sebaliknya, Sudut Aktiviti (C) mencatatkan 47.7% menunjukkan pelajar lebih cenderung kepada pembelajaran interaktif melalui latihan dan aplikasi langsung. Dapatan ini selari dengan kajian Zalizan et al. (2024) yang menekankan bahawa penggunaan elemen multimedia seperti audio, video dan imej dalam bahan bantu mengajar dapat meningkatkan penglibatan dan motivasi pelajar secara signifikan. Keseluruhannya, dapatan menekankan keberkesanan gabungan ilmu, nota dan aktiviti interaktif dengan penekanan khusus pada Sudut Aktiviti untuk meningkatkan motivasi, penglibatan dan keberkesanan pembelajaran pelajar.

***Dapatan Guru/Ibu Bapa***

Dapatan guru/ibu bapa menunjukkan penerimaan yang positif terhadap keberkesanan laman web *Qalbu Verse* sebagai alat sokongan pembelajaran al-Quran di sekolah. Jumlah responden guru/ibu bapa ialah seramai 24 orang.

Bahagian A: Persepsi Guru/Ibu Bapa Terhadap Kebolehgunaan & Keberkesanan Pembelajaran

**Jadual 5. Persepsi Guru/Ibu Bapa Terhadap Kebolehgunaan & Keberkesanan Pembelajaran.**

| Item | Pernyataan | Sangat Tidak Berkesan | Tidak Berkesan | Sederhana | Berkesan | Sangat Berkesan |
|---|---|---|---|---|---|---|
| 1 | Reka bentuk dan susun atur laman web ini memudahkan pelajar/anak mengikuti pembelajaran al-Quran | | | | 10 (41.7%) | 14 (58.3%) |
| 2 | Penggunaan warna, ikon dan susun atur dalam laman web membantu pelajar/anak fokus pada pembelajaran | | | | 8 (33.3%) | 16 (66.7%) |
| 3 | Laman web ini mudah digunakan oleh pelajar/anak tanpa memerlukan banyak tunjuk ajar | | | 2 (8.3%) | 12 (50%) | 10 (41.7%) |
| 4 | Pautan, video dan bahan yang disediakan dalam laman web dapat diakses dengan lancar oleh pelajar/anak | | | | 10 (41.7%) | 14 (58.3%) |
| 5 | Laman web ini menyediakan persekitaran pembelajaran yang sesuai untuk tahap pemahaman pelajar Tingkatan 2 | | | | 10 (41.7%) | 14 (58.3%) |

Jadual 5 menunjukkan bahawa majoriti guru dan ibu bapa menilai kebolehgunaan dan keberkesanan laman web pembelajaran al-Quran ini pada tahap yang tinggi. Bagi aspek reka bentuk dan susun atur, seramai 41.7% pengguna menilai laman web sebagai berkesan manakala 58.3% menilai sebagai sangat berkesan. Penggunaan warna, ikon dan susun atur juga mendapat penilaian positif dengan 33.3% menyatakan berkesan dan 66.7% sangat berkesan. Dari segi kemudahan penggunaan, kebanyakan pengguna (50%) menganggap laman web ini berkesan digunakan tanpa banyak tunjuk ajar, diikuti 41.7% yang menilai sangat berkesan. Bahan seperti pautan, video dan sumber pembelajaran turut dinilai berfungsi dengan baik, dengan 41.7% pengguna menilai berkesan dan 58.3% sangat berkesan. Akhir sekali, 41.7% pengguna bersetuju bahawa laman web menyediakan persekitaran pembelajaran yang sesuai untuk tahap pemahaman pelajar Tingkatan 2 dan 58.3% lagi menilai aspek tersebut sangat berkesan.

Analisis Jadual 5 menunjukkan bahawa guru dan ibu bapa turut menilai *Qalbu Verse* sebagai sangat berkesan dari segi reka bentuk, kemudahan penggunaan dan kesesuaian bahan

pembelajaran. Penemuan ini konsisten dengan hujah Mustapa & Arishin (2024) bahawa teknologi berperanan sebagai medium sokongan penting dalam pembelajaran al-Quran. Penilaian positif golongan dewasa ini menandakan bahawa platform tersebut bukan sahaja mesra murid, tetapi juga memenuhi jangkaan pedagogi guru yang mengutamakan kesesuaian tahap pembelajaran pelajar Tingkatan 2.

Bahagian B: Persepsi Guru/Ibu Bapa Terhadap Kefahaman Ayat Al-Quran

**Jadual 6. Persepsi Guru/Ibu Bapa Terhadap Kefahaman Ayat Al-Quran.**

| Item | Pernyataan | Sangat Tidak Berkesan | Tidak Berkesan | Sederhana | Berkesan | Sangat Berkesan |
|---|---|---|---|---|---|---|
| 1 | Ayat al-Quran yang dipaparkan dalam laman web membantu pelajar/anak memahami maksud ayat dengan lebih jelas | | | | 12 (50%) | 12 (50%) |
| 2 | Kandungan ayat al-Quran dalam laman web ini dapat memberi kesedaran kepada pelajar/anak tentang kepentingan mengamalkan nilai Islam dalam kehidupan | | | | 8 (33.3%) | 16 (66.7%) |
| 3 | Penerangan maksud ayat al-Quran dalam laman web memudahkan pelajar/anak mengingat isi penting topik al-Quran bab 1 | | | 2 (8.3%) | 12 (50%) | 10 (41.7%) |
| 4 | Contoh dan situasi yang dikaitkan dengan ayat al-Quran membantu pelajar/anak menghubungkan ayat dengan kehidupan sebenar | | | | 6 (25%) | 18 (75%) |

Berdasarkan Jadual 6, hasil kajian menunjukkan persepsi guru dan ibu bapa terhadap kefahaman ayat al-Quran melalui penggunaan laman web adalah sangat positif. Bagi item pertama, semua pengguna menyatakan bahawa paparan ayat al-Quran dalam laman web membantu pelajar memahami maksud ayat dengan lebih jelas dengan 50% menilai berkesan dan 50% sangat berkesan. Kandungan ayat al-Quran dalam laman web juga didapati memberi kesedaran kepada pengguna tentang kepentingan mengamalkan nilai Islam apabila 33.3% pengguna menilai berkesan dan majoriti 66.7% menilai sangat berkesan. Penerangan maksud ayat al-Quran turut dinilai membantu proses pembelajaran di mana 50% pengguna menilai berkesan dan 41.7% sangat berkesan. Seterusnya, contoh dan situasi kehidupan sebenar yang dikaitkan dengan ayat al-Quran dilihat sangat berkesan dalam membantu pelajar menghubungkan ayat dengan konteks kehidupan mereka dengan 25% menyatakan berkesan dan 75% sangat berkesan.

Secara keseluruhan, dapatan Jadual 6 menunjukkan kesepakatan guru dan ibu bapa bahawa *Qalbu Verse* membantu memperjelas maksud ayat al-Quran, meningkatkan kesedaran nilai Islam dan memudahkan pengaitan ayat dengan situasi kehidupan sebenar. Hal ini mengukuhkan pandangan Mim Fadhli Rabbi et al. (2025) bahawa teknologi mampu

memperkukuh kefahaman agama melalui penyampaian yang lebih sistematik, moden dan mudah difahami. Sokongan penuh daripada guru dan ibu bapa memberi isyarat bahawa *Qalbu Verse* merupakan platform digital yang berkesan dan boleh dihimpunkan bersama kaedah tradisional dalam PdP Pendidikan Islam.

## Kesimpulan

Secara keseluruhan, laman web ini telah membantu pengguna memahami ayat al-Quran dengan lebih jelas melalui reka bentuk yang teratur, penggunaan warna yang sesuai serta penyediaan penerangan dan contoh situasi kehidupan sebenar. Namun begitu, terdapat beberapa cadangan penambahbaikan untuk meningkatkan lagi keberkesanan platform ini. Pertama, laman web boleh diperkasakan dengan menambah fungsi interaktif seperti kuiz automatik, latihan hafazan dan modul ulang kaji bagi memastikan pengguna lebih aktif terlibat dalam pembelajaran. Kedua, penyediaan audio bacaan ayat al-Quran oleh qari yang bervariasi serta pilihan kelajuan bacaan dapat membantu pengguna mendengar dan mengulang ayat dengan lebih tepat. Ketiga, penambahbaikan dari aspek aksesibiliti teknikal seperti mempercepat masa muat turun video, memperbaiki paparan pada telefon pintar dan menyediakan mod gelap (*dark mode*) agar boleh meningkatkan pengalaman pengguna. Selain itu, guru dan ibu bapa mencadangkan agar laman web menyediakan ruangan bimbingan atau panduan ringkas untuk ibu bapa memantau pembelajaran anak. Akhir sekali, modul pembelajaran boleh diperkaya dengan grafik, animasi ringkas dan peta minda bagi memudahkan pemahaman konsep penting. Dengan penambahbaikan ini, laman web berpotensi menjadi platform pembelajaran al-Quran yang lebih komprehensif, interaktif dan mesra pengguna.

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# KEBERKESANAN PLATFORM DIGITAL E-FIQHUNA SEBAGAI BAHAN PEMBELAJARAN INTERAKTIF SEKOLAH MENENGAH

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***Abstract:*** *Pengajaran dan pembelajaran (PdP) Fiqah di sekolah menengah masih banyak bergantung kepada kaedah tradisional yang berpusatkan guru, menyebabkan tahap kefahaman, motivasi dan penglibatan pelajar berada pada tahap sederhana, khususnya bagi topik yang bersifat aplikatif seperti haji, sembelihan, korban dan aqiqah. Kekurangan bahan pembelajaran digital yang menyeluruh dan interaktif selaras dengan keperluan Pembelajaran Abad ke-21 menuntut penilaian terhadap platform alternatif yang lebih berkesan. Kajian ini menggunakan reka bentuk kajian campuran yang menggabungkan kaedah kuantitatif dan kualitatif bagi menilai keberkesanan platform digital E-Fiqhuna sebagai bahan pembelajaran interaktif Fiqah Tingkatan 4. Data kuantitatif diperoleh melalui ujian pra dan pasca serta soal selidik skala Likert, manakala data kualitatif dikumpulkan melalui maklum balas terbuka responden. Seramai 219 orang responden terlibat dalam kajian ini. Dapatan kajian menunjukkan peningkatan ketara dalam kefahaman pelajar selepas penggunaan E-Fiqhuna, antaranya peningkatan peratus jawapan betul bagi konsep wuquf di Arafah daripada 44.7% kepada 56.2%, haji tamattu' daripada 48.4% kepada 58.0%, serta hukum korban yang mencatat peningkatan tertinggi daripada 32.9% kepada 52.5%. Selain itu, lebih 80% responden menyatakan bahawa penggunaan video, nota interaktif dan elemen gamifikasi meningkatkan motivasi dan kefahaman pembelajaran, manakala 100% responden bersetuju bahawa platform ini mudah diakses dan mesra pengguna. Kesimpulannya, platform digital E-Fiqhuna terbukti berkesan dalam meningkatkan kefahaman, minat dan penglibatan pelajar serta berpotensi menjadi bahan pembelajaran digital komprehensif yang menyokong PdP Fiqah secara lebih interaktif dan bermakna.*

***Kata kunci**: E-Fiqhuna, pembelajaran digital, pembelajaran interaktif, gamifikasi, Pendidikan Islam*

***Abstract:** The teaching and learning of Fiqh in secondary schools remains largely reliant on traditional teacher-centred approaches, resulting in moderate levels of students' understanding, motivation and engagement, particularly for application-based topics such as Hajj, slaughtering, sacrifice and aqiqah. The limited availability of comprehensive and interactive digital learning materials aligned with 21st-century education highlights the need to evaluate more effective alternative platforms. This study employed a mixed-methods research design, integrating quantitative and qualitative approaches to examine the effectiveness of the E-Fiqhuna digital platform as an interactive learning tool for Form Four Fiqh. Quantitative data were collected through pre- and post-tests and Likert-scale questionnaires, while qualitative data were obtained from respondents' open-ended feedback. A total of 219 respondents participated in the study. The findings revealed notable improvements in students' understanding following the use of E-Fiqhuna, including an increase in correct responses for the concept of wuquf in Arafah from 44.7% to 56.2%, Hajj Tamattu' from 48.4% to 58.0%, and Islamic rulings on sacrifice, which recorded the highest improvement from 32.9% to 52.5%. In addition, over 80% of respondents reported enhanced motivation and understanding through interactive videos, digital notes and gamified activities, while 100% of respondents agreed that the platform was easy to access and user-friendly. In conclusion, E-Fiqhuna has been shown to be an effective and accessible digital learning platform that enhances students' understanding, motivation and engagement, and holds strong potential as a comprehensive instructional support for interactive Fiqh learning in secondary education.*

***Keywords:** E-Fiqhuna, digital learning, interactive learning, gamification, Islamic Education*

## Pengenalan

Perkembangan teknologi digital dalam bidang pendidikan telah mencetuskan perubahan ketara terhadap pendekatan pengajaran dan pembelajaran, khususnya di peringkat sekolah menengah, dengan peralihan daripada kaedah tradisional kepada pembelajaran yang lebih interaktif, fleksibel dan berpusatkan pelajar. Integrasi teknologi digital dalam pendidikan bukan sahaja menyokong kepelbagaian gaya pembelajaran pelajar, malah berupaya meningkatkan penglibatan, motivasi serta kefahaman konsep melalui penggunaan elemen multimedia dan interaktif. Dalam konteks Pendidikan Islam, khususnya bidang fiqah, keperluan terhadap bahan pembelajaran digital yang berkesan adalah semakin mendesak memandangkan kandungan fiqah bukan sahaja menekankan pemahaman konsep hukum, malah menuntut keupayaan pelajar untuk mengaplikasikan hukum tersebut dalam situasi kehidupan sebenar.

Sehubungan itu, platform digital E-Fiqhuna dibangunkan sebagai satu inovasi bahan pembelajaran interaktif berasaskan laman web bagi menyokong pengajaran dan pembelajaran fiqah di sekolah menengah. Platform ini mengintegrasikan nota interaktif, video penerangan, animasi, simulasi amali serta kuiz berasaskan gamifikasi bagi memperkukuh kefahaman pelajar terhadap konsep, dalil dan pengaplikasian hukum fiqah secara sistematik.

Pembangunan E-Fiqhuna adalah selari dengan aspirasi Pelan Pembangunan Pendidikan Malaysia (PPPM) serta prinsip Pembelajaran Abad ke-21 (PAK-21) yang menekankan

pembelajaran aktif, kendiri dan penggunaan teknologi secara bermakna. Justeru, kajian ini dijalankan untuk menilai keberkesanan platform digital E-Fiqhuna sebagai bahan pembelajaran interaktif dalam kalangan pelajar sekolah menengah, khususnya bagi topik fiqah Tingkatan 4.

Walaupun perkembangan teknologi pendidikan semakin pesat, pelaksanaan pengajaran dan pembelajaran fiqah di sekolah menengah masih menunjukkan tahap penggunaan teknologi yang sederhana dan tidak konsisten. Kajian terdahulu mendapati bahawa guru Pendidikan Islam berhadapan dengan pelbagai kekangan seperti masa pengajaran yang terhad, tahap kemahiran teknologi maklumat dan komunikasi (ICT) yang tidak seimbang serta ketiadaan bahan bantu mengajar digital fiqah yang khusus dan tersusun selaras dengan Dokumen Standard Kurikulum dan Pentaksiran (DSKP). Keadaan ini menyebabkan PdP fiqah masih bergantung kepada kaedah tradisional seperti syarahan dan hafalan, yang didapati kurang berkesan untuk menerangkan topik fiqah yang bersifat abstrak dan aplikatif seperti sembelihan, haji dan umrah serta korban dan aqiqah. Kekurangan bahan pembelajaran digital yang visual dan interaktif turut menyukarkan pelajar mengaitkan konsep fiqah dengan realiti kehidupan sebenar, seterusnya menurunkan minat dan motivasi mereka terhadap pembelajaran fiqah.

Objektif yang ingin dicapai ialah: I. menilai tahap keberkesanan E-Fiqhuna sebagai bahan bantu mengajar (BBM) digital yang selaras dengan kandungan dan keperluan DSKP Fiqah Tingkatan 4; II. menganalisis kesan penggunaan E-Fiqhuna terhadap tahap pemahaman, pengaplikasian dan analisis konsep fiqah dalam kalangan pelajar; dan III. menilai kebolehlaksanaan E-Fiqhuna sebagai platform pembelajaran fiqah yang mudah digunakan serta berupaya menyokong peningkatan kualiti pengajaran dan pembelajaran Pendidikan Islam. Penyelarasan objektif ini adalah penting bagi memastikan fokus kajian bukan sahaja tertumpu kepada pembangunan platform, tetapi juga kepada impaknya terhadap pembelajaran pelajar dan amalan pedagogi guru.

Sorotan literatur menunjukkan bahawa pembelajaran digital dalam Pendidikan Islam berpotensi besar untuk meningkatkan keberkesanan pengajaran dan pembelajaran apabila dilaksanakan secara interaktif dan terancang. Kajian oleh Hamzah et al. (2023) mendapati bahawa penggunaan platform digital yang mesra pengguna dapat meningkatkan motivasi dan penglibatan pelajar dalam pembelajaran Pendidikan Islam. Dalam konteks pembelajaran fiqah, Azmi et al. (2022) menegaskan bahawa penggunaan visualisasi dan simulasi dalam pembelajaran digital membantu pelajar memahami topik fiqah yang bersifat abstrak dengan lebih jelas dan bermakna.

Selain itu, pendekatan gamifikasi dikenal pasti sebagai strategi pedagogi yang berkesan dalam meningkatkan minat, fokus dan pencapaian pelajar. Kajian oleh Roslan et al. (2024) menunjukkan bahawa pelajar yang mengikuti pembelajaran berasaskan permainan interaktif memperlihatkan peningkatan ketara dalam pemahaman konsep serta daya ingatan jangka panjang. Walau bagaimanapun, sorotan kajian mendapati bahawa aplikasi gamifikasi dalam Pendidikan Islam masih terhad kepada penggunaan kuiz asas dan belum dimanfaatkan sepenuhnya sebagai strategi pembelajaran aktif yang menyeluruh.

Sorotan kajian juga mendapati bahawa integrasi pendekatan gaya pembelajaran VARK masih belum dilaksanakan secara menyeluruh dalam platform digital Pendidikan Islam. Fauzi et al. (2023) menegaskan bahawa penggabungan elemen visual, auditori, membaca/menulis dan kinestetik adalah penting bagi memastikan keberkesanan pembelajaran fiqah yang melibatkan

prosedur dan amali. Namun, kebanyakan platform sedia ada hanya menekankan elemen visual dan bacaan, manakala aspek auditori dan kinestetik kurang diberi perhatian.

Akhir sekali. kajian terhadap platform digital fiqah sedia ada mendapati bahawa kebanyakannya tidak menyediakan kandungan yang menyeluruh mengikut silibus KSSM Tingkatan 4 serta kurang menyokong pembelajaran kendiri secara komprehensif. Kajian oleh Jamil et al. (2022), Rahim et al. (2023) serta Suhaila et al. (2024) menunjukkan bahawa platform digital fiqah masih mempunyai batasan dari segi kepelbagaian aktiviti interaktif dan keselarasan dengan keperluan PdP sebenar di bilik darjah. Oleh itu, dapatan sorotan literatur ini mengukuhkan keperluan untuk membangunkan dan menilai keberkesanan satu platform digital pembelajaran fiqah yang lebih menyeluruh, interaktif dan selaras dengan DSKP, sebagaimana yang diusahakan melalui pembangunan E-Fiqhuna.

## Metodologi Kajian

Kajian ini menggunakan reka bentuk kajian campuran (mix method) yang menggabungkan kaedah kuantitatif dan kualitatif bagi menilai tahap keberkesanan platform digital E-Fiqhuna sebagai bahan pembelajaran interaktif di sekolah menengah. Pendekatan kuantitatif digunakan melalui kaedah tinjauan, soal selidik berskala Likert serta ujian pra dan pasca, manakala pendekatan kualitatif digunakan untuk mendapatkan maklum balas terbuka dan cadangan penambahbaikan daripada responden. Menurut Chua (2020), kaedah tinjauan sesuai digunakan kerana ia membolehkan pengumpulan data dijalankan dengan cepat dan berkesan walaupun melibatkan bilangan sampel yang besar. Reka bentuk ini dipilih bagi memberikan gambaran menyeluruh terhadap persepsi, tahap kepuasan serta impak penggunaan platform E-Fiqhuna terhadap kefahaman pembelajaran Fiqah. Soal selidik yang dibangunkan menggunakan skala Likert empat mata iaitu sangat tidak setuju, tidak setuju, setuju dan sangat setuju bagi mengukur tahap kebolehgunaan, kefahaman kognitif, motivasi, penglibatan serta kepuasan pengguna. Menurut Ahmad Shindi Yusoff et al. (2024), skala Likert berbentuk ordinal ini sesuai digunakan untuk analisis deskriptif seperti kekerapan dan peratusan.Selain itu, kajian ini turut melibatkan ujian pra dan pasca bagi mengukur perubahan tahap pengetahuan responden sebelum dan selepas menggunakan platform E-Fiqhuna. Perbandingan skor ujian ini digunakan untuk menilai keberkesanan sebenar platform terhadap pencapaian pembelajaran pengguna. Kajian ini melibatkan seramai 219 orang responden yang terdiri daripada guru, pelajar sekolah menengah dan orang awam yang mempunyai pengetahuan asas dalam bidang Fiqah. kajian dahulu menyatakan sekiranya skala populasi seramai 500 orang maka bilangan sampel akan menjadi 217 hingga 225 ( Krejcie, R.V., & Morgan, D.W., 1970).

Instrumen kajian yang digunakan dalam kajian ini terdiri daripada ujian pra dan pasca serta set soal selidik melalui Google Forms sebagai medium pengumpulan data. Soal selidik dibangunkan dalam talian menggunakan Google Forms dan mengandungi lima bahagian, iaitu Bahagian A hingga Bahagian E. Item-item soal selidik merangkumi aspek kebolehgunaan platform, kefahaman kognitif pelajar, motivasi dan penglibatan pembelajaran, kepuasan guru serta cadangan penambahbaikan. Bahagian B hingga Bahagian D menggunakan skala Likert bagi tujuan analisis kuantitatif, manakala soalan E berbentuk terbuka disertakan untuk mendapatkan data kualitatif. Selain itu, ujian pra dan pasca dibina dalam bentuk set soalan objektif yang mengandungi 15 soalan berkaitan topik Fiqah Tingkatan 4, iaitu Haji dan Umrah, Sembelihan, Korban dan Akikah. Ujian pra dilaksanakan sebelum responden menggunakan platform E-Fiqhuna bagi mengukur tahap pengetahuan sedia ada, manakala ujian pasca

dilaksanakan selepas tempoh penggunaan platform bagi menilai peningkatan pemahaman mereka. Platform E-Fiqhuna menyediakan kandungan pembelajaran interaktif yang merangkumi nota, video, simulasi dan kuiz yang selari dengan prinsip Pembelajaran Abad Ke-21 serta Model Teknologi-Pedagogi-Kandungan (TPK) dalam pendidikan Islam (Jahidih Saili et al, 2024). Data yang diperoleh daripada soal selidik serta ujian pra dan pasca dianalisis bagi menentukan tahap keberkesanan platform digital E-Fiqhuna sebagai bahan pembelajaran interaktif.

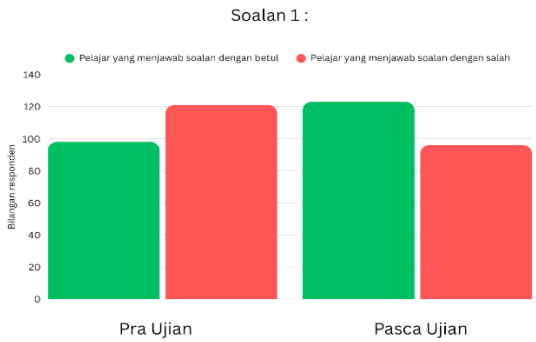
## Keputusan Dan Perbincangan

Bahagian ini membincangkan dapatan kajian berdasarkan analisis data kuantitatif dan kualitatif yang diperoleh daripada 219 orang responden yang terdiri daripada pelajar, guru serta orang awam. Analisis dijalankan menggunakan statistik deskriptif dan inferensi bagi menjawab objektif kajian berkaitan tahap penggunaan, persepsi keberkesanan, dan hubungan penggunaan platform digital terhadap motivasi pembelajaran.

***Perbandingan Dapatan Ujian Pra Dan Pasca***

| Bil | Item |
|---|---|
| 1. | Bilakah waktu wuquf di Arafah ? |
| 2. | Pilih makna yang berkaitan dengan haji tamatu’ |
| 3. | Apakah maksud sembelihan dari segi istilah ? |
| 4. | Siapakah yang dibenarkan untuk melakukan sembelihan ? |
| 5. | Apakah hukum melakukan korban ? |
| 6. | Apakah maksud aqiqah dari segi syarak ? |

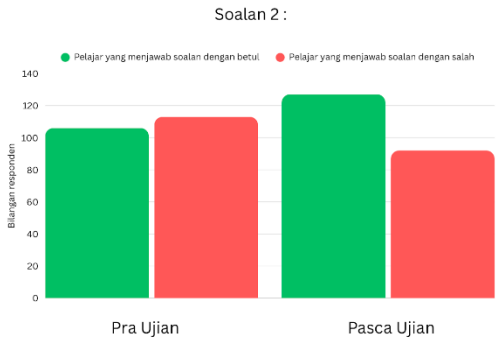
**Jadual 1 : Borang Soal Selidik Ujian Pra dan Pasca**




**Rajah 1: Bilangan responden yang menjawab soalan 1**

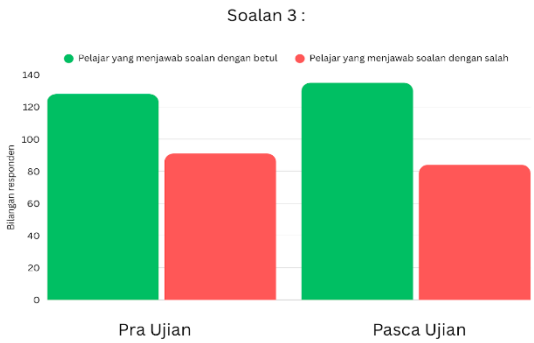
Berdasarkan graf Soalan 1, bilangan responden yang menjawab dengan betul semasa ujian pra adalah seramai 98 orang manakala selebihnya iaitu 121 orang menjawab dengan salah. Dalam kajian ini, selepas intervensi mendapati bilangan responden yang menjawab dengan betul meningkat kepada 123 orang manakala bilangan jawapan salah menurun kepada 96 orang. Jumlah responden kekal seramai 219 orang bagi kedua-dua ujian. Berdasarkan peratusan pula, 44.7% responden menjawab dengan betul dalam pra ujian manakala peratusan ini meningkat kepada 56.2% dalam pasca ujian. Ini menunjukkan peningkatan sebanyak 11.5% bagi jawapan betul selepas intervensi dijalankan. Peningkatan prestasi responden dalam ujian pasca mencadangkan bahawa penggunaan platform E-Fiqhuna sebagai intervensi pembelajaran

berupaya meningkatkan kefahaman responden terhadap konsep waktu wuquf di Arafah secara berkesan dan selari dengan penurunan bilangan jawapan yang salah.




**Rajah 2: Bilangan responden yang menjawab soalan 2**

Graf Soalan 2 menunjukkan bahawa dalam ujian pra yang dijawab iaitu seramai 106 orang responden menjawab dengan betul manakala 113 orang menjawab dengan salah. Dalam ujian pasca, bilangan responden yang menjawab dengan betul meningkat kepada 127 orang manakala bilangan yang menjawab dengan salah menurun kepada 92 orang. Mengikut peratusan, 48.4% responden menjawab dengan betul dalam ujian pra manakala peratusan ini meningkat kepada 58.0% dalam ujian pasca iaitu meningkat sebanyak 9.6%. Peningkatan keputusan ujian pasca menunjukkan bahawa penggunaan platform E-Fiqhuna sebagai intervensi pembelajaran berkesan dalam meningkatkan kefahaman responden terhadap konsep haji tamattu' seperti yang ditunjukkan melalui peningkatan bilangan responden yang menjawab dengan betul.




**Rajah 3: Bilangan responden yang menjawab soalan 3**

Berdasarkan graf Soalan 3, bilangan responden yang menjawab dengan betul dalam ujian pra adalah seramai 128 orang manakala 91 orang menjawab dengan salah. Dalam ujian pasca, bilangan responden yang menjawab dengan betul meningkat kepada 135 orang manakala bilangan jawapan yang salah menurun kepada 84 orang. Dari segi peratusan, 58.4% responden yang menjawab dengan betul dalam ujian pra meningkat kepada 61.6% dalam ujian pasca dengan peningkatan sebanyak 3.2%. Walaupun peningkatan bagi Soalan 3 adalah lebih kecil berbanding soalan lain, dapatan ini masih menunjukkan kesan positif intervensi terhadap kefahaman responden. Peratusan jawapan betul yang tinggi dalam ujian pra menunjukkan bahawa responden telah mempunyai pengetahuan sedia ada yang baik berkaitan maksud

sembelihan dari segi istilah. Oleh itu, intervensi lebih berfungsi sebagai pengukuhan dan penyeragaman kefahaman, bukannya pembinaan pengetahuan baharu sepenuhnya.




**Rajah 4: Bilangan responden yang menjawab soalan 4**

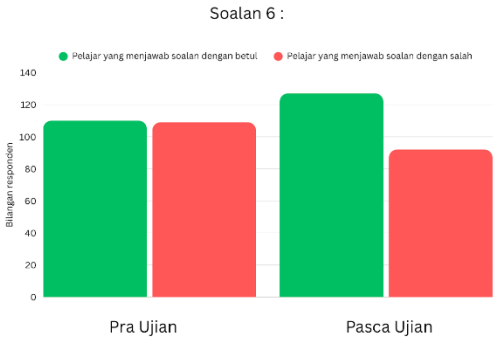
Berdasarkan graf Soalan 4, seramai 147 orang responden menjawab dengan betul dalam ujian pra manakala 72 orang menjawab dengan salah. Dalam ujian pasca, bilangan responden yang menjawab dengan betul meningkat kepada 151 orang manakala bilangan jawapan yang salah menurun kepada 68 orang. Jumlah responden adalah seramai 219 orang bagi kedua-dua ujian. Dari segi peratusan, 67.1% responden menjawab dengan betul dalam ujian pra dan meningkat kepada 68.9% dalam ujian pasca. Ini menunjukkan peningkatan sebanyak 1.8% selepas intervensi. Peningkatan yang kecil tetapi konsisten ini menunjukkan bahawa majoriti responden telah mempunyai kefahaman yang baik tentang individu yang dibenarkan melakukan sembelihan sebelum intervensi dijalankan. Oleh itu, intervensi lebih berfungsi sebagai pengukuhan pengetahuan sedia ada. Penurunan bilangan jawapan salah turut menunjukkan peningkatan ketepatan kefahaman responden selepas pengajaran.




**Rajah 5: Bilangan responden yang menjawab soalan 5**

Bagi Soalan 5, graf menunjukkan bahawa dalam ujian pra hanya 72 orang responden menjawab dengan betul, manakala 147 orang menjawab salah. Selepas intervensi, bilangan responden yang menjawab dengan betul meningkat dengan ketara kepada 115 orang manakala bilangan jawapan yang salah menurun kepada 104 orang. Dari segi peratusan, 32.9% responden menjawab dengan betul dalam ujian pra manakala peratusan ini meningkat kepada 52.5% dalam ujian pasca telah menunjukkan peningkatan sebanyak 19.6%. Dapatan ini menunjukkan peningkatan yang sangat signifikan terhadap kefahaman responden berkaitan hukum melakukan korban. Peratusan pra yang rendah menunjukkan bahawa majoriti responden sebelum ini keliru atau kurang jelas tentang status hukum korban. Intervensi dalam penggunaan platform W-Fiqhuna yang dilaksanakan didapati sangat berkesan dalam memperbetulkan salah

faham tersebut seperti yang ditunjukkan oleh peningkatan yang mendadak daripada bilangan jawapan yang betul dalam ujian pasca.




**Rajah 6: Bilangan responden yang menjawab soalan 6**

Berdasarkan graf Soalan 6, seramai 110 orang responden menjawab dengan betul dalam ujian pra, manakala 109 orang menjawab dengan salah. Dalam ujian pasca, bilangan responden yang menjawab dengan betul meningkat kepada 127 orang manakala bilangan jawapan yang salah menurun kepada 92 orang. Dari segi peratusan, 50.2% responden menjawab dengan betul dalam ujian pra dan meningkat kepada 58.0% dalam ujian pasca, dengan peningkatan sebanyak 7.8%. Peningkatan ini menunjukkan bahawa kefahaman responden terhadap maksud aqiqah dari segi syarak berada pada tahap sederhana sebelum intervensi dan bertambah baik selepas pengajaran dijalankan. Peratusan pra yang hampir seimbang antara betul dan salah menunjukkan wujud kekeliruan dalam kalangan responden. Intervensi yang memberi penekanan kepada definisi dan tujuan aqiqah berjaya meningkatkan tahap kefahaman responden secara keseluruhan.

***Keberkesanan Platform Digital E-Fiqhuna Dalam Pembelajaran* Fiqah**

**Jadual 2: Maklumbalas Keberkesanan Platform Digital E-Fiqhuna Dalam Pembelajaran Fiqah**

| Soalan | Sangat Tidak Setuju | Tidak setuju | Setuju | Sangat Setuju |
|---|---|---|---|---|
| E-Fiqhuna mudah untuk diakses menggunakan telefon atau komputer. | 0% | 0% | 29.2% | 70.8% |
| Video dan nota dalam E-Fiqhuna membantu memahami konsep Fiqah dengan lebih jelas. | 0% | 0% | 18.3% | 81.7% |
| Hukum fiqah dapat diaplikasikan selepas menggunakan E-Fiqhuna. | 0% | 0% | 26.5% | 73.5% |
| Platform digital E-Fiqhuna meningkatkan motivasi dalam mempelajari ilmu fiqah. | 0% | 0% | 30.6% | 69,4% |
| E-Fiqhuna dapat digunakan sebagai bahan bantu mengajar PdP yang efektif. | 0% | 0% | 39.7% | 60.3% |

Jadual 2 menunjukkan keberkesanan platform digital E-Fiqhuna dalam pembelajaran fiqah. Hasil kajian menunjukkan bahawa platform digital E-Fiqhuna mempunyai tahap kebolehcapaian, keberkesanan pembelajaran, keupayaan aplikasi ilmu serta impak terhadap

motivasi pelajar yang sangat tinggi, sekali gus sesuai digunakan sebagai bahan bantu mengajar (BBM) dalam pengajaran dan pembelajaran abad ke-21 (PAK-21).

Berdasarkan hasil kajian, tahap kebolehcapaian E-Fiqhuna adalah sangat baik dan mesra pengguna. Medium pembelajaran ini boleh diakses melalui komputer atau telefon bimbit yang membolehkan pelajar belajar di mana sahaja dan pada bila-bila masa. Justeru, fleksibiliti dan kemudahan akses ini dapat meningkatkan keberkesanan proses pembelajaran serta menarik minat pelajar untuk menggunakan platform pembelajaran digitak secara berterusan. Penemuan ini selaras dengan kajian Hamzah et al. (2023) yang mendapati bahawa penggunaan platform digital yang mesra pengguna dapat meningkatkan motivasi dan penglibatan pelajar dalam pembelajaran Pendidikan Islam.

Selain itu, penggunaan gabungan video dan nota merupakan pendekatan yang sangat berkesan dalam menyampaikan ilmu fiqah. Selari dengan kajian oleh Roslan et al. (2024) yang mendapati bahawa pelajar yang terlibat dalam pembelajaran berasaskan elemen interaktif menunjukkan peningkatan ketara dalam pemahaman konsep serta daya ingatan jangka panjang. Visual melalui video membantu pelajar memahami proses serta aplikasi hukum dengan lebih jelas, manakala nota berfungsi sebagai rujukan bertulis yang menyokong kefahaman dan memudahkan proses ulang kaji. Secara keseluruhan, dapatan ini menunjukkan bahawa bahan multimedia yang digunakan dalam platform E-Fiqhuna berjaya meningkatkan tahap kefahaman pelajar serta menyokong pembelajaran yang aktif dan bermakna.

E-Fiqhuna juga membantu pelajar dan pengguna bukan sahaja memahami konsep fiqah, malah dapat menerapkan hukum fiqah dalam kehidupan seharian dengan lebih tepat dan berkesan. E-Fiqhuna mengandungi unsur kemahiran berfikir aras tinggi (KBAT) yang membolehkan pelajar mengembangkan kemahiran kognitif, daya analisis dan kemampuan menyelesaikan masalah dalam konteks pembelajaran fiqah yang holistik. Hal ini selaras dengan kajian Azmi et al. (2022) yang menegaskan bahawa penggunaan visualisasi dan simulasi dalam pembelajaran digital membantu pelajar memahami topik fiqah yang bersifat abstrak dengan lebih jelas dan bermakna.

Di samping itu, platform digital E-Fiqhuna terbukti meningkatkan motivasi pelajar dalam mempelajari ilmu fiqah. Hal ini kerana platform digital E-Fiqhuna menyediakan pelbagai kandungan pembelajaran interaktif seperti nota, video, simulasi dan kuiz yang direka selaras dengan prinsip Pembelajaran Abad Ke-21 serta Model Teknologi-Pedagogi-Kandungan (TPK) dalam pendidikan Islam (Jahidih Saili et al., 2024). Pendekatan interaktif ini bukan sahaja memudahkan pemahaman konsep fiqah, tetapi juga secara signifikan meningkatkan motivasi pelajar untuk belajar. Dengan pengalaman pembelajaran yang lebih menarik, menyeronokkan dan bermakna pelajar terdorong untuk lebih aktif menimba ilmu, mengaplikasikan pengetahuan yang dipelajari serta mengekalkan minat dan komitmen yang tinggi terhadap pendidikan Islam secara menyeluruh.

Akhir sekali, E-Fiqhuna dapat digunakan sebagai bahan bantu mengajar (PdP) yang efektif kerana ia menyediakan kandungan multimedia, visual yang menarik dan susunan topik yang teratur, sekali gus menyokong pembelajaran aktif dan meningkatkan pencapaian pelajar dalam ilmu fiqah. Walau bagaimanapun, kajian oleh Jamil et al. (2022), Rahim et al. (2023), serta Suhaila et al. (2024) menunjukkan bahawa platform digital fiqh secara umum masih mempunyai batasan dari segi kepelbagaian aktiviti interaktif dan keselarasan dengan keperluan

PdP sebenar di bilik darjah. Ini menunjukkan bahawa walaupun E-Fiqhuna berpotensi menjadi alat PdP yang berkesan, masih terdapat ruang untuk penambahbaikan, khususnya dalam memperkayakan aktiviti interaktif dan memastikan kesesuaian sepenuhnya dengan kehendak pengajaran di bilik darjah.

## Kesimpulan

Keseluruhannya, kajian ini membincangkan keperluan mendesak untuk mengintegrasikan teknologi digital dalam pengajaran Fiqah di sekolah menengah bagi memenuhi tuntutan pembelajaran abad ke-21. Walaupun Pendidikan Islam menuntut pemahaman konsep yang mendalam, PdP Fiqah masih banyak bergantung pada kaedah lama seperti syarahan dan hafalan, mengakibatkan murid kurang bermotivasi serta sukar memahami aplikasi hukum dalam kehidupan sebenar. Kekurangan bahan digital interaktif, integrasi Jawi, pendekatan gamifikasi dan penggunaan strategi VARK dikenal pasti sebagai jurang utama dalam platform sedia ada.

Bagi mengatasi isu ini, platform E-Fiqhuna dibangunkan sebagai BBM digital interaktif yang merangkumi nota multimedia, video, simulasi dan permainan gamifikasi selaras dengan KSSM Tingkatan 4. Kajian tinjauan kuantitatif dijalankan menggunakan soal selidik serta ujian pra dan pos untuk menilai kebolehgunaan, kefahaman, motivasi dan keberkesanan pemahaman pengguna. Hasil kajian menunjukkan bahawa platform digital seperti E-Fiqhuna berpotensi besar meningkatkan minat, penglibatan dan pencapaian murid dalam Fiqh melalui pendekatan yang menyeluruh, interaktif dan berasaskan teknologi.

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# KEBERKESANAN LAMAN WEB EKIBTA DALAM MENINGKATKAN KEFAHAMAN BERKAITAN TOPIK AKIDAH TINGKATAN DUA

## *(THE EFFECTIVENESS OF THE EKIBTA WEBSITE IN ENHANCING UNDERSTANDING OF FORM TWO AKIDAH TOPICS)*

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***Abstrak:*** *Kajian ini bertujuan menilai keberkesanan penggunaan laman web eKiBTa (Elektronik Kit Bidang Tauhid) sebagai bahan bantu mengajar digital dalam meningkatkan kefahaman pelajar terhadap topik Akidah Tingkatan Dua dalam mata pelajaran Pendidikan Islam. Pembangunan eKiBTa adalah selaras dengan keperluan Pembelajaran Abad Ke-21 (PAK-21) dan aspirasi Pelan Pembangunan Pendidikan Malaysia 2013–2025 yang menekankan integrasi Teknologi Maklumat dan Komunikasi (TMK) dalam pengajaran dan pembelajaran. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk pra–pasca bagi mengukur perubahan kefahaman pelajar sebelum dan selepas penggunaan eKiBTa. Seramai 200 orang pelajar Tingkatan Dua dari sebuah sekolah menengah di Kuala Terengganu dipilih sebagai sampel kajian melalui kaedah pensampelan bertujuan. Data kajian diperoleh melalui ujian pra dan ujian pasca, pemerhatian berfokus sepanjang pelaksanaan PdP, serta sesi soal jawab bagi mendapatkan maklum balas pelajar terhadap penggunaan platform eKiBTa. Dapatan kajian menunjukkan peningkatan pencapaian yang sangat signifikan apabila purata markah pelajar meningkat daripada 51.6% dalam ujian pra kepada 90.2% dalam ujian pasca, dengan perbezaan peningkatan sebanyak 74.8%, sekali gus membuktikan keberkesanan intervensi pembelajaran berasaskan web. Taburan markah ujian pasca turut memperlihatkan bahawa majoriti pelajar mencapai tahap penguasaan tinggi, di mana 96% pelajar memperoleh markah antara 8 hingga 10, menunjukkan kefahaman yang lebih mendalam terhadap konsep Akidah yang bersifat abstrak dan metafizik. Selain itu, maklum balas pelajar menunjukkan bahawa elemen multimedia interaktif, susun atur*

*kandungan yang tersusun mengikut sukatan KSSM serta aktiviti gamifikasi yang disediakan dalam eKiBTa berjaya meningkatkan minat, motivasi dan penglibatan aktif pelajar sepanjang proses pembelajaran. Secara keseluruhannya, kajian ini mengesahkan bahawa eKiBTa merupakan platform pembelajaran digital yang berkesan dalam memperkukuh kefahaman dan penguasaan konsep Akidah pelajar Tingkatan Dua, serta berpotensi untuk diperluaskan penggunaannya dalam pengajaran Pendidikan Islam bagi menyokong PdP yang lebih interaktif, berpusatkan pelajar dan relevan dengan keperluan pendidikan moden.*

***Kata Kunci:*** *Akidah; eKiBTa; Pembelajaran Digital; Kefahaman Pelajar; Bahan Bantu Mengajar Interaktif.*

***Abstract:*** *This study aims to evaluate the effectiveness of the eKiBTa (Electronic Kit for the Field of Tawhid) website as a digital teaching aid in enhancing students' understanding of Form Two Akidah topics in Islamic Education. The development of eKiBTa aligns with the requirements of 21st Century Learning (PAK-21) and the aspirations of the Malaysia Education Blueprint 2013–2025, which emphasize the integration of Information and Communication Technology (ICT) in teaching and learning. This study employed a qualitative approach using a pre–post research design to measure changes in students' understanding before and after the use of eKiBTa. A total of 200 Form Two students from a secondary school in Kuala Terengganu were selected as the study sample through purposive sampling. Data were collected through pre-test and post-test assessments, focused classroom observations during the teaching and learning process, and question-and-answer sessions to obtain students' feedback on the use of the eKiBTa platform. The findings revealed a highly significant improvement in student achievement, with the mean score increasing from 51.6% in the pre-test to 90.2% in the post-test, representing an improvement of 74.8%, thus demonstrating the effectiveness of the web-based learning intervention. The post-test score distribution further showed that the majority of students achieved a high level of mastery, with 96% of students scoring between 8 and 10, indicating a deeper understanding of abstract and metaphysical Akidah concepts. In addition, students' feedback indicated that the interactive multimedia elements, systematically organized content aligned with the KSSM syllabus, and gamification activities embedded in eKiBTa successfully enhanced students' interest, motivation, and active engagement throughout the learning process. Overall, this study confirms that eKiBTa is an effective digital learning platform for strengthening Form Two students' understanding and mastery of Akidah concepts and has strong potential to be expanded in Islamic Education teaching to support a more interactive, student-centred, and contemporary learning environment.*

***Keywords:*** *Akidah; eKiBTa; Digital Learning; Student Understanding; Interactive Teaching Aids*

## Pengenalan

Dunia pendidikan masa kini sedang menempuh fasa transformasi yang amat pesat impak daripada gelombang Revolusi Industri 4.0 (IR 4.0) yang membawa perubahan radikal dalam ekosistem pembelajaran global. Transformasi ini tidak hanya menuntut perubahan daripada aspek infrastruktur fizikal sekolah, malah mewajibkan anjakan paradigma dalam metodologi penyampaian ilmu oleh para pendidik (Gros, 2016). Di Malaysia, Kementerian Pendidikan Malaysia (KPM) telah menetapkan hala tuju yang jelas menerusi Pelan Pembangunan

Pendidikan Malaysia (PPPM) 2013-2025. Anjakan ketujuh dalam pelan tersebut menekankan pemanfaatan Teknologi Maklumat dan Komunikasi (TMK) bagi meningkatkan kualiti pembelajaran merentas semua subjek, termasuklah bidang Pendidikan Islam (KPM, 2013). Seiring dengan hasrat melahirkan modal insan yang kompetitif, integrasi teknologi dalam bilik darjah dilihat sebagai instrumen kritikal untuk mewujudkan persekitaran Pembelajaran Abad Ke-21 (PAK-21) yang berpusatkan pelajar.

Pendidikan Islam sebagai teras pembentukan sahsiah dan rohani pelajar di Malaysia tidak boleh terkecuali daripada arus pendigitalan ini. Menurut Ab. Halim Tamuri (2015), keberkesanan pengajaran Pendidikan Islam pada zaman moden ini amat bergantung kepada keupayaan guru untuk mengintegrasikan wasilah (medium) yang relevan dengan jiwa generasi muda. Penggunaan Bahan Bantu Mengajar (BBM) digital bukan sekadar trend kosmetik semata-mata, tetapi merupakan ejen pemangkin yang mampu mengubah suasana pembelajaran daripada pasif kepada aktif dan dinamik. Dalam konteks ini, pembelajaran berasaskan laman web atau *web-based learning* menawarkan kelebihan luar biasa dari segi fleksibiliti, di mana pelajar boleh mengakses kandungan ilmu tanpa had masa dan batasan geografi (Hashim & Wan Hassan, 2020). Hal ini selaras dengan teori konstruktivisme yang menggalakkan pelajar membina kefahaman mereka sendiri melalui interaksi dengan bahan pembelajaran yang interaktif. Bidang Akidah, yang merupakan tunjang utama dalam kurikulum Pendidikan Islam Tingkatan Dua, sering dianggap mencabar oleh para pelajar kerana sifat kandungannya yang bersifat metafizik, ghaib, dan abstrak. Pengintegrasian teknologi melalui platform khusus seperti laman web *eKiBTa* (Elektronik Kit Bidang Tauhid) merupakan satu inisiatif strategik untuk memvisualisasikan konsep-konsep tersebut secara lebih sistematik. Melalui gabungan elemen multimedia seperti grafik yang berkualiti, video penerangan, dan navigasi yang mesra pengguna, *eKiBTa* berfungsi sebagai jambatan kognitif yang menghubungkan teks statik dalam buku teks dengan kefahaman visual pelajar. Inovasi ini bertujuan untuk memastikan setiap pelajar bukan sahaja menghafal rukun-rukun kepercayaan, tetapi mampu memahami dan menghayati intipati Akidah Islamiah dengan lebih mendalam dan tepat (Haron et al., 2021).

### *Pernyataan Masalah*

Meskipun kesedaran mengenai kepentingan ICT dalam pendidikan semakin meningkat, namun realiti pengajaran di lapangan menunjukkan bahawa bidang Pendidikan Islam masih lagi dibelenggu oleh kaedah tradisional yang bersifat searah (Musa et al., 2019). Kebergantungan yang keterlaluan kepada teknik syarahan dan nota statik menyebabkan pelajar mudah merasa bosan, terutama apabila membincangkan topik Akidah yang memerlukan daya imaginasi dan analisis yang tinggi. Ramai pelajar gagal menguasai konsep Akidah dengan baik disebabkan oleh ketiadaan bahan rujukan digital yang mampu merangsang minat *digital native* iaitu generasi yang membesar dengan teknologi. Apabila bahan bantu mengajar tidak selari dengan gaya pembelajaran semasa, objektif pengajaran sukar dicapai dan pelajar cenderung untuk hilang fokus semasa proses PdP berlangsung.

Masalah ini menjadi lebih kritikal dengan wujudnya lambakan maklumat di internet yang tidak disaring mengikut sukatan pelajaran Standard Kurikulum Sekolah Menengah (KSSM). Terdapat banyak kandungan digital yang membincangkan isu Akidah, namun kadangkala ia mengandungi fakta yang tidak tepat atau tidak sesuai dengan tahap kognitif pelajar tingkatan dua (Zailani et al., 2022). Ketidakcukupan platform digital yang tersusun, sahih, dan khusus bagi silibus tempatan menyebabkan guru-guru Pendidikan Islam menghadapi kesukaran untuk melaksanakan aktiviti pembelajaran kendiri yang berkesan. Tanpa intervensi yang tepat, jurang

kefahaman pelajar akan terus melebar, di mana mereka hanya mampu menjawab peperiksaan secara hafalan tanpa memiliki kekuatan pegangan Akidah yang hakiki dalam mendepani cabaran sosial masa kini (Aziz & Kamaruddin, 2021).

Selain itu, keberkesanan penggunaan laman web dalam meningkatkan pencapaian pelajar dalam Pendidikan Islam masih kurang dibuktikan secara empirikal melalui data yang sistematik. Kebanyakan inovasi digital yang dibangunkan tidak melalui proses penilaian yang ketat dari segi impak kefahaman pelajar melalui ujian pra dan pasca. Oleh itu, wujud keperluan mendesak untuk mengkaji sejauh mana laman web *eKiBTa* yang dibangunkan dengan susun atur yang jelas dan elemen multimedia yang menarik dapat memberikan kesan signifikan terhadap peningkatan markah pelajar. Kegagalan untuk mendokumentasikan keberkesanan ini akan menyebabkan usaha pembangunan BBM digital hanya bersifat sementara dan tidak dapat dijadikan model rujukan dalam sistem pendidikan arus perdana.

***Kepentingan Kajian***

Kajian ini membawa implikasi yang signifikan kepada pelbagai pihak berkepentingan dalam dunia pendidikan. Bagi para pelajar, pembangunan laman web *eKiBTa* menyediakan alternatif pembelajaran yang jauh lebih menarik dan membantu mereka memvisualisasikan konsep Akidah yang kompleks. Dengan adanya elemen interaktiviti, pelajar dapat melibatkan diri secara aktif dalam proses pembelajaran, yang seterusnya meningkatkan motivasi dan daya ingatan jangka panjang mereka. Bagi guru-guru Pendidikan Islam pula, kajian ini menjadi model rujukan (exemplar) dalam membangunkan atau memilih bahan pengajaran digital yang berkualiti. Ia membuktikan bahawa penggunaan teknologi tidak menjejaskan kualiti kandungan agama, sebaliknya memartabatkan lagi subjek Pendidikan Islam setanding dengan subjek sains dan teknologi yang lain.

Dari perspektif institusi pendidikan dan Kementerian Pendidikan Malaysia, dapatan kajian ini membekalkan input data yang berharga mengenai keberkesanan intervensi digital bagi topik-topik berasaskan teori. Data pencapaian pelajar yang melonjak sehingga 74.8% membuktikan bahawa pelaburan dalam kandungan digital yang tersusun adalah langkah yang tepat dalam merealisasikan agenda PAK-21. Selain itu, kajian ini menyumbang kepada khazanah literatur dalam bidang *Islamic Educational Technology* (Islamic EdTech) yang masih memerlukan banyak sumbangan akademik di Malaysia. Ia mengisi jurang kajian mengenai penggunaan laman web khusus bagi subjek agama, sekali gus membuktikan bahawa metodologi kualitatif dan analisis pra-pasca adalah pendekatan yang kukuh untuk menilai keberkesanan sesuatu inovasi pendidikan.

Bagi memastikan kajian ini dijalankan dengan hala tuju yang jelas, beberapa objektif utama telah digariskan. Pertama, kajian ini bertujuan untuk menilai kebolehgunaan laman web *eKiBTa* sebagai bahan bantu mengajar digital yang khusus bagi topik Akidah Tingkatan Dua mengikut standard KSSM. Kedua, ia bertujuan untuk mengukur tahap peningkatan kefahaman pelajar secara empirikal melalui analisis perbandingan skor ujian pra dan ujian pasca setelah intervensi dijalankan. Ketiga, kajian ini ingin menganalisis persepsi dan maklum balas pelajar terhadap aspek teknikal laman web, merangkumi kejelasan susun atur, ketepatan penerangan konsep, dan keberkesanan elemen multimedia dalam membantu proses kognitif mereka. Melalui objektif-objektif ini, kajian diharapkan dapat memberikan gambaran menyeluruh tentang potensi laman web sebagai ejen transformasi dalam pengajaran Pendidikan Islam masa kini.

## Metodologi Kajian

Kajian ini menggunakan kaedah kualitatif bagi memperoleh pemahaman mendalam tentang keberkesanan platform digital *eKiBTa* sebagai medium pembelajaran Akidah dalam kalangan pelajar Tingkatan dua di sebuah sekolah menengah harian di Kuala Terengganu. Pemilihan kaedah kualitatif dilakukan kerana pendekatan ini memberi ruang kepada penyelidik meneliti pengalaman, persepsi dan tindak balas pelajar secara mendalam terhadap penggunaan bahan pembelajaran digital yang disediakan dalam *eKiBTa*. Penggunaan pendekatan ini juga selaras dengan tujuan kajian yang ingin menilai bagaimana pelajar berinteraksi dengan nota pelbagai bentuk seperti video, lukisan nota ringkas dan padat serta teks bertulis di samping meninjau bagaimana elemen gamifikasi seperti *Bingo Akidah*, *Froggy Jumps* dan aktiviti kuiz digital mempengaruhi kefahaman dan motivasi mereka terhadap tajuk-tajuk Akidah Pendidikan Islam Tingkatan dua. Kuiz secara gamifikasi dapat meningkatkan penglibatan murid dan memberikan pengalaman yang lebih menyeronokkan (Zamzami Zainuddin et al. 2020). Eleman permainan mampu meningkatkan penglibatan aktif pelajar sepanjang proses pembelajaran berlangsung (Mohd Syaubari Othman et al. 2021). Penggunaan teknologi dan aplikasi digital dapat meningkatkan kemampuan mengajar termasuk menggunakan kaedah baharu sebagai strategi penyampaian ilmu pengetahuan yang lebih menarik dan interaktif (Nurul Julia 2021).

Populasi kajian ini terdiri daripada 420 orang pelajar Tingkatan dua, manakala seramai 200 orang pelajar telah terlibat sebagai responden kajian (Krejcie and Morgen 1970). Pemilihan responden dilakukan melalui kaedah pensampelan bertujuan, iaitu berdasarkan penglibatan langsung pelajar dengan platform *eKiBTa*. Pendekatan ini membolehkan penyelidik memperoleh data yang autentik berkaitan pengalaman sebenar penggunaan *eKiBTa* dalam konteks pengajaran dan pembelajaran (PdP) Akidah. Selain itu, guru Pendidikan Islam turut dilibatkan sebagai pemerhati bagi menilai kesesuaian kandungan serta tahap interaksi pelajar dengan elemen gamifikasi sepanjang penggunaan platform tersebut. Fasilitator pula berperanan memberikan penerangan, membimbing pelajar semasa penerokaan platform *eKiBTa* serta memastikan setiap aktiviti dijalankan dengan lancar dan teratur.

Pengumpulan data dilaksanakan melalui dua kaedah utama iaitu ujian pra dan pasca melalui pengagihan kertas yang mengandungi soalan-soalan berkaitan bidang Aqidah Tingkatan dua. Pemerhatian dilakukan sepanjang sesi pembelajaran apabila pelajar meneroka semua bahagian dalam *eKiBTa*, membaca nota, menonton video, memerhati lukisan info ringkas, serta menyertai permainan gamifikasi. Pemerhatian ini memberikan gambaran jelas mengenai pola penglibatan pelajar, cara mereka menyelesaikan tugasan, serta interaksi mereka terhadap elemen-elemen digital yang disediakan. Selain itu, pengumpulan data turut dilaksanakan melalui sesi soal jawab langsung antara fasilitator dan para pelajar setelah mereka menggunakan platform tersebut. Dalam kaedah ini, fasilitator berperanan mendapatkan maklum balas segera berkaitan pengalaman pembelajaran pelajar iaitu tahap kefahaman, keseronokan, kesukaran yang dialami serta persepsi mereka terhadap keberkesanan aktiviti yang disediakan. Pendekatan soal jawab secara langsung ini membolehkan fasilitator memperoleh data autentik dan respons spontan, di samping memberi ruang kepada pelajar untuk meluahkan pandangan secara lebih terbuka. Kaedah ini juga membantu pengkaji mengenal pasti aspek-aspek yang perlu diperbaiki dalam platform sama ada dari segi reka

bentuk, kandungan mahupun interaktiviti, seterusnya memastikan platform benar-benar memenuhi keperluan pengguna sasaran.

Dari segi prosedur pelaksanaan, kajian dimulakan dengan sesi taklimat oleh fasilitator bagi memberi penerangan ringkas tentang penggunaan platform *eKiBTa*. Selepas taklimat, pelajar perlu mendaftar diri dalam platform sebelum memulakan aktiviti pembelajaran. Setiap pelajar diberi peluang untuk meneroka platform secara kendiri mengikut gaya pembelajaran mereka, termasuk membaca nota bertulis yang sesuai untuk pelajar dengan gaya pembelajaran linguistik, menonton nota video yang sesuai untuk pelajar auditori dan visual serta menggunakan nota pantas bergrafik yang sesuai untuk pelajar visual. Pendekatan ini memastikan variasi bahan pembelajaran disesuaikan dengan keperluan individu supaya pengalaman pembelajaran menjadi lebih berkesan dan bermakna. Guru perlulah mengambil kira gaya pembelajaran pelajar (Say & Yildirim 2020) . Pada peringkat pendidikan yang paling asas, bahan audio-visual digunakan sebagai alat oleh para pendidik untuk membantu mewujudkan pengalaman pembelajaran yang relevan dengan kehidupan kanak-kanak (Meli et al., 2023; Niman et al., 2024). Seterusnya, pelajar melibatkan diri dalam permainan pertama iaitu *Bingo eKiBTa*, di mana mereka didedahkan kepada soalan bonus yang dapat meningkatkan semangat mereka untuk menjawab soalan seterusnya. Aktiviti diikuti dengan permainan kedua iaiut *Froggy Jumps* yang memperuntukkan masa supaya pelajar berfikir dengan pantas untuk menjawab soalan dengan betul. Kemudian, pelajar menyertai permainan ketiga iaitu *Kahoot* yang mengandungi 10 soalan dan memperuntukkan masa selama 20 saat bagi setiap soalan di samping menyediakan bonus kepada pelajar yang menekan jawapan dengan lebih cepat. Sepanjang sesi penerokaan ini, penyelidik menjalankan pemerhatian berfokus terhadap tingkah laku dan tahap interaksi pelajar dengan pelbagai elemen pembelajaran. Setelah semua aktiviti selesai, penyelidik mengagih soalan ujian pasca untuk mengumpul data berkaitan pencapaian dan perubahan kefahaman pelajar selepas menggunakan platform *eKiBTa*.

Data yang diperoleh daripada pemerhatian, soal jawab dan ujian pra serta ujian pasca dianalisis menggunakan kaedah analisis tema bagi mengenal pasti corak, pengalaman dan persepsi pelajar terhadap penggunaan platform *eKiBTa*. Proses analisis melibatkan pembentukan tema-tema utama serta semakan silang antara pemerhatian dan maklum balas pelajar untuk memastikan kesahihan dapatan. Kaedah ini membolehkan penyelidik menilai keberkesanan elemen nota pelbagai bentuk dan permainan gamifikasi dalam meningkatkan kefahaman, minat dan motivasi pelajar terhadap pembelajaran Akidah. Keseluruhan prosedur kajian dijalankan dengan mematuhi prinsip etika penyelidikan termasuk mendapatkan persetujuan yang dimaklumkan, menjaga kerahsiaan identiti pelajar dan memastikan semua data digunakan hanya untuk tujuan kajian dan akademik. Dengan pendekatan ini, kajian dapat memberikan gambaran menyeluruh mengenai keberkesanan platform *eKibta* sebagai medium pembelajaran digital bagi pelajar Tingkatan dua dalam bidang Akidah.

## Keputusan dan Perbincangan

Bahagian ini membincangkan dapatan kajian berkaitan keberkesanan penggunaan laman web *eKiBTa* sebagai bahan bantu mengajar digital bagi topik Akidah tingkatan dua berdasarkan perbandingan keputusan ujian pra dan ujian pasca yang melibatkan 200 orang pelajar Tingkatan 2 di Sekolah Menengah di Kuala Terengganu. Hasil analisis menunjukkan terdapat peningkatan prestasi pelajar selepas penggunaan *eKiBTa* dalam sesi pengajaran dan

pembelajaran, sekali gus membuktikan keberkesanan pendekatan pembelajaran digital interaktif dalam meningkatkan tahap penguasaan konsep akidah. Kaedah pra–pasca yang digunakan membolehkan perubahan pencapaian pelajar diukur secara objektif, manakala penglibatan sampel yang besar memberikan dapatan yang lebih kukuh dan signifikan secara statistik. Selain itu, penggunaan *eKiBTa* turut menyumbang kepada pengalaman pembelajaran yang lebih menarik dan berfokus, sekali gus menyokong keperluan pembelajaran berasaskan teknologi serta memperkukuh pelaksanaan pendidikan Islam selaras dengan keperluan pendidikan abad ke- 21.

**Jadual 1: Bilangan Markah, Bilangan Pelajar, dan Peratusannya dalam Ujian Pra Bagi Tajuk Akidah Tingkatan Dua**

| Bilangan Markah | Bilangan Pelajar | Peratusan |
|---|---|---|
| 7 | 40 | 20 % |
| 6 | 40 | 20 % |
| 5 | 80 | 40 % |
| 4 | 16 | 8 % |
| 2 | 24 | 12 % |

Sumber: Keputusan daripada Ujian Pra

Hasil ujian pra yang telah melibatkan 200 pelajar menunjukkan tahap pencapaian mereka dalam topik Akidah sebelum pendedahan kepada laman web *eKiBTa*. Daripada jumlah ini, sekitar 20% dalam 40 orang pelajar memperoleh markah 7, manakala bilangan yang sama iaitu 40 pelajar dalam memperoleh markah 6, menunjukkan sebahagian pelajar telah mencapai tahap penguasaan yang baik terhadap konsep asas Akidah. Majoriti pelajar iaitu 80 orang atau 40% mencatatkan markah 5, menandakan tahap penguasaan mereka sederhana dan menunjukkan pemahaman yang asas tetapi stabil terhadap topik yang diuji. Sebanyak 16 pelajar sekitar 8 % memperoleh markah 4, manakala 24 pelajar lain dalam 12% mencatatkan markah rendah iaitu 2, memperlihatkan bahawa sebahagian pelajar masih menghadapi kesukaran untuk memahami beberapa konsep dalam topik Akidah. Taburan markah ini menunjukkan variasi pencapaian di kalangan pelajar, di mana sebahagian kecil berada pada tahap penguasaan tinggi manakala segmen lain masih berada pada tahap sederhana hingga rendah. Keseluruhan dapatan daripada ujian pra ini memberikan gambaran awal tentang tahap pemahaman pelajar terhadap topik Akidah sebelum sebarang intervensi menggunakan *eKiBTa* dijalankan.

Taburan peratusan markah ujian pra menunjukkan bahawa tahap kefahaman awal pelajar terhadap topik Akidah masih belum menyeluruh dan bersifat tidak sekata. Walaupun sebahagian pelajar memperoleh markah sederhana tinggi, peratusan pelajar yang berada pada tahap markah rendah dan sederhana masih mendominasi keseluruhan pencapaian. Keadaan ini menggambarkan bahawa sebelum sebarang intervensi pembelajaran dilaksanakan, pelajar belum benar-benar menguasai konsep-konsep asas Akidah secara mendalam, sebaliknya hanya memahami secara permukaan atau berasaskan hafalan semata-mata. Penguasaan Akidah dalam kalangan pelajar sering terjejas apabila kaedah pengajaran terlalu bergantung kepada penyampaian sehala tanpa sokongan visual dan interaksi yang mencukupi (Mohd Aderi Che Noh. 2018). Selain itu, peratusan pelajar yang memperoleh markah rendah juga menunjukkan kewujudan jurang kefahaman yang ketara dalam kalangan pelajar. Pelajar yang berada pada tahap pencapaian rendah berkemungkinan menghadapi kesukaran memahami konsep Akidah yang bersifat abstrak, metafizik dan memerlukan penaakulan yang tinggi. Pendekatan pengajaran tradisional yang kurang variasi sering gagal memenuhi keperluan pembelajaran

pelajar generasi digital (Musa 2019). Tanpa penggunaan bahan bantu mengajar yang bersifat interaktif dan kontekstual, pelajar cenderung untuk hilang minat dan menghadapi kesukaran mengaitkan konsep Akidah dengan kefahaman sebenar.

**Jadual 2: Bilangan Markah, Bilangan Pelajar dan Peratusan yang Diperolehi dalam Menjawab Ujian Pasca**

| Bilangan Markah | Bilangan Pelajar | Peratusan |
|---|---|---|
| 10 | 68 | 34 % |
| 9 | 76 | 38 % |
| 8 | 48 | 24 % |
| 7 | 8 | 4 % |

Sumber: Keputusan Pasca Selepas Penggunaan *eKiBTa*

Keputusan ujian pasca menunjukkan peningkatan pencapaian pelajar dalam topik Akidah selepas penggunaan laman web *eKiBTa*. Daripada bilangan pelajar yang diuji, 68 pelajar atau 34% memperoleh markah penuh 10, manakala 76 pelajar atau 38% memperoleh markah 9, menunjukkan bahawa majoriti pelajar kini berada pada tahap penguasaan yang tinggi dan mampu memahami konsep-konsep Akidah dengan baik serta menunjukkan kefahaman yang lebih mendalam berbanding sebelum pendedahan kepada eKiBTa. Selain itu, 48 pelajar atau 24% mencatatkan markah 8, menandakan tahap penguasaan mereka masih kukuh dan mantap, menunjukkan kemampuan pelajar untuk mengaplikasikan konsep asas dengan baik. Hanya sebilangan kecil, iaitu 8 pelajar atau 4%, memperoleh markah 7, menandakan mereka berada pada tahap penguasaan sederhana dan masih memerlukan pengulangan untuk memperkukuh pemahaman. Taburan markah ini memperlihatkan peningkatan yang ketara berbanding prestasi sebelum penggunaan *eKiBTa*, dengan majoriti pelajar kini menunjukkan pencapaian tinggi dan pemahaman yang lebih menyeluruh terhadap topik Akidah. Keputusan ini juga mencerminkan keberkesanan *eKiBTa* sebagai bahan bantu digital dalam mempertingkatkan penguasaan konsep dan kemampuan pelajar untuk mengingati serta mengaplikasikan ilmu yang telah dipelajari, sekaligus menunjukkan perubahan positif dalam prestasi keseluruhan kelas selepas penggunaan intervensi digital ini.

Peningkatan pencapaian pelajar yang diperlihatkan melalui ujian pasca menekankan keberkesanan laman web *eKiBTa* sebagai bahan bantu digital dalam pembelajaran topik Akidah Tingkatan dua. Kejayaan ini selari dengan prinsip Pembelajaran Abad Ke-21 (PAK 21) yang menekankan pembelajaran berpusatkan pelajar, di mana *eKiBTa* membolehkan pelajar mengakses kandungan secara kendiri, fleksibel, dan berulang mengikut kadar mereka sendiri, seterusnya menyokong pembinaan pengetahuan secara aktif dan bukan sekadar penerimaan pasif (Hashim & Wan Hassan, 2020). Elemen multimedia yang disediakan, termasuk grafik, animasi, dan video penerangan, membolehkan pelajar memvisualisasikan konsep abstrak dan metafizik dalam Akidah, sekaligus menghubungkan teori dengan kefahaman sebenar melalui pengalaman interaktif, yang sejajar dengan teori konstruktivisme yang menekankan pembinaan pengetahuan melalui interaksi dengan bahan pembelajaran (Haron et al., 2021). Tambahan pula, *eKiBTa* menyediakan kandungan yang tersusun mengikut sukatan KSSM, yang memastikan pelajar tidak hanya menerima maklumat secara rawak seperti yang terdapat di internet, tetapi dapat memahami isi pelajaran dengan lebih fokus dan terarah (Musa et al., 2019; Zailani et al., 2022). Aspek interaktiviti ini juga terbukti merangsang minat dan motivasi pelajar, terutamanya generasi *digital native* yang membesar dengan teknologi, menjadikan proses pembelajaran lebih menarik dan menggalakkan pengulangan yang berkesan untuk

pengukuhan konsep (Ab. Halim Tamuri, 2015; Mohd Aderi Che Noh, 2018). Tambahan lagi, penggunaan *eKiBTa* dapat menurunkan bilangan pelajar yang berada pada tahap penguasaan sederhana, menunjukkan bahawa jurang kefahaman dapat dikurangkan dengan penglibatan bahan digital yang tepat. Secara keseluruhan, dapatan ini menegaskan bahawa integrasi teknologi melalui laman web *eKiBTa* bukan sahaja meningkatkan pencapaian akademik tetapi juga memperkukuh penghayatan dan penguasaan konsep Akidah secara menyeluruh, sejajar dengan aspirasi KPM untuk membangunkan modal insan yang berkompetensi tinggi dalam konteks Pendidikan Islam yang berkesan dan relevan dengan kehendak pendidikan moden (KPM, 2013; Aziz & Kamaruddin, 2021).

**Jadual 3 Menunjukkan Jumlah Peratusan Purata Markah dalam Ujian yang Berlaku Selepas Penggunaan Web eKiBTa.**

| Jenis Ujian | Jumlah Peratusan |
|---|---|
| Pra | 51.6 % |
| Pasca | 90.2 % |

Sumber: Dapatan Peratusan Purata Markah

Berdasarkan analisis ujian pra dan ujian pasca terhadap sampel , keputusan ujian pra menunjukkan purata markah pelajar ialah 5.16 daripada 10, bersamaan dengan 51.6%. Selepas penggunaan laman web *eKiBTa*, keputusan ujian pasca menunjukkan peningkatan purata markah kepada 9.02 daripada 10, bersamaan dengan 90.2%. Perbandingan ini merekodkan peningkatan sebanyak 74.8% antara ujian pra dan ujian pasca, sekali gus menunjukkan perbezaan pencapaian yang ketara sebelum dan selepas penggunaan *eKiBTa* dalam pembelajaran topik Akidah.

Peningkatan peratusan pencapaian pelajar menunjukkan bahawa penggunaan laman web *eKiBTa* memberi kesan yang sangat signifikan terhadap penguasaan konsep Akidah dalam kalangan pelajar. Perbezaan peratusan yang besar ini membuktikan bahawa integrasi bahan bantu mengajar digital berasaskan web mampu mengatasi kelemahan pendekatan pengajaran tradisional yang kurang berkesan dalam menyampaikan kandungan Akidah yang bersifat abstrak dan konseptual. Pembelajaran berasaskan teknologi dan multimedia interaktif dapat meningkatkan kefahaman, fokus serta penglibatan pelajar secara aktif (Wan Hassan. 2020). Selain itu, lonjakan peratusan ini juga menyokong aspirasi Pelan Pembangunan Pendidikan Malaysia 2013–2025 (KPM. 2013) yang menekankan pemanfaatan Teknologi Maklumat Komunikasi (TMK) dalam meningkatkan kualiti pembelajaran, sekali gus mengesahkan bahawa eKiBTa berpotensi menjadi bahan bantu mengajar digital yang berkesan dan relevan dalam memperkukuh penguasaan Akidah pelajar selaras dengan keperluan Pembelajaran Abad Ke-21.

## *Kesimpulan Hasil Kajian*

Kesimpulannya, penggunaan *eKiBTa* telah membuktikan peningkatan yang signifikan terhadap pencapaian pelajar dalam topik Akidah, apabila majoriti pelajar mampu menguasai dan memahami konsep dengan lebih tepat serta mendalam. Dari perspektif pelajar, *eKiBTa* meningkatkan penglibatan aktif dalam pembelajaran, memudahkan pemahaman konsep yang bersifat abstrak, serta menyemai motivasi dan keyakinan untuk mengaplikasikan ilmu yang dipelajari. Selain itu, dari sudut pengajaran dan pembelajaran, *eKiBTa* menyokong pelaksanaan PdP yang lebih interaktif dan berkesan dengan membantu guru menyampaikan kandungan

Akidah secara visual dan digital, sekali gus meningkatkan keberkesanan PdP secara keseluruhan. Kesimpulannya, kajian ini membuktikan bahawa eKiBTa mampu memudahkan pelajar memahami konsep Akidah yang kompleks, meningkatkan penglibatan mereka dalam pembelajaran, serta memperkukuh kualiti pengajaran dan pembelajaran Pendidikan Islam secara menyeluruh.

## Kesimpulan

Kesimpulannya, dapatan kajian ini secara jelas membuktikan bahawa penggunaan laman web *eKiBTa* sebagai bahan bantu mengajar digital memberikan kesan yang signifikan terhadap peningkatan penguasaan konsep Akidah dalam kalangan pelajar Tingkatan dua. Perbandingan keputusan ujian pra dan ujian pasca menunjukkan peningkatan pencapaian yang sangat ketara, apabila purata markah pelajar meningkat daripada 5.16 atau 51.6% dalam ujian pra kepada 9.02 atau 90.2% dalam ujian pasca, iaitu peningkatan sebanyak 74.8% selepas intervensi penggunaan *eKiBTa* dilaksanakan. Dari segi taburan markah, ujian pra memperlihatkan bahawa majoriti pelajar berada pada tahap penguasaan sederhana dan rendah, di mana 40% pelajar memperoleh markah 5, manakala 20% masing-masing mencatatkan markah 6 dan 7, serta 20% lagi berada pada tahap rendah dengan markah 4 dan 2, menunjukkan kefahaman awal pelajar terhadap topik Akidah masih belum menyeluruh dan tidak sekata. Namun begitu, selepas penggunaan *eKiBTa*, keputusan ujian pasca menunjukkan perubahan yang amat positif apabila 96% pelajar mencapai markah tinggi antara 8 hingga 10, dengan 34% memperoleh markah penuh 10 dan 38% mencatatkan markah 9, sekali gus mencerminkan peningkatan tahap penguasaan yang tinggi dan lebih menyeluruh dalam kalangan pelajar. Selain itu, bilangan pelajar yang berada pada tahap penguasaan sederhana telah menurun dengan ketara apabila hanya 4% pelajar memperoleh markah 7 dalam ujian pasca, menunjukkan bahawa penggunaan *eKiBTa* berjaya mengurangkan jurang kefahaman dan membantu pelajar yang sebelum ini lemah untuk meningkatkan pencapaian mereka. Dapatan ini membuktikan bahawa elemen multimedia interaktif, penyampaian kandungan yang tersusun mengikut sukatan KSSM serta pembelajaran kendiri yang fleksibel melalui *eKiBTa* berkesan dalam membantu pelajar memahami konsep Akidah yang bersifat abstrak dan metafizik dengan lebih jelas dan bermakna. Secara keseluruhannya, kajian ini mengesahkan bahawa integrasi *eKiBTa* dalam pengajaran dan pembelajaran Akidah bukan sahaja meningkatkan pencapaian akademik secara signifikan, malah menyokong pembelajaran berpusatkan pelajar selaras dengan prinsip Pembelajaran Abad Ke-21 serta aspirasi pendidikan Islam yang relevan dengan keperluan pendidikan moden.

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# KEBERKESANAN LAMAN WEB EKIBTA DALAM MENINGKATKAN KEFAHAMAN BERKAITAN TOPIK AKIDAH TINGKATAN DUA

## *(THE EFFECTIVENESS OF THE EKIBTA WEBSITE IN ENHANCING UNDERSTANDING OF FORM TWO AKIDAH TOPICS)*

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***Abstrak:*** *Kajian ini bertujuan menilai keberkesanan penggunaan laman web eKiBTa (Elektronik Kit Bidang Tauhid) sebagai bahan bantu mengajar digital dalam meningkatkan kefahaman pelajar terhadap topik Akidah Tingkatan Dua dalam mata pelajaran Pendidikan Islam. Pembangunan eKiBTa adalah selaras dengan keperluan Pembelajaran Abad Ke-21 (PAK-21) dan aspirasi Pelan Pembangunan Pendidikan Malaysia 2013–2025 yang menekankan integrasi Teknologi Maklumat dan Komunikasi (TMK) dalam pengajaran dan pembelajaran. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk pra–pasca bagi mengukur perubahan kefahaman pelajar sebelum dan selepas penggunaan eKiBTa. Seramai 200 orang pelajar Tingkatan Dua dari sebuah sekolah menengah di Kuala Terengganu dipilih sebagai sampel kajian melalui kaedah pensampelan bertujuan. Data kajian diperoleh melalui ujian pra dan ujian pasca, pemerhatian berfokus sepanjang pelaksanaan PdP, serta sesi soal jawab bagi mendapatkan maklum balas pelajar terhadap penggunaan platform eKiBTa. Dapatan kajian menunjukkan peningkatan pencapaian yang sangat signifikan apabila purata markah pelajar meningkat daripada 51.6% dalam ujian pra kepada 90.2% dalam ujian pasca, dengan perbezaan peningkatan sebanyak 74.8%, sekali gus membuktikan keberkesanan intervensi pembelajaran berasaskan web. Taburan markah ujian pasca turut memperlihatkan bahawa majoriti pelajar mencapai tahap penguasaan tinggi, di mana 96% pelajar memperoleh markah antara 8 hingga 10, menunjukkan kefahaman yang lebih mendalam terhadap konsep Akidah yang bersifat abstrak dan metafizik. Selain itu, maklum balas pelajar menunjukkan bahawa elemen multimedia interaktif, susun atur kandungan yang tersusun mengikut sukatan KSSM serta aktiviti gamifikasi yang disediakan dalam eKiBTa berjaya meningkatkan minat, motivasi dan penglibatan aktif pelajar sepanjang proses pembelajaran. Secara keseluruhannya, kajian ini mengesahkan bahawa eKiBTa*

*merupakan platform pembelajaran digital yang berkesan dalam memperkukuh kefahaman dan penguasaan konsep Akidah pelajar Tingkatan Dua, serta berpotensi untuk diperluaskan penggunaannya dalam pengajaran Pendidikan Islam bagi menyokong PdP yang lebih interaktif, berpusatkan pelajar dan relevan dengan keperluan pendidikan moden.*

***Kata Kunci:*** *Akidah; eKiBTa; Pembelajaran Digital; Kefahaman Pelajar; Bahan Bantu Mengajar Interaktif.*

***Abstract:*** *This study aims to evaluate the effectiveness of the eKiBTa (Electronic Kit for the Field of Tawhid) website as a digital teaching aid in enhancing students' understanding of Form Two Akidah topics in Islamic Education. The development of eKiBTa aligns with the requirements of 21st Century Learning (PAK-21) and the aspirations of the Malaysia Education Blueprint 2013–2025, which emphasize the integration of Information and Communication Technology (ICT) in teaching and learning. This study employed a qualitative approach using a pre–post research design to measure changes in students' understanding before and after the use of eKiBTa. A total of 200 Form Two students from a secondary school in Kuala Terengganu were selected as the study sample through purposive sampling. Data were collected through pre-test and post-test assessments, focused classroom observations during the teaching and learning process, and question-and-answer sessions to obtain students' feedback on the use of the eKiBTa platform. The findings revealed a highly significant improvement in student achievement, with the mean score increasing from 51.6% in the pre-test to 90.2% in the post-test, representing an improvement of 74.8%, thus demonstrating the effectiveness of the web-based learning intervention. The post-test score distribution further showed that the majority of students achieved a high level of mastery, with 96% of students scoring between 8 and 10, indicating a deeper understanding of abstract and metaphysical Akidah concepts. In addition, students' feedback indicated that the interactive multimedia elements, systematically organized content aligned with the KSSM syllabus, and gamification activities embedded in eKiBTa successfully enhanced students' interest, motivation, and active engagement throughout the learning process. Overall, this study confirms that eKiBTa is an effective digital learning platform for strengthening Form Two students' understanding and mastery of Akidah concepts and has strong potential to be expanded in Islamic Education teaching to support a more interactive, student-centred, and contemporary learning environment.*

***Keywords:*** *Akidah; eKiBTa; Digital Learning; Student Understanding; Interactive Teaching Aids.*

## Pengenalan

Dunia pendidikan masa kini sedang menempuh fasa transformasi yang amat pesat impak daripada gelombang Revolusi Industri 4.0 (IR 4.0) yang membawa perubahan radikal dalam ekosistem pembelajaran global. Transformasi ini tidak hanya menuntut perubahan daripada aspek infrastruktur fizikal sekolah, malah mewajibkan anjakan paradigma dalam metodologi penyampaian ilmu oleh para pendidik (Gros, 2016). Di Malaysia, Kementerian Pendidikan Malaysia (KPM) telah menetapkan hala tuju yang jelas menerusi Pelan Pembangunan Pendidikan Malaysia (PPPM) 2013-2025. Anjakan ketujuh dalam pelan tersebut menekankan pemanfaatan Teknologi Maklumat dan Komunikasi (TMK) bagi meningkatkan kualiti pembelajaran merentas semua subjek, termasuklah bidang Pendidikan Islam (KPM, 2013).

Seiring dengan hasrat melahirkan modal insan yang kompetitif, integrasi teknologi dalam bilik darjah dilihat sebagai instrumen kritikal untuk mewujudkan persekitaran Pembelajaran Abad Ke-21 (PAK-21) yang berpusatkan pelajar.

Pendidikan Islam sebagai teras pembentukan sahsiah dan rohani pelajar di Malaysia tidak boleh terkecuali daripada arus pendigitalan ini. Menurut Ab. Halim Tamuri (2015), keberkesanan pengajaran Pendidikan Islam pada zaman moden ini amat bergantung kepada keupayaan guru untuk mengintegrasikan wasilah (medium) yang relevan dengan jiwa generasi muda. Penggunaan Bahan Bantu Mengajar (BBM) digital bukan sekadar trend kosmetik semata-mata, tetapi merupakan ejen pemangkin yang mampu mengubah suasana pembelajaran daripada pasif kepada aktif dan dinamik. Dalam konteks ini, pembelajaran berasaskan laman web atau *web-based learning* menawarkan kelebihan luar biasa dari segi fleksibiliti, di mana pelajar boleh mengakses kandungan ilmu tanpa had masa dan batasan geografi (Hashim & Wan Hassan, 2020). Hal ini selaras dengan teori konstruktivisme yang menggalakkan pelajar membina kefahaman mereka sendiri melalui interaksi dengan bahan pembelajaran yang interaktif. Bidang Akidah, yang merupakan tunjang utama dalam kurikulum Pendidikan Islam Tingkatan Dua, sering dianggap mencabar oleh para pelajar kerana sifat kandungannya yang bersifat metafizik, ghaib, dan abstrak. Pengintegrasian teknologi melalui platform khusus seperti laman web *eKiBTa* (Elektronik Kit Bidang Tauhid) merupakan satu inisiatif strategik untuk memvisualisasikan konsep-konsep tersebut secara lebih sistematik. Melalui gabungan elemen multimedia seperti grafik yang berkualiti, video penerangan, dan navigasi yang mesra pengguna, *eKiBTa* berfungsi sebagai jambatan kognitif yang menghubungkan teks statik dalam buku teks dengan kefahaman visual pelajar. Inovasi ini bertujuan untuk memastikan setiap pelajar bukan sahaja menghafal rukun-rukun kepercayaan, tetapi mampu memahami dan menghayati intipati Akidah Islamiah dengan lebih mendalam dan tepat (Haron et al., 2021).

***Pernyataan Masalah***

Meskipun kesedaran mengenai kepentingan ICT dalam pendidikan semakin meningkat, namun realiti pengajaran di lapangan menunjukkan bahawa bidang Pendidikan Islam masih lagi dibelenggu oleh kaedah tradisional yang bersifat searah (Musa et al., 2019). Kebergantungan yang keterlaluan kepada teknik syarahan dan nota statik menyebabkan pelajar mudah merasa bosan, terutama apabila membincangkan topik Akidah yang memerlukan daya imaginasi dan analisis yang tinggi. Ramai pelajar gagal menguasai konsep Akidah dengan baik disebabkan oleh ketiadaan bahan rujukan digital yang mampu merangsang minat *digital native* iaitu generasi yang membesar dengan teknologi. Apabila bahan bantu mengajar tidak selari dengan gaya pembelajaran semasa, objektif pengajaran sukar dicapai dan pelajar cenderung untuk hilang fokus semasa proses PdP berlangsung.

Masalah ini menjadi lebih kritikal dengan wujudnya lambakan maklumat di internet yang tidak disaring mengikut sukatan pelajaran Standard Kurikulum Sekolah Menengah (KSSM). Terdapat banyak kandungan digital yang membincangkan isu Akidah, namun kadangkala ia mengandungi fakta yang tidak tepat atau tidak sesuai dengan tahap kognitif pelajar tingkatan dua (Zailani et al., 2022). Ketidakcukupan platform digital yang tersusun, sahih, dan khusus bagi silibus tempatan menyebabkan guru-guru Pendidikan Islam menghadapi kesukaran untuk melaksanakan aktiviti pembelajaran kendiri yang berkesan. Tanpa intervensi yang tepat, jurang kefahaman pelajar akan terus melebar, di mana mereka hanya mampu menjawab peperiksaan

secara hafalan tanpa memiliki kekuatan pegangan Akidah yang hakiki dalam mendepani cabaran sosial masa kini (Aziz & Kamaruddin, 2021).

Selain itu, keberkesanan penggunaan laman web dalam meningkatkan pencapaian pelajar dalam Pendidikan Islam masih kurang dibuktikan secara empirikal melalui data yang sistematik. Kebanyakan inovasi digital yang dibangunkan tidak melalui proses penilaian yang ketat dari segi impak kefahaman pelajar melalui ujian pra dan pasca. Oleh itu, wujud keperluan mendesak untuk mengkaji sejauh mana laman web *eKiBTa* yang dibangunkan dengan susun atur yang jelas dan elemen multimedia yang menarik dapat memberikan kesan signifikan terhadap peningkatan markah pelajar. Kegagalan untuk mendokumentasikan keberkesanan ini akan menyebabkan usaha pembangunan BBM digital hanya bersifat sementara dan tidak dapat dijadikan model rujukan dalam sistem pendidikan arus perdana.

***Kepentingan Kajian***

Kajian ini membawa implikasi yang signifikan kepada pelbagai pihak berkepentingan dalam dunia pendidikan. Bagi para pelajar, pembangunan laman web *eKiBTa* menyediakan alternatif pembelajaran yang jauh lebih menarik dan membantu mereka memvisualisasikan konsep Akidah yang kompleks. Dengan adanya elemen interaktiviti, pelajar dapat melibatkan diri secara aktif dalam proses pembelajaran, yang seterusnya meningkatkan motivasi dan daya ingatan jangka panjang mereka. Bagi guru-guru Pendidikan Islam pula, kajian ini menjadi model rujukan (exemplar) dalam membangunkan atau memilih bahan pengajaran digital yang berkualiti. Ia membuktikan bahawa penggunaan teknologi tidak menjejaskan kualiti kandungan agama, sebaliknya memartabatkan lagi subjek Pendidikan Islam setanding dengan subjek sains dan teknologi yang lain.

Dari perspektif institusi pendidikan dan Kementerian Pendidikan Malaysia, dapatan kajian ini membekalkan input data yang berharga mengenai keberkesanan intervensi digital bagi topik-topik berasaskan teori. Data pencapaian pelajar yang melonjak sehingga 74.8% membuktikan bahawa pelaburan dalam kandungan digital yang tersusun adalah langkah yang tepat dalam merealisasikan agenda PAK-21. Selain itu, kajian ini menyumbang kepada khazanah literatur dalam bidang *Islamic Educational Technology* (Islamic EdTech) yang masih memerlukan banyak sumbangan akademik di Malaysia. Ia mengisi jurang kajian mengenai penggunaan laman web khusus bagi subjek agama, sekali gus membuktikan bahawa metodologi kualitatif dan analisis pra-pasca adalah pendekatan yang kukuh untuk menilai keberkesanan sesuatu inovasi pendidikan.

Bagi memastikan kajian ini dijalankan dengan hala tuju yang jelas, beberapa objektif utama telah digariskan. Pertama, kajian ini bertujuan untuk menilai kebolehgunaan laman web *eKiBTa* sebagai bahan bantu mengajar digital yang khusus bagi topik Akidah Tingkatan Dua mengikut standard KSSM. Kedua, ia bertujuan untuk mengukur tahap peningkatan kefahaman pelajar secara empirikal melalui analisis perbandingan skor ujian pra dan ujian pasca setelah intervensi dijalankan. Ketiga, kajian ini ingin menganalisis persepsi dan maklum balas pelajar terhadap aspek teknikal laman web, merangkumi kejelasan susun atur, ketepatan penerangan konsep, dan keberkesanan elemen multimedia dalam membantu proses kognitif mereka. Melalui objektif-objektif ini, kajian diharapkan dapat memberikan gambaran menyeluruh tentang potensi laman web sebagai ejen transformasi dalam pengajaran Pendidikan Islam masa kini.

## Metodologi Kajian

Kajian ini menggunakan kaedah kualitatif bagi memperoleh pemahaman mendalam tentang keberkesanan platform digital *eKiBTa* sebagai medium pembelajaran Akidah dalam kalangan pelajar Tingkatan dua di sebuah sekolah menengah harian di Kuala Terengganu. Pemilihan kaedah kualitatif dilakukan kerana pendekatan ini memberi ruang kepada penyelidik meneliti pengalaman, persepsi dan tindak balas pelajar secara mendalam terhadap penggunaan bahan pembelajaran digital yang disediakan dalam *eKiBTa*. Penggunaan pendekatan ini juga selaras dengan tujuan kajian yang ingin menilai bagaimana pelajar berinteraksi dengan nota pelbagai bentuk seperti video, lukisan nota ringkas dan padat serta teks bertulis di samping meninjau bagaimana elemen gamifikasi seperti *Bingo Akidah*, *Froggy Jumps* dan aktiviti kuiz digital mempengaruhi kefahaman dan motivasi mereka terhadap tajuk-tajuk Akidah Pendidikan Islam Tingkatan dua. Kuiz secara gamifikasi dapat meningkatkan penglibatan murid dan memberikan pengalaman yang lebih menyeronokkan (Zamzami Zainuddin et al. 2020). Eleman permainan mampu meningkatkan penglibatan aktif pelajar sepanjang proses pembelajaran berlangsung (Mohd Syaubari Othman et al. 2021). Penggunaan teknologi dan aplikasi digital dapat meningkatkan kemampuan mengajar termasuk menggunakan kaedah baharu sebagai strategi penyampaian ilmu pengetahuan yang lebih menarik dan interaktif (Nurul Julia 2021).

Populasi kajian ini terdiri daripada 420 orang pelajar Tingkatan dua, manakala seramai 200 orang pelajar telah terlibat sebagai responden kajian (Krejcie and Morgen 1970). Pemilihan responden dilakukan melalui kaedah pensampelan bertujuan, iaitu berdasarkan penglibatan langsung pelajar dengan platform *eKiBTa*. Pendekatan ini membolehkan penyelidik memperoleh data yang autentik berkaitan pengalaman sebenar penggunaan *eKiBTa* dalam konteks pengajaran dan pembelajaran (PdP) Akidah. Selain itu, guru Pendidikan Islam turut dilibatkan sebagai pemerhati bagi menilai kesesuaian kandungan serta tahap interaksi pelajar dengan elemen gamifikasi sepanjang penggunaan platform tersebut. Fasilitator pula berperanan memberikan penerangan, membimbing pelajar semasa penerokaan platform *eKiBTa* serta memastikan setiap aktiviti dijalankan dengan lancar dan teratur.

Pengumpulan data dilaksanakan melalui dua kaedah utama iaitu ujian pra dan pasca melalui pengagihan kertas yang mengandungi soalan-soalan berkaitan bidang Aqidah Tingkatan dua. Pemerhatian dilakukan sepanjang sesi pembelajaran apabila pelajar meneroka semua bahagian dalam *eKiBTa*, membaca nota, menonton video, memerhati lukisan info ringkas, serta menyertai permainan gamifikasi. Pemerhatian ini memberikan gambaran jelas mengenai pola penglibatan pelajar, cara mereka menyelesaikan tugasan, serta interaksi mereka terhadap elemen-elemen digital yang disediakan. Selain itu, pengumpulan data turut dilaksanakan melalui sesi soal jawab langsung antara fasilitator dan para pelajar setelah mereka menggunakan platform tersebut. Dalam kaedah ini, fasilitator berperanan mendapatkan maklum balas segera berkaitan pengalaman pembelajaran pelajar iaitu tahap kefahaman, keseronokan, kesukaran yang dialami serta persepsi mereka terhadap keberkesanan aktiviti yang disediakan. Pendekatan soal jawab secara langsung ini membolehkan fasilitator memperoleh data autentik dan respons spontan, di samping memberi ruang kepada pelajar untuk meluahkan pandangan secara lebih terbuka. Kaedah ini juga membantu pengkaji mengenal pasti aspek-aspek yang perlu diperbaiki dalam platform sama ada dari segi reka

bentuk, kandungan mahupun interaktiviti, seterusnya memastikan platform benar-benar memenuhi keperluan pengguna sasaran.

Dari segi prosedur pelaksanaan, kajian dimulakan dengan sesi taklimat oleh fasilitator bagi memberi penerangan ringkas tentang penggunaan platform *eKiBTa*. Selepas taklimat, pelajar perlu mendaftar diri dalam platform sebelum memulakan aktiviti pembelajaran. Setiap pelajar diberi peluang untuk meneroka platform secara kendiri mengikut gaya pembelajaran mereka, termasuk membaca nota bertulis yang sesuai untuk pelajar dengan gaya pembelajaran linguistik, menonton nota video yang sesuai untuk pelajar auditori dan visual serta menggunakan nota pantas bergrafik yang sesuai untuk pelajar visual. Pendekatan ini memastikan variasi bahan pembelajaran disesuaikan dengan keperluan individu supaya pengalaman pembelajaran menjadi lebih berkesan dan bermakna. Guru perlulah mengambil kira gaya pembelajaran pelajar (Say & Yildirim 2020) . Pada peringkat pendidikan yang paling asas, bahan audio-visual digunakan sebagai alat oleh para pendidik untuk membantu mewujudkan pengalaman pembelajaran yang relevan dengan kehidupan kanak-kanak (Meli et al., 2023; Niman et al., 2024). Seterusnya, pelajar melibatkan diri dalam permainan pertama iaitu *Bingo eKiBTa*, di mana mereka didedahkan kepada soalan bonus yang dapat meningkatkan semangat mereka untuk menjawab soalan seterusnya. Aktiviti diikuti dengan permainan kedua iaiut *Froggy Jumps* yang memperuntukkan masa supaya pelajar berfikir dengan pantas untuk menjawab soalan dengan betul. Kemudian, pelajar menyertai permainan ketiga iaitu *Kahoot* yang mengandungi 10 soalan dan memperuntukkan masa selama 20 saat bagi setiap soalan di samping menyediakan bonus kepada pelajar yang menekan jawapan dengan lebih cepat. Sepanjang sesi penerokaan ini, penyelidik menjalankan pemerhatian berfokus terhadap tingkah laku dan tahap interaksi pelajar dengan pelbagai elemen pembelajaran. Setelah semua aktiviti selesai, penyelidik mengagih soalan ujian pasca untuk mengumpul data berkaitan pencapaian dan perubahan kefahaman pelajar selepas menggunakan platform *eKiBTa*.

Data yang diperoleh daripada pemerhatian, soal jawab dan ujian pra serta ujian pasca dianalisis menggunakan kaedah analisis tema bagi mengenal pasti corak, pengalaman dan persepsi pelajar terhadap penggunaan platform *eKiBTa*. Proses analisis melibatkan pembentukan tema-tema utama serta semakan silang antara pemerhatian dan maklum balas pelajar untuk memastikan kesahihan dapatan. Kaedah ini membolehkan penyelidik menilai keberkesanan elemen nota pelbagai bentuk dan permainan gamifikasi dalam meningkatkan kefahaman, minat dan motivasi pelajar terhadap pembelajaran Akidah. Keseluruhan prosedur kajian dijalankan dengan mematuhi prinsip etika penyelidikan termasuk mendapatkan persetujuan yang dimaklumkan, menjaga kerahsiaan identiti pelajar dan memastikan semua data digunakan hanya untuk tujuan kajian dan akademik. Dengan pendekatan ini, kajian dapat memberikan gambaran menyeluruh mengenai keberkesanan platform *eKibta* sebagai medium pembelajaran digital bagi pelajar Tingkatan dua dalam bidang Akidah.

## Keputusan dan Perbincangan

Bahagian ini membincangkan dapatan kajian berkaitan keberkesanan penggunaan laman web *eKiBTa* sebagai bahan bantu mengajar digital bagi topik Akidah tingkatan dua berdasarkan perbandingan keputusan ujian pra dan ujian pasca yang melibatkan 200 orang pelajar Tingkatan 2 di Sekolah Menengah di Kuala Terengganu. Hasil analisis menunjukkan terdapat peningkatan prestasi pelajar selepas penggunaan *eKiBTa* dalam sesi pengajaran dan

pembelajaran, sekali gus membuktikan keberkesanan pendekatan pembelajaran digital interaktif dalam meningkatkan tahap penguasaan konsep akidah. Kaedah pra–pasca yang digunakan membolehkan perubahan pencapaian pelajar diukur secara objektif, manakala penglibatan sampel yang besar memberikan dapatan yang lebih kukuh dan signifikan secara statistik. Selain itu, penggunaan *eKiBTa* turut menyumbang kepada pengalaman pembelajaran yang lebih menarik dan berfokus, sekali gus menyokong keperluan pembelajaran berasaskan teknologi serta memperkukuh pelaksanaan pendidikan Islam selaras dengan keperluan pendidikan abad ke- 21.

**Jadual 1: Bilangan Markah, Bilangan Pelajar, dan Peratusannya dalam Ujian Pra Bagi Tajuk Akidah Tingkatan Dua**

| Bilangan Markah | Bilangan Pelajar | Peratusan |
|---|---|---|
| 7 | 40 | 20 % |
| 6 | 40 | 20 % |
| 5 | 80 | 40 % |
| 4 | 16 | 8 % |
| 2 | 24 | 12 % |

Sumber: Keputusan daripada Ujian Pra

Hasil ujian pra yang telah melibatkan 200 pelajar menunjukkan tahap pencapaian mereka dalam topik Akidah sebelum pendedahan kepada laman web *eKiBTa*. Daripada jumlah ini, sekitar 20% dalam 40 orang pelajar memperoleh markah 7, manakala bilangan yang sama iaitu 40 pelajar dalam memperoleh markah 6, menunjukkan sebahagian pelajar telah mencapai tahap penguasaan yang baik terhadap konsep asas Akidah. Majoriti pelajar iaitu 80 orang atau 40% mencatatkan markah 5, menandakan tahap penguasaan mereka sederhana dan menunjukkan pemahaman yang asas tetapi stabil terhadap topik yang diuji. Sebanyak 16 pelajar sekitar 8 % memperoleh markah 4, manakala 24 pelajar lain dalam 12% mencatatkan markah rendah iaitu 2, memperlihatkan bahawa sebahagian pelajar masih menghadapi kesukaran untuk memahami beberapa konsep dalam topik Akidah. Taburan markah ini menunjukkan variasi pencapaian di kalangan pelajar, di mana sebahagian kecil berada pada tahap penguasaan tinggi manakala segmen lain masih berada pada tahap sederhana hingga rendah. Keseluruhan dapatan daripada ujian pra ini memberikan gambaran awal tentang tahap pemahaman pelajar terhadap topik Akidah sebelum sebarang intervensi menggunakan *eKiBTa* dijalankan.

Taburan peratusan markah ujian pra menunjukkan bahawa tahap kefahaman awal pelajar terhadap topik Akidah masih belum menyeluruh dan bersifat tidak sekata. Walaupun sebahagian pelajar memperoleh markah sederhana tinggi, peratusan pelajar yang berada pada tahap markah rendah dan sederhana masih mendominasi keseluruhan pencapaian. Keadaan ini menggambarkan bahawa sebelum sebarang intervensi pembelajaran dilaksanakan, pelajar belum benar-benar menguasai konsep-konsep asas Akidah secara mendalam, sebaliknya hanya memahami secara permukaan atau berasaskan hafalan semata-mata. Penguasaan Akidah dalam kalangan pelajar sering terjejas apabila kaedah pengajaran terlalu bergantung kepada penyampaian sehala tanpa sokongan visual dan interaksi yang mencukupi (Mohd Aderi Che Noh. 2018). Selain itu, peratusan pelajar yang memperoleh markah rendah juga menunjukkan kewujudan jurang kefahaman yang ketara dalam kalangan pelajar. Pelajar yang berada pada tahap pencapaian rendah berkemungkinan menghadapi kesukaran memahami konsep Akidah yang bersifat abstrak, metafizik dan memerlukan penaakulan yang tinggi. Pendekatan pengajaran tradisional yang kurang variasi sering gagal memenuhi keperluan pembelajaran

pelajar generasi digital (Musa 2019). Tanpa penggunaan bahan bantu mengajar yang bersifat interaktif dan kontekstual, pelajar cenderung untuk hilang minat dan menghadapi kesukaran mengaitkan konsep Akidah dengan kefahaman sebenar.

**Jadual 2: Bilangan Markah, Bilangan Pelajar dan Peratusan yang Diperolehi dalam Menjawab Ujian Pasca**

| Bilangan Markah | Bilangan Pelajar | Peratusan |
|---|---|---|
| 10 | 68 | 34 % |
| 9 | 76 | 38 % |
| 8 | 48 | 24 % |
| 7 | 8 | 4 % |

Sumber: Keputusan Pasca Selepas Penggunaan *eKiBTa*

Keputusan ujian pasca menunjukkan peningkatan pencapaian pelajar dalam topik Akidah selepas penggunaan laman web *eKiBTa*. Daripada bilangan pelajar yang diuji, 68 pelajar atau 34% memperoleh markah penuh 10, manakala 76 pelajar atau 38% memperoleh markah 9, menunjukkan bahawa majoriti pelajar kini berada pada tahap penguasaan yang tinggi dan mampu memahami konsep-konsep Akidah dengan baik serta menunjukkan kefahaman yang lebih mendalam berbanding sebelum pendedahan kepada eKiBTa. Selain itu, 48 pelajar atau 24% mencatatkan markah 8, menandakan tahap penguasaan mereka masih kukuh dan mantap, menunjukkan kemampuan pelajar untuk mengaplikasikan konsep asas dengan baik. Hanya sebilangan kecil, iaitu 8 pelajar atau 4%, memperoleh markah 7, menandakan mereka berada pada tahap penguasaan sederhana dan masih memerlukan pengulangan untuk memperkukuh pemahaman. Taburan markah ini memperlihatkan peningkatan yang ketara berbanding prestasi sebelum penggunaan *eKiBTa*, dengan majoriti pelajar kini menunjukkan pencapaian tinggi dan pemahaman yang lebih menyeluruh terhadap topik Akidah. Keputusan ini juga mencerminkan keberkesanan *eKiBTa* sebagai bahan bantu digital dalam mempertingkatkan penguasaan konsep dan kemampuan pelajar untuk mengingati serta mengaplikasikan ilmu yang telah dipelajari, sekaligus menunjukkan perubahan positif dalam prestasi keseluruhan kelas selepas penggunaan intervensi digital ini.

Peningkatan pencapaian pelajar yang diperlihatkan melalui ujian pasca menekankan keberkesanan laman web *eKiBTa* sebagai bahan bantu digital dalam pembelajaran topik Akidah Tingkatan dua. Kejayaan ini selari dengan prinsip Pembelajaran Abad Ke-21 (PAK 21) yang menekankan pembelajaran berpusatkan pelajar, di mana *eKiBTa* membolehkan pelajar mengakses kandungan secara kendiri, fleksibel, dan berulang mengikut kadar mereka sendiri, seterusnya menyokong pembinaan pengetahuan secara aktif dan bukan sekadar penerimaan pasif (Hashim & Wan Hassan, 2020). Elemen multimedia yang disediakan, termasuk grafik, animasi, dan video penerangan, membolehkan pelajar memvisualisasikan konsep abstrak dan metafizik dalam Akidah, sekaligus menghubungkan teori dengan kefahaman sebenar melalui pengalaman interaktif, yang sejajar dengan teori konstruktivisme yang menekankan pembinaan pengetahuan melalui interaksi dengan bahan pembelajaran (Haron et al., 2021). Tambahan pula, *eKiBTa* menyediakan kandungan yang tersusun mengikut sukatan KSSM, yang memastikan pelajar tidak hanya menerima maklumat secara rawak seperti yang terdapat di internet, tetapi dapat memahami isi pelajaran dengan lebih fokus dan terarah (Musa et al., 2019; Zailani et al., 2022). Aspek interaktiviti ini juga terbukti merangsang minat dan motivasi pelajar, terutamanya generasi *digital native* yang membesar dengan teknologi, menjadikan proses pembelajaran lebih menarik dan menggalakkan pengulangan yang berkesan untuk

pengukuhan konsep (Ab. Halim Tamuri, 2015; Mohd Aderi Che Noh, 2018). Tambahan lagi, penggunaan *eKiBTa* dapat menurunkan bilangan pelajar yang berada pada tahap penguasaan sederhana, menunjukkan bahawa jurang kefahaman dapat dikurangkan dengan penglibatan bahan digital yang tepat. Secara keseluruhan, dapatan ini menegaskan bahawa integrasi teknologi melalui laman web *eKiBTa* bukan sahaja meningkatkan pencapaian akademik tetapi juga memperkukuh penghayatan dan penguasaan konsep Akidah secara menyeluruh, sejajar dengan aspirasi KPM untuk membangunkan modal insan yang berkompetensi tinggi dalam konteks Pendidikan Islam yang berkesan dan relevan dengan kehendak pendidikan moden (KPM, 2013; Aziz & Kamaruddin, 2021).

**Jadual 3 Menunjukkan Jumlah Peratusan Purata Markah dalam Ujian yang Berlaku Selepas Penggunaan Web eKiBTa.**

| Jenis Ujian | Jumlah Peratusan |
|---|---|
| Pra | 51.6 % |
| Pasca | 90.2 % |

Sumber: Dapatan Peratusan Purata Markah

Berdasarkan analisis ujian pra dan ujian pasca terhadap sampel , keputusan ujian pra menunjukkan purata markah pelajar ialah 5.16 daripada 10, bersamaan dengan 51.6%. Selepas penggunaan laman web *eKiBTa*, keputusan ujian pasca menunjukkan peningkatan purata markah kepada 9.02 daripada 10, bersamaan dengan 90.2%. Perbandingan ini merekodkan peningkatan sebanyak 74.8% antara ujian pra dan ujian pasca, sekali gus menunjukkan perbezaan pencapaian yang ketara sebelum dan selepas penggunaan *eKiBTa* dalam pembelajaran topik Akidah.

Peningkatan peratusan pencapaian pelajar menunjukkan bahawa penggunaan laman web *eKiBTa* memberi kesan yang sangat signifikan terhadap penguasaan konsep Akidah dalam kalangan pelajar. Perbezaan peratusan yang besar ini membuktikan bahawa integrasi bahan bantu mengajar digital berasaskan web mampu mengatasi kelemahan pendekatan pengajaran tradisional yang kurang berkesan dalam menyampaikan kandungan Akidah yang bersifat abstrak dan konseptual. Pembelajaran berasaskan teknologi dan multimedia interaktif dapat meningkatkan kefahaman, fokus serta penglibatan pelajar secara aktif (Wan Hassan. 2020). Selain itu, lonjakan peratusan ini juga menyokong aspirasi Pelan Pembangunan Pendidikan Malaysia 2013–2025 (KPM. 2013) yang menekankan pemanfaatan Teknologi Maklumat Komunikasi (TMK) dalam meningkatkan kualiti pembelajaran, sekali gus mengesahkan bahawa eKiBTa berpotensi menjadi bahan bantu mengajar digital yang berkesan dan relevan dalam memperkukuh penguasaan Akidah pelajar selaras dengan keperluan Pembelajaran Abad Ke-21.

## *Kesimpulan Hasil Kajian*

Kesimpulannya, penggunaan *eKiBTa* telah membuktikan peningkatan yang signifikan terhadap pencapaian pelajar dalam topik Akidah, apabila majoriti pelajar mampu menguasai dan memahami konsep dengan lebih tepat serta mendalam. Dari perspektif pelajar, *eKiBTa* meningkatkan penglibatan aktif dalam pembelajaran, memudahkan pemahaman konsep yang bersifat abstrak, serta menyemai motivasi dan keyakinan untuk mengaplikasikan ilmu yang dipelajari. Selain itu, dari sudut pengajaran dan pembelajaran, *eKiBTa* menyokong pelaksanaan PdP yang lebih interaktif dan berkesan dengan membantu guru menyampaikan kandungan

Akidah secara visual dan digital, sekali gus meningkatkan keberkesanan PdP secara keseluruhan. Kesimpulannya, kajian ini membuktikan bahawa eKiBTa mampu memudahkan pelajar memahami konsep Akidah yang kompleks, meningkatkan penglibatan mereka dalam pembelajaran, serta memperkukuh kualiti pengajaran dan pembelajaran Pendidikan Islam secara menyeluruh.

## Kesimpulan

Kesimpulannya, dapatan kajian ini secara jelas membuktikan bahawa penggunaan laman web *eKiBTa* sebagai bahan bantu mengajar digital memberikan kesan yang signifikan terhadap peningkatan penguasaan konsep Akidah dalam kalangan pelajar Tingkatan dua. Perbandingan keputusan ujian pra dan ujian pasca menunjukkan peningkatan pencapaian yang sangat ketara, apabila purata markah pelajar meningkat daripada 5.16 atau 51.6% dalam ujian pra kepada 9.02 atau 90.2% dalam ujian pasca, iaitu peningkatan sebanyak 74.8% selepas intervensi penggunaan *eKiBTa* dilaksanakan. Dari segi taburan markah, ujian pra memperlihatkan bahawa majoriti pelajar berada pada tahap penguasaan sederhana dan rendah, di mana 40% pelajar memperoleh markah 5, manakala 20% masing-masing mencatatkan markah 6 dan 7, serta 20% lagi berada pada tahap rendah dengan markah 4 dan 2, menunjukkan kefahaman awal pelajar terhadap topik Akidah masih belum menyeluruh dan tidak sekata. Namun begitu, selepas penggunaan *eKiBTa*, keputusan ujian pasca menunjukkan perubahan yang amat positif apabila 96% pelajar mencapai markah tinggi antara 8 hingga 10, dengan 34% memperoleh markah penuh 10 dan 38% mencatatkan markah 9, sekali gus mencerminkan peningkatan tahap penguasaan yang tinggi dan lebih menyeluruh dalam kalangan pelajar. Selain itu, bilangan pelajar yang berada pada tahap penguasaan sederhana telah menurun dengan ketara apabila hanya 4% pelajar memperoleh markah 7 dalam ujian pasca, menunjukkan bahawa penggunaan *eKiBTa* berjaya mengurangkan jurang kefahaman dan membantu pelajar yang sebelum ini lemah untuk meningkatkan pencapaian mereka. Dapatan ini membuktikan bahawa elemen multimedia interaktif, penyampaian kandungan yang tersusun mengikut sukatan KSSM serta pembelajaran kendiri yang fleksibel melalui *eKiBTa* berkesan dalam membantu pelajar memahami konsep Akidah yang bersifat abstrak dan metafizik dengan lebih jelas dan bermakna. Secara keseluruhannya, kajian ini mengesahkan bahawa integrasi *eKiBTa* dalam pengajaran dan pembelajaran Akidah bukan sahaja meningkatkan pencapaian akademik secara signifikan, malah menyokong pembelajaran berpusatkan pelajar selaras dengan prinsip Pembelajaran Abad Ke-21 serta aspirasi pendidikan Islam yang relevan dengan keperluan pendidikan moden.

## Penghargaan

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# HALA TUJU PEMBANGUNAN NUKLEAR IRAN PASCA PERANG ISRAEL 13-24 JUNE 2025

**Mohamad Faisol Keling**
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***Abstrak***: *Serangan Amerika Syarikat (AS) dan Israel ke atas kemudahan nuclear Iran pada 22 Jun 2025 ke atas kemudahan nuclear Fordo, Natanz dan Isfahan telah menimbulkan reaksi global terhadap persoalan kelangsungan program pembangunan nuclear Iran. Pihak AS dan Israel telah mengumumkan kejayaan operasi ketenteraan ke atas Iran dan mendakwa berjaya memusnahkan program nuklear Iran. Kajian ini menggunakan maklumat dan laporan dari pelbagai laporan agensi keselamatan serta laporan media antarabangsa bagi menganalisa kelangsungan program pembangunan nuclear Iran pasca Perang. Serangan AS dan Israel ini walau bagaimanapun telah dipertikaikan berdasarkan maklumat dan laporan agensi dan media antarabangsa yang menunjukan terdapat pelbagai pendapat yang menunjukan kesangsian, perdebatan dan percanggahan maklumat yang menimbulkan persoalan terhadap pengumuman kejayaan oleh AS dan Israel. Berdasarkan maklumat tersebut, ia menunjukan Iran mampu meneruskan program nuklearnya dengan dua kaedah iaitu meneruskan program yang sedia ada kerana ia dipercayai tidak musnah secara total.*

***Kata Kunci***: *Nuklear Iran, Cuban Missile Crisis,*

## Pengenalan

Perang Israel-Iran bermula pada awal 13 Jun 2025 selepas Israel melancarkan serangan ketenteraan ke atas Iran yang dikenali sebagai operasi *Rising Lion* dengan dakwaan bahawa Iran telah menjalankan program nuklear ketenteraan secara rahsia[18]. Dakwaan ini telah dinafikan oleh Iran menafikan mengenai wujudnya elemen ketenteraan dalam program nuklear. Pihak Iran telah bertindak balas dengan melancarkan operasi *True Promise* 3 bagi membalas tindakan Israel pada 13 Jun yang menyasarkan kemudahan ketenteraan Israel[19]. Penafian Iran telah diperkukukhkan dengan kenyataan Ketua Pengarah IAEA Rafael Grossi pada 18 Jun 2025 yang menjelaskan IAEA tidak mempunyai bukti kukuh Iran sedang membangunkan senjata nuklear. Malah dalam laporan CNN pada 17 Jun 2025 menyatakan perisikan AS turut melaporkan Iran tidak membangunkan senjata nuklear[20]. Pada 22 Jun 2025, AS telah mengambil keputusan untuk menyertai kempen ketenteraan Israel ke atas Iran dengan melancarkan Operation Midnight Hammer dengan membedil tiga tapak nuklear Iran iaitu

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Natanz, Fordow dan Isfahan[21]. Operasi *Midnight Hammer* AS dilaksanakan dengan taktik strategik yang mengejutkan dunia dengan kaedah '*fake-out'* yang berjaya mengaburi sistem pertahanan Iran dengan elemen kejutan. Operasi ini dilancarkan pada 21 Jun 2025 dengan sekumpulan pesawat pengebom B-2 dilihat berlepas dari pangkalan di Missouri menuju ke arah Guam, mencetuskan spekulasi bahawa AS sedang membuat persiapan awal di Pasifik. Namun, itu hanyalah umpan kerana sebanyak tujuh pesawat B-2 stealth yang lain telah terbang ke arah timur secara senyap selama 18 jam dengan komunikasi secara minimum dan pengisian minyak di udara bergerak ke Iran[22]. Ketika pesawat menghampiri sasaran, sebuah kapal selam AS melancarkan lebih dua dozen peluru berpandu Tomahawk, manakala jet pejuang AS bertindak untuk mengalih perhatian pertahanan Iran dengan formasi operasi pengeboman. Menurut Jeneral Dan Caine, Pengerusi Ketua Turus Bersama menyatakan Iran langsung tidak sempat melepaskan sebarang tembakan balas kerana sistem pertahanan udara Iran gagal mengesan operasi AS[23]. Majlis Keselamatan Negara Tertinggi Iran (SNSC) pada 24 Jun 2025 telah mengumumkan untuk hentikan perang terhadap Israel dan sekutunya, selepas mendakwa telah memberikan tindak balas memalukan AS dan menjadi teladan terhadap pencerobohan musuh. Manakala Menteri Pertahanan Israel, Israel Katz pada 24 Jun 2025 pula telah mengarahkan operasi ketenteraan berskala besar terhadap Tehran selepas mendakwa Iran melanggar perjanjian gencatan senjata yang dimeterai[24]. Arahan Menteri Pertahanan Israel dikeluarkan selepas tentera Israel mendakwa mengesan pelancaran peluru berpandu balistik oleh Iran ke arah wilayahnya selepas AS mengumumkan gencatan senjata berkuat kuasa[25]. Tentera Israel memintas serangan tersebut dan melancarkan serangan balas ke atas infrastruktur penting Iran termasuk penjara dan kemudahan tenaga[26].

Perdana Menteri Israel, Benjamin Netanyahu telah mengisytiharkan bahawa Israel telah mencapai "kemenangan bersejarah" dan menghapuskan ancaman terhadap Israel dalam perang selama 12 hari dengan Iran pada 25 Jun 2025. Ini kerana Israel telah mendakwa berjaya menyingkirkan ancaman nuklear Iran serta ribuan peluru berpandu yang disasarkan ke arah Israel[27]. Perdana Menteri Israel turut berima kasih kepada Donald Trump atas sokongan luar biasa dan menyifatkannya sebagai "sahabat terbesar Israel yang pernah menduduki White House[28]". Malah menyatakan serangan Israel ke atas Iran juga adalah atas arahan Presiden Donald Trump, tentera AS telah memusnahkan fasiliti nuklear Fordow, manakala Israel menyerang puluhan tapak lain termasuk makmal dan kilang kepala peledak serta

[21] Ibid
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[26] Ibid
[27] Anthony Celso (2024) Iran's Proxy War Strategy, Orbis. Vol 68 (3). pp416-437 https://doi.org/10.1016/j.orbis.2024.05.006 and refer_Konflik Israel-Iran: Netanyahu dakwa Israel capai kemenangan bersejarah, Astro Awani, 25 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-netanyahu-dakwa-israel-capai-kemenangan-bersejarah-526594
[28] Ibid

menghapuskan kepimpinan tertinggi Iran dalam satu serangan yang membabitkan sasaran ke atas tiga ketua turus dan pegawai kanan lain[29].

Perang Israel-Iran telah memberikan kesan kemusnahan kepada kedua-dua negara. Kementerian Kesihatan Iran telah mengesahkan sekurang-kurangnya 610 rakyatnya terbunuh dan 4,746 lagi cedera dalam tempoh 12 hari serangan udara oleh Israel sejak 13 Jun 2025 menjadikan krisis kemanusiaan paling buruk dalam sejarah moden Iran. Sebanyak 971 mangsa masih dirawat di hospital, manakala 687 telah menjalani pembedahan. Iran juga turut menghadapi kemusnahan infrastruktur perubatan dengan tujuh buah hospital, enam pangkalan kecemasan, empat klinik dan sembilan ambulans dilaporkan rosak atau musnah. Kementerian Kesihatan Iran menyifatkan angka korban ini sebagai bukti bahawa serangan Israel menyasarkan kawasan awam dan bukan hanya kemudahan ketenteraan[30].

**Analisa: Adakah Iran Mampu Meneruskan Program Nuclearnya?**

Serangan US ke atas tiga tapak nuklear Iran termasuk kemudahan pengayaan uranium bawah tanah penting di Fordo, Natanz dan Isfahan pada 22 Jun 2025 telah menimbulkan persaoalan mengenai adakah Iran mampu meneruskan program pembangunan nuklearnya? Ini kerana selepas serangan AS, Presiden Donald Trump telah mengumumkan kejayaan menyerang dan memusnahkan kemudahan nuclear Iran. Malah Trump menyatakan "*Iran kini mesti bersetuju untuk menamatkan perang ini*" dan menyifatkan serangan tersebut sebagai detik "bersejarah" bagi AS, Israel dan dunia[31]. Persoalannya adalah adakah benar-benar AS dan Israel berjaya memusnahkan program pembangunan nuclear Iran dalam erti kata yang sebenar?

***Keupayaan Iran Membangunkan Semula Nuklear***

Pengumuman kejayaan melakukan serangan ke atas kemudahan nuclear Iran pada 22 Jun 2025 telah menimbulkan persoalan, kesangsian dan perdebatan antarabangsa. Adakah serangan tersebut benar-benar memusnahkan kemampuan Iran? Menurut Ketua CIA, John Ratcliffe pada 26 Jun 2025 telah menyatakan bahawa risikan terkini yang dijalankan oleh CIA menunjukkan kemusnahan yang ketara sehingga memerlukan bertahun lamanya untuk dibangunkan semula[32]. Namun menurut Penasihat Kanan kepada Pemimpin Tertinggi Iran Ayatollah Ali Khamenei telah mengesahkan bahawa simpanan uranium yang diperkayakan

[29] Ibid
[30] Iran sahkan 610 terbunuh, hampir 5,000 cedera akibat serangan Israel sejak 13 Jun, Astro Awani, 24 Jun 2025, https://www.astroawani.com/berita-dunia/iran-sahkan-610-terbunuh-hampir-5000-cedera-akibat-serangan-israel-sejak-13-jun-526563
[31] AS serang tiga tapak nuklear Iran, Trump sifatkan serangan sangat Berjaya, AFP, Berita Harian, 22 Jun 2025, https://www.bharian.com.my/dunia/amerika/2025/06/1411021/serang-tiga-tapak-nuklear-iran-trump-sifatkan-serangan-sangat-berjaya
[32] Nathan Williams and Brandon Livesay (2025), CIA says intelligence indicates Iran nuclear programme 'severely damaged', BBC News, 25 June 2025, **https://www.bbc.com/news/live/c20xel1e97gt#:~:text=Middle%20East-,CIA%20says%20intelligence%20indicates%20Iran%20nuclear%20programme%20'severely%20damaged',Lyse%20Doucet%20from%20inside%20Iran** and refer Konflik Israel-Iran: Apa kita tahu setakat ini? Op.cit **Also refer** Trump dakwa tapak nuklear Iran 'dimusnahkan', perisikan AS kata sebaliknya, Astro Awani, 26 Jun 2025, **https://www.astroawani.com/berita-dunia/trump-dakwa-tapak-nuklear-iran-dimusnahkan-perisikan-kata-sebaliknya-526778**

Iran selamat meskipun AS menyerang tiga tapak nuklear pada 22 Jun 2025[33]. Malah stesen penyiaran rasmi Iran, *Islamic Republic of Iran Broadcasting* (IRIB) turut melaporkan bahawa kesemua lokasi yang menjadi sasaran telah dikosongkan sebelum serangan dan bahan nuklear sensitif dipindahkan ke lokasi selamat[34]. Malah menurut Ketua AEOI, Mohammad Eslami pada 24 Jun 2025 menyatakan bahawa persiapan pemulihan telah dijangka dilakukan lebih awal bagi memastikan tiada gangguan terhadap pengeluaran atau perkhidmatan nuclear. Ini bermaksud Iran telah mengambil langkah awal untuk menilai dan memulihkan kemudahan yang terjejas akibat serangan AS dan Israel. Ia telah menggambarkan pendirian tegas Iran untuk tidak tunduk kepada tekanan antarabangsa termasuk dari AS yang telah berulang kali menggesa Iran agar menghentikan pengayaan uranium ke tahap tinggi[35].

Menurut Ahli Parlimen Iran pada 26 Jun 2025 telah menyatakan bahawa kerosakan kemudahan nuklear Iran dianggap "tidak serius" dan hanya melibatkan bahagian permukaan yang boleh dipulihkan. Ini diperkuatkan lagi dengan pengumuman kerajaan Iran bahawa tiada kebocoran bahan radioaktif berlaku[36]. Ini jelas menunjukan sekiranya serangan yang menggunakan bom bunker-buster seberat 30,000 paun telah berjaya menghasilkan kerosakan besar, maka pastinya ia sekurang-kurang menjejaskan kawasan sekitar dengan kesan radioaktif seperti mana yang berlaku di Chernobyl pada tahun 1986 dan Hiroshima dan Nagasaki pada Ogos 1945. Namun sehingga kini, belum ada laporan mengenai kesan radiasi di kawasan tapak fasiliti yang didakwa telah rosak. Kementerian Kesihatan Iran mengesahkan tiada kebocoran radiasi berlaku di sekitar tapak nuklear Fordow, Natanz dan Isfahan selepas serangan udara oleh AS dan Israel[37]. Malah terdapat laporan eksklusif *CNN* berdasarkan sumber perisikan Pentagon menjelaskan penilaian awal perisikan AS mendapati bahawa serangan udara ke atas tiga kemudahan nuklear utama Iran tidak memusnahkan komponen teras program nuclear[38]. Ini bermaksud Iran masih berpeluang untuk meneruskan program pembangunan nuklearnya pasca perang.

### *Percanggahan Laporan Agensi Dan Antarabangsa Dengan Kenyataan Donald Trump*

Kesangsian terhadap pengumuman kejayaan AS dan Israel memusnahkan kemudahan nuclear Iran ini turut membabitkan laporan penilaian oleh CIA yang menyatakan serangan AS dan Israel hanya menyebabkan kerosakan teruk pada struktur atas tanah dan sistem kuasa, manakala stok uranium dan kebanyakan kemudahan kekal utuh. Ia adalah selaras dengan kenyataan penasihat pemimpin tertinggi Iran yang menegaskan bahawa simpanan uranium masih

[33] **Michael Young** (2025), Iran's Nuclear Program Has Survived, Diwan, July 23, 2025, **https://carnegieendowment.org/middle-east/diwan/2025/07/irans-nuclear-program-has-largely-survived?lang=en**

[34] Konflik Israel-Iran: Penasihat pemimpin tertinggi Iran tegas simpanan uranium masih selamat, Bernama, 23 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-penasihat-pemimpin-tertinggi-iran-tegas-simpanan-uranium-masih-selamat-526300

[35] Iran tekad teruskan program nuklear walaupun diancam AS, Astro Awani, 24 Jun 2025, https://www.astroawani.com/berita-dunia/iran-tekad-teruskan-program-nuklear-walaupun-diancam-526552

[36] Konflik Israel-Iran: Apa kita tahu setakat ini?Astro Awani, 26 Jun 2025, https://www.astroawani.com/berita-dunia/terkini-konflik-israeliran-apa-kita-tahu-setakat-ini-526196

[37] Konflik Israel-Iran: Apa kita tahu setakat ini? Op.cit

[38] Natasha Bertrand, Katie Bo Lillis and Zachary Cohen, (2025). Exclusive: Early US intel assessment suggests strikes on Iran did not destroy nuclear sites, sources say, CNN, June 25, 2025, **https://edition.cnn.com/2025/06/24/politics/intel-assessment-us-strikes-iran-nuclear-sites**

selamat[39]. Malah CIA menyatakan serangan tersebut hanya melengahkan proses pembangunan nuclear Iran untuk selama beberapa bulan. Laporan ini jelas bertentangan dengan dakwaan Presiden Donald Trump bahawa kemudahan nuclear Iran telah "dihapuskan sepenuhnya." Malah pakar keselamatan memberi amaran bahawa tindakan ketenteraan AS dan Israel akan lebih meningkatkan keazaman politik Iran untuk mempercepatkan program nuklearnya, walaupun kapasiti teknikalnya terjejas, namun ia hanya buat sementara waktu[40]. Manakala menurut laporan *The New York Times,* serangan tersebut hanya melengahkan kemajuan program berkenaan selama "beberapa bulan sahaja". Laporan-laporan agensi dan media antarabangsa ini telah mempengaruhi jurucakap White House, Karoline Leavitt pada 25 Jun 2025 menjelaskan laporan kegagalan sebagai tidak tepat dan mendakwa dokumen penilaian tersebut diklasifikasikan sebagai "rahsia besar negara."

*"Penilaian yang kononnya disebut itu adalah tidak benar sama sekali dan telah diklasifikasikan sebagai 'top secret', namun tetap dibocorkan kepada CNN oleh individu tidak dikenali dalam komuniti risikan yang kami anggap sebagai 'petualang bertaraf bawahan'."*[41]

Walaupun laporan agensi dan media antarabangsa telah dinafikan namun di sebalik penafian dan penolakan laporan kegagalan operasi ketenteraan AS dan Israel memusnahkan program nuclear Iran, ia membuktikan bahawa pihak White House telah mengesahkan kewujudan penilaian oleh agensi keselamatan terhadap operasi ketenteraan AS dan Israel pada 22 Jun 2025.

***Tindakan Donald Trump Menghadkan Maklumat Selepas Kebocoran Laporan Sulit***

Ketidakyakinan terhadap pengumuman kejayaan AS dan Israel memusnahkan kemudahan nuclear Iran ini turut membabitkan tindakan Presiden Donald Trump pada 26 Jun 2025 telah merancang untuk mengehadkan perkongsian maklumat risikan sulit dengan Kongres selepas laporan awal mengenai kesan serangan ke atas kemudahan nuklear Iran telah bocor kepada media. Kebocoran maklumat sulit tersebut adalah melibatkan penilaian awal oleh DIA menunjukkan serangan udara AS pada 21 Jun 2025 yang melaporkan hanya menjejaskan program nuklear Iran selama beberapa bulan yang jauh berbeza daripada dakwaan Trump bahawa kemudahan tersebut telah "dimusnahkan sepenuhnya". Laporan tersebut telah dimuat naik ke sistem CAPNET yang merupakan platform khas untuk berkongsi maklumat sulit dengan Kongres telah bocor dalam masa kurang 24 jam yang telah mencetuskan kemarahan di White House. Keputusan untuk mengambil langkah mengehadkan akses kepada CAPNET mencetuskan ketegangan baharu dengan ahli Kongres, khususnya dari Parti Demokrat, yang sebelum ini sudah tidak berpuas hati kerana tidak diberi taklimat sebelum operasi ketenteraan

[39] CIA says Iran's nuclear sites were "severely damaged" in US strikes, contradicting Pentagon leak, The New York Times, Jun 26, 2025, https://www.nytimes.com/2025/06/24/us/politics/iran-nuclear-sites.html
[40] Konflik Israel-Iran: Serangan AS gagal musnahkan kemudahan nuklear Iran secara menyeluruh – CNN, Astro Awani, 25 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-serangan-gagal-musnahkan-kemudahan-nuklear-iran-secara-menyeluruh-cnn-526595
[41] White House nafi laporan risikan dakwa tapak nuklear Iran tidak musnah, Agensi, 25 Jun 2025, https://www.astroawani.com/berita-dunia/white-house-nafi-laporan-risikan-dakwa-tapak-nuklear-iran-tidak-musnah-526597

dilancarkan[42]. Tindakan ini membuktikan terdapat maklumat sebenar yang cuba disembunyikan oleh AS di sebalik pengumuman kejayaan memusnahkan program nuclear Iran.

***Kenyataan IAEA Mengenai Kemampuan Iran***

Pada 29 Jun 2025, Ketua Agensi IAEA, Rafael Grossi telah mengumumkan bahawa IAEA menjangkakan Iran mampu memulakan semula pengeluaran uranium diperkayakan dalam tempoh beberapa bulan walaupun beberapa kemudahan nuklear Iran mengalami kerosakan akibat serangan oleh AS dan Israel. IAEA telah mengesahkan bahawa pintu masuk ke terowong bawah tanah di tapak nuklear Isfahan mengalami kerosakan namun tidak menyatakan mengenai kemusnahan secara total akibat serangan udara AS[43]. Ini kerana sebahagian daripada infrastruktur nuklear Iran masih berfungsi, sekali gus membolehkan beberapa kemudahan nuclear dapat beroperasi semula bagi menjalankan pengayaan uranium. Presiden AS, Donald Trump, mendakwa program nuklear Iran telah "mundur beberapa dekad". Namun menurut Ketua Agensi IAEA menegaskan "Sebahagiannya masih utuh.". *"Dalam beberapa bulan… atau mungkin lebih singkat mereka (Iran) boleh kembali memutarkan beberapa rangkaian sentrifug[44] untuk menghasilkan uranium diperkayakan"*[45]. Ketua Agensi IAEA juga menjelaskan mengenai persoalan sama ada Iran sempat memindahkan simpanan uranium diperkayakan seberat kira-kira 408.6-kilogram (bersamaan 900 paun) sebelum serangan berlaku. Uranium berkenaan telah diperkayakan sehingga 60 peratus melebihi tahap untuk kegunaan awam, tetapi masih di bawah tahap bagi menghasilkan senjata. Sekiranya dimurnikan sepenuhnya, ia cukup untuk menghasilkan lebih sembilan bom nuklear[46]. Ini bermaksud Iran memiliki keupayaan untuk meneruskan program pembangunan nuklearnya.

***Iran Sudah Memiliki Pengetahuan, Kemudahan Dan Pengalaman***

Serangan AS dan Israel ke atas Iran tidak bermakna ia telah menghapuskan program nuclear Iran. Ini kerana Iran telah memiliki pengetahuan, saintis, kemudahan serta pengalaman yang terbukti berjaya melakukan *uranium enrichment* sehingga 60%[47]. Pada 5 Februari 2023, Ketua Agensi IAEA, Rafael Grossi menyatakan mengenai kebimbangan perubahan rahsia peralatan di loji pengayaan uranium Fordo yang dilakukan oleh Iran. Menurut IAEA, Iran melakukan ubah suai secara besar-besaran yang menghubungkan antara dua kelompok emparan yang diperkaya uranium sehingga 60 peratus di Fordo Fuel Enrichment Plant, (FFEP) tanpa memberi notis kepada IAEA. Pada 21 Januari 2023 IAEA menyatakan hasil pemeriksaan ke atas tapak nuclear Fordo mendapati pembangunan dua lata emparan IR-6 berbeza daripada yang diisytiharkan Iran[48] sebelum ini. Pada 7 Disember 2024 Iran telah didakwa merancang untuk

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[42] Konflik Israel-Iran: Trump perketat maklumat sulit selepas serangan Iran, Astro Awani, 26 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-trump-perketat-maklumat-sulit-selepas-serangan-iran-526774

[43] Konflik Israel-Iran: Apa kita tahu setakat ini? Op.cit.

[44] Sila lihat penjelasan Centrifuges dalam Jon Gambrell (2024) Iran To Begin Enriching Uranium With Thousands Of Advanced Centrifuges, UN Watchdog Says, AP, November 30, 2024 https://apnews.com/article/iran-nuclear-iaea-mideast-wars-israel-7450481f9e42ea5b786c5d672ec382a1

[45] ***Iran berupaya perkaya uranium semula dalam tempoh beberapa bulan - Ketua IAEA, Agensi, 29 Jun 2025, https://www.astroawani.com/berita-dunia/iran-berupaya-perkaya-uranium-semula-dalam-tempoh-beberapa-bulan-ketua-iaea-527171***

[46] ***Ibid***

[47] Mark Fitzpatrick (2025) Op.cit

[48] Iran kecam PPB bangkit kebimbangan ubah suai nuclear, 5 Februari 2023, **https://www.buletintv3.my/dunia/iran-kecam-ppb-bangkit-kebimbangan-ubah-suai-nuklear/**

meningkatkan pengeluaran uranium secara signifikan yang membolehkan Iran membina senjata nuklear. Ini kerana terdapat laporan yang mendedahkan reka bentuk terkini di kilang pengeluaran unsur nadir bumi menunjukkan telah diubah suai yang dapat meningkatkan pengeluaran uranium diperkayakan sehingga 60 peratus kepada lebih 34 kilogram sebulan, berbanding 4.7 kilogram. IAEA menyatakan uranium yang diperkayakan oleh Iran mencapai hingga 60 peratus menghampiri tahap 90 peratus yang diperlukan untuk pengeluaran senjata nuklear. Namun Iran telah menafikan hasrat meningkatkan pengeluaran uranium itu bagi membangunkan senjata nuklear. Iran mempertahankan haknya terhadap tenaga nuklear untuk tujuan damai dan menolak sebarang dakwaan mengenai pembangunan senjata. Iran telah menjadi satu-satunya negara bukan pemilik senjata nuklear yang memperkaya uranium hingga tahap melebihi 50 peratus.

***Tindakan Unilateral AS Mendapat Tentangan Dari Dalam Negara***

Kempen memerangi program pembangunan nuclear Iran memiliki peluang untuk dibangunkan berikutan Presiden Donald Trump sendiri menghadapi tentangan dari dalam negara sendiri[49]. Ini kerana terdapat Ahli Kongres Thomas Massie dari Kentucky dan Senator Tim Kaine dari Virginia telah mendakwa Presiden Donald Trump melancarkan serangan udara ke atas Iran tanpa kebenaran rasmi daripada Kongres. Ia telah mencetuskan perdebatan hangat mengenai kuasa perlembagaan dan pembabitan ketenteraan AS di luar negara. Ini kerana memperkenalkan rang undang-undang di Dewan Perwakilan dan Senat menetapkan sebarang tindakan ketenteraan terhadap Iran memerlukan kelulusan Kongres terlebih dahulu. Di dalam Perlembagaan AS, ia memberikan kuasa eksklusif kepada Kongres untuk mengisytiharkan perang dan tindakan unilateral presiden yang melakukan tindakan tanpa kebenaran Kongres adalah melanggar prinsip perlembagaan AS[50].Selain itu, beberapa tokoh lain seperti Bernie Sanders dan Alexandria Ocasio-Cortez menuntut pertanggungjawaban dan menyifatkan tindakan Trump sebagai “tidak berperlembagaan”. Ahli Kongres Thomas Massie (R-Kentucky) dan Ro Khanna (D-California) turut mengemukakan usul dwipartisan bagi mengehadkan tindakan ketenteraan ke atas Iran tanpa persetujuan Kongres kerana menurut Perlembagaan AS hanya Kongres boleh mengisytiharkan perang.

Bagi pihak Republikan pula menyokong tindakan Donald trump atas dasar keselamatan negara. Beberapa tokoh Republikan mempertahankan tindakan presiden seperti Speaker Dewan, Mike Johnson menyatakan keputusan melakukan serangan sebagai tindakan wajar untuk mengekang keupayaan nuklear Iran, manakala Senator John Thune menyatakan sokongan penuh atas dasar keselamatan nasional. Pentadbiran Trump pula menegaskan bahawa serangan itu adalah langkah pencegahan terhadap ancaman strategik dan tertakluk di bawah kuasa eksekutif presiden. Namun bagi pengkritik berpendapat bahawa Iran tidak menimbulkan ancaman serta-merta, dan tindakan unilateral seperti ini melampaui batas kuasa eksekutif. Mereka menyatakan bahawa keputusan seumpama ini boleh mendorong negara ke arah konflik berkepanjangan tanpa mandat rakyat[51].

[49] Makar, D. T., Pillah, T. P., (2025). Twelve Days of Escalation: Analyzing the June 2025 Israel Iran War and U.S. Precision Strikes on Nuclear Infrastructure. IRASS Journal of Arts, Humanities and Social Sciences, 2(7)1-12. https://irasspublisher.com/assets/articles/1751440309.pdf

[50] Trump serang Iran tanpa kebenaran Kongres - Ahli Parlimen AS, Agensi, Berita harian,22 Jun 2025, **https://www.bharian.com.my/dunia/amerika/2025/06/1411037/trump-serang-iran-tanpa-kebenaran-kongres-ahli-parlimen**

[51] Konflik Israel-Iran: Ahli Kongres AS terus pertikai keabsahan serangan Trump ke atas Iran, Astro Awani, 23 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-ahli-kongres-terus-pertikai-keabsahan-serangan-trump-ke-atas-iran-526307

***Kegagalan Meruntuhkan Kerajaan Semasa Iran***

Program pembangunan nuclear Iran memiliki peluang apabila AS dan Israel gagal menjatuhkan rejim Iran ketika ini. Pada 23 Jun 2025, Presiden Donald Trump telah mencetuskan spekulasi perubahan rejim di Iran selepas menyatakan di *Truth Social* bahawa jika rejim Iran ketika kini gagal "menjadikan Iran hebat semula", maka perubahan mungkin diperlukan. Donald Trump telah mengeluarkan kenyataan melalui platform Truth Social yang mencetuskan spekulasi berhubung kemungkinan dasar perubahan rejim di Iran. Donald Trump telah memuatkan catatan yang tular "*Tidak wajar secara politik untuk guna istilah 'Perubahan Rejim', tetapi jika Rejim Iran yang ada sekarang tidak mampu MENJADIKAN IRAN HEBAT SEMULA, kenapa tidak berlaku perubahan rejim???"* Trump menyatakan bahawa jika Iran enggan memilih jalan damai, ia akan berdepan "tragedi yang jauh lebih besar daripada apa yang telah berlaku"[52]. Catatan ini diterbitkan selepas ucapan rasmi Donald Trump dari White House apabila menyifatkan serangan udara ke atas fasiliti nuklear Iran di Fordow, Natanz dan Isfahan sebagai "kejayaan ketenteraan yang spektakular". Kenyataan tersebut menunjukan bawa sasaran sebenar AS bukan sekadar infrastruktur nuklear, tetapi juga struktur pemerintahan Iran[53]. Namun ia gagal mempengaruhi rakyat Iran apabila Presiden Iran, Masoud Pezeshkian menyertai ribuan rakyat Iran dalam satu perhimpunan besar di Dataran Enghelab. Khamenei menyifatkan tindakan Israel sebagai kesalahan besar yang tidak boleh dibiarkan tanpa balasan[54]. Masoud Pezeshkian pada 25 Jun 2025 telah mengumumkan secara rasmi berakhirnya "perang 12 hari" dengan Israel dan memuji rakyat Iran kerana terus menunjukkan perpaduan dan ketabahan dalam menghadapi pencerobohan Israel[55].

*"Hari ini, setelah ketabahan wira bangsa kita, yang keazamannya mencipta sejarah, kita menyaksikan terciptanya gencatan senjata dan pengakhiran perang 12 hari ini yang dikenakan oleh 'adventurisme dan provokasi' Israel"*[56].

Pada 27 Jun 2025 Donald Trump telah mengkritik Ayatollah Ali Khamenei dan membatalkan rancangan untuk menarik balik sekatan terhadap Tehran serta menyatakan tidak menolak kemungkinan untuk melancarkan serangan bom ke atas Iran kali kedua sekiranya Iran terus meningkatkan uranium ke tahap membimbangkan. Namun ia tidak mempengaruhi Iran yang mana Ayatollah Ali Khamenei pernah mendakwa Iran telah "menampar muka Amerika" dengan melancarkan serangan balas ke atas sebuah pangkalan tentera utama AS di Qatar selepas serangan tersebut sambil menegaskan bahawa Iran tidak akan tunduk kepada tekanan asing[57]. Ayatollah Ali Khamenei juga menjelaskan serangan udara AS ke atas Iran "tidak membawa kesan besar" kepada program nuklear Iran.

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[52] Trump asks why there would not be 'regime change' in Iran, Reuters, June 23, 2025 **https://www.reuters.com/world/trump-asks-why-there-would-not-be-regime-change-iran-2025-06-22/**

[53] Op.cit

[54] Konflik Israel-Iran: Apa kita tahu setakat ini? Op.cit

[55] Konflik Israel-Iran: Presiden Masoud isytihar 'perang 12 hari' tamat, Sinar Harian, 25 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-presiden-masoud-isytihar-perang-12-hari-tamat-526642

[56] Ibid

[57] Trump pertimbang bom Iran sekali lagi, batal rancangan pelonggaran sekatan, Agensi, 28 Jun 2025, https://www.astroawani.com/berita-dunia/trump-pertimbang-bom-iran-sekali-lagi-batal-rancangan-pelonggaran-sekatan-527056

*"Republik Islam menang dan dalam tindakan balasnya, memberi tamparan hebat kepada muka Amerika… Sebahagian besar tapak nuklear masih berfungsi, dan Iran akan meneruskan program nuklearnya"*[58].

Malah Ayatollah Ali Khamenei turut menyatakan Israel hampir mengalami kehancuran akibat serangan balas Iran, namun berjaya diselamatkan dengan campur tangan AS. Presiden Pezeshkian juga menuduh AS bekerjasama secara langsung dengan Israel selepas gagal menghalang kekuatan pertahanan Iran melalui tekanan ekonomi dan diplomatik[59]. Pada 29 Jun 2025, ratusan ribu rakyat Iran membanjiri jalan-jalan di ibu kota Tehran untuk menghadiri upacara pengebumian kenegaraan bagi memperingati pegawai tinggi tentera, saintis nuklear dan orang awam yang terbunuh dalam konflik berdarah selama 12 hari antara Iran dan Israel[60]. Pihak berkuasa Iran mendakwa lebih 30 komander kanan dan 627 orang awam terkorban dalam serangan tersebut. Antara tokoh utama yang terbunuh dalam konflik yang bermula pada 13 Jun ialah:-

Jeneral Mohammad Bagheri, Ketua Turus Angkatan Tentera
Jeneral Hossein Salami, Komander Tertinggi Kor Pengawal Revolusi Islam (IRGC)
Jeneral Amir-Ali Hajizadeh, Ketua Bahagian Aeroangkasa IRGC
Mohammad Mehdi Tehranchi, saintis nuklear terkemuka
Beberapa pegawai kanan lain serta ahli keluarga mereka[61]

Menurut Ali Larijani Penasihat kanan kepada Pemimpin Tertinggi Iran pada 30 Jun 2025 menyatakan Israel telah gagal mencapai matlamat utamanya untuk menumbangkan kepimpinan Iran dalam konflik bersenjata selama 12 hari. Larijani mendedahkan bahawa beliau sendiri telah menerima ancaman untuk meninggalkan Iran dalam masa 12 jam sebelum konflik bermula atau berdepan nasib yang sama seperti pegawai kanan lain yang terbunuh dalam serangan udara Israel. Israel telah merancang untuk menyerang mesyuarat Majlis Keselamatan Negara Iran yang dihadiri oleh ketua tiga cabang kuasa negara, termasuk Pemimpin Tertinggi Ayatollah Ali Khamenei[62].

***Sokongan Antarabangsa Terhadap Iran***

Program nuklear Iran telah mendapat perhatian dan simpati daripada pelbagai negara dan badan antarabangsa termasuk United Nations (UN)[63]. Pada 22 Jun 2025 Setiausaha PBB, Antonio

[58] Khamenei tegaskan Iran 'tidak akan sesekali tunduk' kepada AS, Agensi, Astro Awani, 27 Jun 2025, https://www.astroawani.com/berita-dunia/khamenei-tegaskan-iran-tidak-akan-sesekali-tunduk-kepada-526939
[59] Konflik Israel-Iran: Presiden Pezeshkian tegaskan kemenangan Iran hasil tekad rakyat, Astro Awani, 25 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-presiden-pezeshkian-tegaskan-kemenangan-iran-hasil-tekad-rakyat-526601
[60] Presiden Iran zahir penghargaan kepada rakyat yang hadir hormati mangsa serangan Israel, Agensi, 29 Jun 2025, https://www.astroawani.com/berita-dunia/presiden-iran-zahir-penghargaan-kepada-rakyat-yang-hadir-hormati-mangsa-serangan-israel-527167
[61] Iran isytihar hari berkabung negara sempena pengebumian komander tertinggi, Astro Awani, 28 Jun 2025, https://www.astroawani.com/berita-dunia/iran-isytihar-hari-berkabung-negara-sempena-pengebumian-komander-tertinggi-527084
[62] Konflik Israel-Iran: Larijani dakwa Israel gagal tumbangkan Iran, Astro Awani, 30 Jun 2025, **https://www.astroawani.com/berita-dunia/konflik-israeliran-larijani-dakwa-israel-gagal-tumbangkan-iran-527288**
[63] Andrew A. Michta (2024), America Needs a Grand Strategy, Orbis. Vol 68 (4). pp 517-525 https://doi.org/10.1016/j.orbis.2024.09.002

Guterres menyatakan kebimbangan mendalam terhadap tindakan ketenteraan AS ke atas Iran yang berisiko menjadi tidak terkawal, dengan kesan buruk yang besar terhadap orang awam dan rantau Asia Barat.

*"Saya amat bimbang dengan penggunaan kekerasan oleh AS terhadap Iran hari ini. Ini adalah satu peningkatan bahaya di rantau yang sudah pun berada di ambang konflik dan satu ancaman langsung kepada keamanan serta keselamatan global. Saya menyeru semua negara anggota untuk menurunkan ketegangan dan mematuhi tanggungjawab mereka di bawah Piagam PBB serta undang-undang antarabangsa. Tiada penyelesaian ketenteraan. Satu-satunya jalan ke hadapan adalah melalui diplomasi. Satu-satunya harapan adalah keamanan"*[64]
Manakala Pejabat Hak Asasi Manusia PBB turut mengecam serangan udara Israel ke atas Penjara Evin di Tehran, menyifatkannya sebagai pelanggaran serius undang-undang kemanusiaan antarabangsa.

Negara kuasa veto Presiden Rusia Vladimir Putin pula telah menyifatkan serangan ke atas Iran sebagai "pencerobohan tanpa provokasi" dan tiada sebarang justifikasi pada 23 Jun 2025. Rusia dan Iran mempunyai hubungan "lama, baik dan boleh dipercayai", dan pendirian Moscow berusaha memberikan bantuan kepada rakyat Iran. Rusia turut mengecam "tindakan agresif oleh Israel dan AS"[65]. Menteri Luar Iran, Abbas Araghchi, mengumumkan bahawa beliau akan mengadakan rundingan "serius" dengan Presiden Rusia, Vladimir Putin[66]. Menteri Luar Iran, Abbas Araghchi pada 23 Jun 2025, mengumumkan bahawa mengadakan rundingan "serius" dengan Presiden Rusia, Vladimir Putin, susulan serangan udara AS ke atas tiga tapak nuklear utama Iran. Ia menyatakan tindakan Washington sebagai "pelanggaran besar terhadap Piagam PBB, undang-undang antarabangsa dan Perjanjian Non-Proliferasi Nuklear (NPT)"[67]. Rundingan Iran-Rusia juga adalah untuk menyelaraskan pendirian strategik bersama Rusia dan membincangkan tindak balas diplomatik serta keselamatan serantau[68]. Rusia merupakan sekutu rapat apabila Iran telah menerima dron ketenteraan dari Iran untuk digunakan dalam konflik di Ukraine, manakala Iran pula mendapat sokongan teknikal dalam program nuklear awamnya. Rusia sebelum ini pernah menyuarakan penentangan terhadap sebarang usaha perubahan rejim di Iran dan memberi amaran bahawa tindakan sedemikian boleh mencetuskan ketidakstabilan ekstrem di rantau Timur Tengah[69].

Negara kuasa veto China turut mengutuk keras tindakan AS yang menyasarkan tapak nuklear Iran yang dilindungi IAEA. Kementerian Luar China berkata serangan itu "secara serius melanggar tujuan dan prinsip PBB" serta memburukkan lagi ketegangan di Timur Tengah dan

[64] PBB kecam serangan AS ke atas Iran, beri amaran konflik boleh jadi tidak terkawal, **AGENSI**, Berita Harian, 22 Jun 2025, **https://www.bharian.com.my/dunia/lain-lain/2025/06/1411100/pbb-kecam-serangan-ke-atas-iran-beri-amaran-konflik-boleh-jadi-tidak**
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[66] Konflik Israel-Iran: Apa kita tahu setakat ini? Op.cit
[67] Konflik Israel-Iran: Lawatan Araghchi ke Rusia akan jadi 'serius' selepas serangan AS, Astro Awani, 23 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-lawatan-araghchi-ke-rusia-akan-jadi-serius-selepas-serangan-526294
[68] Ibid
[69] Ibid

menyeru semua pihak mengutamakan dialog[70]. Pada 24 Jun 2025 China memberi amaran bahawa tindakan AS melancarkan serangan ke atas kemudahan nuklear Iran bukan sahaja menjejaskan kestabilan rantau Asia Barat, malah turut mencemarkan kredibiliti AS di peringkat antarabangsa. Walaupun Iran mengalami kerosakan akibat serangan tersebut, kredibiliti AS sebagai sebuah negara khususnya dalam peranannya sebagai pihak dalam sebarang rundingan antarabangsa turut terjejas. Terdapat laporan akhbar China, *Global Times* melaporkan campur tangan ketenteraan oleh kuasa luar tidak pernah membawa kedamaian, sebaliknya, hanya akan "mendalamkan kebencian serta luka trauma serantau"[71]. China mengecam serangan Israel sebagai pelanggaran kedaulatan Iran dan menyeru semua pihak bertenang serta mengelakkan tindakan ketenteraan lanjut. China dan Rusia turut mengecam Israel di Majlis Keselamatan PBB kerana tidak menyertai Perjanjian NPT dan mengelak daripada pemeriksaan penuh IAEA[72]. Rusia, China dan Pakistan turut mengemukakan draf resolusi kepada Majlis Keselamatan PBB yang mengecam serangan oleh AS dan Israel ke atas kemudahan nuklear Iran.[73] China menyokong usaha Iran dalam memelihara kedaulatan dan keselamatan negara, mewujudkan gencatan senjata yang mendorong pengurangan ketegangan di Asia Barat[74].

Negara kuasa nuklear Pakistan dan India turut memberikan sokongan kepada Iran. Menteri Pertahanan Pakistan, Khawaja Muhammad Asif telah mengecam sikap berat sebelah kuasa Barat dan IAEA terhadap Iran dalam isu nuklear, serta menyifatkan serangan AS dan Israel telah melanggar undang-undang antarabangsa[75]. Perdana Menteri Pakistan Shehbaz Sharif pada 5 Julai 2025 turut mengulangi solidariti Pakistan "tidak berbelah bahagi" kepada Iran dan menghargai kepimpinan Pezeshkian yang "berani dan bijaksana" semasa serangan Israel terhadap Iran dan mengalu-alukan gencatan senjata. "*Angkatan tentera ketidakstabilan dan huru-hara terus menyahstabilkan rantau kita untuk agenda geopolitik mereka*," dan menyifatkan serangan Israel ke atas Iran adalah "tidak sah di sisi undang-undang, tidak ada justifikasi, dan tidak wajar"[76]. Pakistan turut mengutuk serangan itu sebagai pelanggaran norma antarabangsa dan menegaskan hak Iran untuk mempertahankan diri di bawah Piagam PBB. Islamabad menyuarakan kebimbangan terhadap situasi yang semakin buruk dan menggesa semua pihak bersabar. Manakala Perdana Menteri India Narendra Modi telah berbincang dengan Presiden Iran dan menggesa penamatan segera ketegangan.

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[70] Konflik Israel-Iran: Serangan bom AS ke atas tapak nuklear Iran cetus kecaman seluruh dunia, Bernama, 22 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-serangan-bom-ke-atas-tapak-nuklear-iran-cetus-kecaman-seluruh-dunia-526267

[71] Amaran China pada AS: Serangan ke atas Iran jejas kredibiliti Washington, situasi berisiko di luar kawalan, Agensi, 24 Jun 2025, https://www.astroawani.com/berita-dunia/amaran-china-pada-serangan-ke-atas-iran-jejas-kredibiliti-washington-situasi-berisiko-di-luar-kawalan-526451

[72] Umar Farooq, Muhammad Saqib and Ghulam Mustafa (2025) Iran's Nuclear Ambitions: A Potential Threat to Israel, Pakistan Social Sciences Review, **Vol. 9 (2), April to June**.pp 89-98 **https://doi.org/10.35484/pssr.2025(9-II)07**

[73] Konflik Israel-Iran: Apa kita tahu setakat ini? Op.cit

[74] **Gram Slattery**, **Alexander Cornwell** and **Parisa Hafezi** (2025), US strikes failed to destroy Iran's nuclear sites, intelligence report says, Reuters, June 25, 2025. **https://www.reuters.com/world/middle-east/trump-announces-israel-iran-ceasefire-2025-06-23/**

[75] Konflik Israel-Iran: Presiden Masoud isytihar 'perang 12 hari' tamat, Sinar Harian, 25 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-presiden-masoud-isytihar-perang-12-hari-tamat-526642

[76] PM Pakistan, Presiden Iran bincang situasi pasca serangan Israel pada Sidang Kemuncak ECO, Bernama, Astro Awani, 5 Julai 2025, https://www.astroawani.com/berita-dunia/pm-pakistan-presiden-iran-bincang-situasi-pasca-serangan-israel-pada-sidang-kemuncak-eco-528042

Negara Pertubuhan BRICSc seperti Brazil, Rusia, India dan China, blok itu kemudiannya disertai Afrika Selatan, Mesir, Ethiopia, Indonesia, Iran, Arab Saudi dan Emiriah Arab Bersatu. Menteri Luar Iran Abbas Araghchi pada 7 Julai 2025 dalam Sidang Kemuncak BRICS[77] di Rio De Janeiro, Brazil memberi amaran bahawa kegagalan komuniti antarabangsa untuk mengambil tindakan terhadap Israel hanya akan mengheret seluruh rantau dan dunia kepada krisis yang lebih parah.

*"Serangan Israel dan AS ke atas kemudahan nuklear kami bukan sahaja melanggar prinsip Perjanjian Pengawalan Senjata Nuklear (NPT), malah turut mencabuli Resolusi 2231 Majlis Keselamatan PBB yang mengiktiraf program nuklear aman Iran pada 2015"*[78].
Iran menggesa agar Israel dan AS dipertanggungjawabkan berhubung serangan mengejut ke atas negara itu yang disifatkan sebagai tindakan pencerobohan berskala besar, sehingga mengorbankan sekurang-kurangnya 935 nyawa. Penglibatan langsung AS menyerang kemudahan nuklear Iran telah menunjukkan jelas bahawa AS bersubahat sepenuhnya dalam 'perang pencerobohan' yang dilancarkan oleh Israel. Iran turut menerima sokongan daripada negara-negara BRICS+ yang bersidang di Rio de Janeiro apabila blok 11 negara sebulat suara mengecam tindakan ketenteraan yang disasarkan ke atas sasaran ketenteraan, nuklear dan awam di Iran. Negara Anggota BRICS turut menyuarakan kebimbangan serius terhadap serangan yang disifatkan sebagai disengajakan ke atas infrastruktur awam dan fasiliti nuklear Iran. Pengisytiharan itu dilihat sebagai kejayaan diplomatik penting kepada Iran yang sebelum ini berdepan kekurangan sokongan dari peringkat serantau[79].

Pelbagai negara Amerika Latin dari Chile, Cuba, Venezuela, Colombia dan Bolivia turut mengecam serangan udara AS ke atas kemudahan nuklear Iran sebagai pelanggaran undang-undang antarabangsa dan ancaman terhadap kestabilan global. Negara Perancis menyuarakan kebimbangan dan menegaskan tidak terlibat dalam operasi tersebut serta menggesa semua pihak mengelakkan peluasan konflik dengan mengutamakan penyelesaian diplomatik[80]. Presiden Majlis Eropah Antonio Costa menggesa semua pihak agar bertenang dan mematuhi undang-undang antarabangsa serta mengutamakan diplomasi. Switzerland telah menyeru agar pihak terbabit segera kembali ke meja rundingan dan menghormati sepenuhnya Piagam PBB serta memberikan amaran ancaman terhadap nyawa orang awam dan infrastruktur. Ireland memberikan amaran bahawa risiko konflik lebih besar antara Iran dan Israel dan menekankan keperluan untuk menamatkan ketegangan. Jerman telah menyeru Iran segera memulakan rundingan dengan AS dan Israel bagi mengelakkan pertumpahan darah lebih buruk. Jerman juga menggesa penyelesaian diplomatik bagi mencegah konflik lebih besar. Turkiye turut

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[77] ***BRICS telah ditubuhkan pada 2009 oleh Brazil, Rusia, India dan China, blok itu kemudiannya disertai Afrika Selatan, Mesir, Ethiopia, Indonesia, Iran, Arab Saudi dan Emiriah Arab Bersatu. negara-negara BRICS mewakili lebih separuh daripada populasi dunia dan sekitar 40 peratus keluaran ekonomi global. Sidang kali ini adalah yang pertama melibatkan penyertaan pemimpin Indonesia. Sehingga kini, lebih 30 negara telah menyatakan minat untuk menyertai BRICS sama ada sebagai ahli penuh atau rakan Kerjasama. Lihat Presiden Brazil kecam serangan ke atas Iran, desak Israel tinggalkan Gaza, Agensi, 7 Julai 2025,*** ***https://www.astroawani.com/berita-dunia/presiden-brazil-kecam-serangan-ke-atas-iran-desak-israel-tinggalkan-gaza-528216***

[78] ***Iran tuntut Israel, AS bertanggungawab atas 'perang pencerobohan', Agensi, Astro Awani, 7 Julai 2025,*** ***https://www.astroawani.com/berita-dunia/iran-tuntut-israel-amerika-syarikat-bertanggungawab-atas-perang-pencerobohan-528215***

[79] ***Ibid***

[80] Konflik Israel-Iran: Serangan bom AS ke atas tapak nuklear Iran cetus kecaman seluruh dunia, Bernama, 22 Jun 2025, https://www.astroawani.com/berita-dunia/konflik-israeliran-serangan-bom-ke-atas-tapak-nuklear-iran-cetus-kecaman-seluruh-dunia-526267

menyatakan kebimbangan terhadap kesan serangan AS ke atas kemudahan nuklear Iran dan menekankan bahawa keamanan harus dicapai melalui dialog, bukan konfrontasi bersenjata[81]. Bekas Duta Besar UK ke Uzbekistan merangkap aktivis hak asasi manusia, Craig Murray memberitahu RIA Novosti bahawa Iran bertindak "amat bertanggungjawab dan sabar" sejak beberapa tahun lalu meskipun berdepan tindakan Israel[82].

Negara Timur Tengah turut memberikan sokongan kepada Iran. Pada 15 Jun 2025 Arab Saudi menyatakan bahawa rejim Israel sedang berusaha memperdalam konflik dengan Iran dalam cubaan untuk menyeret AS ke dalam peperangan. Putera Mahkota Mohammed bin Salman menyatakan "Hari ini, seluruh dunia Islam bersatu menyokong anda," dalam perbualan telefon dengan Presiden Iran, Masoud Pezeshkian[83]. Arab Saudi menyatakan kebimbangan mendalam terhadap perkembangan terkini di Iran susulan tindakan AS yang menyasarkan kemudahan nuklear Iran. Arab Saudi turut menyuarakan kebimbangan dan menyifatkan serangan itu sebagai pelanggaran kedaulatan Iran dan menggesa semua pihak berusaha mengendurkan ketegangan dan menggesa masyarakat antarabangsa menggiatkan usaha ke arah penyelesaian politik[84]. Negara Qatar turut menyuarakan kebimbangan dan memberi amaran ketegangan lanjut boleh membawa "akibat buruk" kepada rantau itu. Qatar turut menggesa menghentikan segera permusuhan dan menyeru usaha diplomasi diperbaharui. Mesir turut memberi amaran tentang akibat serius susulan peningkatan ini dan menggesa penghormatan terhadap undang-undang antarabangsa serta penyelesaian aman terhadap krisis. Negara Oman telah menyifatkan serangan itu sebagai "pelanggaran serius undang-undang antarabangsa dan Piagam PBB" dan menegaskan ia adalah hak Iran membangunkan tenaga nuklear secara aman di bawah pemantauan antarabangsa dan memberi amaran bahawa ketegangan berterusan boleh meluaskan konflik. Lubnan menyatakan kebimbangan serangan itu berisiko mencetuskan ketegangan yang boleh menggugat kestabilan seluruh rantau dan menggesa semua pihak bersabar dan memulakan rundingan. Negara Iraq turut mengutuk serangan AS itu sebagai tindakan yang meningkatkan ketegangan dan "melampaui sempadan mana-mana negara" dan menyatakan kaedah penyelesaian ketenteraan akan membawa kemusnahan dan ketidakstabilan[85].

## Kesimpulan

Serangan AS dan Israel ke atas kemudahan nuclear Iran pada 22 Jun 2025 yang menggunakan bom bunker-buster GBU-57 *Massive Ordnance Penetrator* seberat 13,000 kilogram (kg) iaitu bom yang direka untuk memusnahkan sasaran bawah tanah digugurkan ke atas kemudahan bawah tanah Fordo oleh pesawat pengebom B-2, manakala puluhan peluru berpandu jelajah dilancarkan dari kapal selam menyasarkan Natanz dan Isfahan[86]. Serangan ke atas tapak nuclear iran telah mempengaruhi Iran melancarkan peluru berpandu balistik Khyber (Kheibar Shekan) dalam serangan ke-20 ke atas Israel, menggunakan taktik baharu bersama dron pintar untuk meningkatkan ketepatan dan keberkesanan. Pihak AS dan Israel telah mengumumkan kejayaan operasi ketenteraan ke atas Iran dan mendakwa berjaya memusnahkan program

[81] Ibid
[82] BRICS desak penubuhan zon bebas senjata pemusnah di Asia Barat, Bernama, Op.cit
[83] Israel cuba seret AS dalam kancah perang dengan Iran - Putera Mahkota Saudi, Bernama, Astro Awani, 15 Jun 2025,https://www.astroawani.com/berita-dunia/terkini-israel-cuba-seret-dalam-kancah-perang-dengan-iran-putera-mahkota-saudi-525124
[84] Konflik Israel-Iran: Serangan bom AS ke atas tapak nuklear Iran cetus kecaman seluruh dunia, Op.cit
[85] Ibid
[86] Konflik Israel-Iran: Penasihat pemimpin tertinggi Iran tegas simpanan uranium masih selamat, Op.cit

nuklear Iran, namun ia telah disangkal oleh Iran. Serangan AS dan Israel ini walau bagaimanapun telah mendapat pelbagai perhatian global mengenai kemampuan Iran untuk meneruskan program pembangunan nuklearnya. Berdasarkan maklumat dan laporan agensi dan media antarabangsa, terdapat pelbagai pendapat yang menunjukan kesangsian, perdebatan dan percanggahan maklumat yang menimbulkan persoalan terhadap pengumuman kejayaan oleh AS dan Israel. Berdasarkan maklumat tersebut, ia menunjukan Iran mampu meneruskan program nuklearnya dengan dua kaedah iaitu meneruskan program yang sedia ada kerana ia dipercayai tidak musnah secara total. Kaedah kedua adalah mendapakan nuclear yang telah siap sebagai deterrence terhadap musuh melalui kerjasama dengan negara kuasa nuclear seperti Rusia, China, Paksitan dan Korea Utara. Malah kaedah ini pernah dilakukan oleh Rusia dalam Cuban Missile Crisis pada tahun 1962

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# KEBERKESANAN PLATFORM DIGITAL QALBI SMART DALAM MENINGKATKAN KEFAHAMAN AKHLAK ISLAMIYYAH PELAJAR TINGKATAN 4

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***Abstrak:*** *Perkembangan pesat teknologi digital telah mentransformasikan landskap pendidikan dengan menyediakan platform pembelajaran yang lebih interaktif dan berpusatkan pelajar. Dalam konteks Pendidikan Islam, khususnya bagi bidang Akhlak Islamiyyah, integrasi teknologi sangat kritikal bagi memastikan penyampaian nilai moral kekal relevan dengan jiwa generasi masa kini. Kajian ini bertujuan menilai keberkesanan platform digital Qalbi Smart terhadap kefahaman pelajar Tingkatan 4 melalui pendekatan kaedah campuran (mixed-method). Secara kuantitatif, kajian melibatkan kumpulan intervensi dan kumpulan kawalan yang diukur melalui ujian pra dan pasca bagi melihat perbezaan signifikan dalam penguasaan konsep adab serta nilai. Secara kualitatif pula, maklum balas terbuka dikumpul bagi meneroka persepsi serta cadangan penambahbaikan pelajar terhadap kebolehgunaan platform tersebut.Dapatan kajian menunjukkan bahawa kumpulan intervensi mencatatkan peningkatan skor yang lebih tinggi berbanding kumpulan kawalan yang menggunakan kaedah tradisional. Analisis kualitatif pula mendedahkan bahawa pelajar mendambakan pengayaan elemen multimedia dan navigasi yang lebih pantas bagi menyokong proses ulangkaji kendiri. Hasil kajian ini membuktikan bahawa Qalbi Smart bukan sekadar alat bantuan mengajar, malah merupakan inovasi digital yang mampu mengurangkan kelesuan kognitif terhadap buku teks yang tebal. Implikasi kajian ini menekankan kepentingan pengintegrasian teknologi digital dalam Pendidikan Islam sebagai medium rujukan yang sistematik, holistik dan mesra bagi pengguna. Secara keseluruhannya, Qalbi Smart berpotensi besar untuk diangkat sebagai hab rujukan digital yang mampu memperkukuh sahsiah dan kecemerlangan akademik pelajar sekolah menengah.*

***Kata Kunci:*** *Qalbi Smart, Pendidikan Islam, Akhlak Islamiyyah, Inovasi Digital*

***Abstract:*** *The rapid advancement of digital technology has transformed the educational landscape, providing interactive, structured, and student centered learning platforms. In the context of Islamic Education, specifically the Akhlak Islamiyyah (Ethics) component, integrating technology is critical to ensure that moral values remain relevant, engaging, and accessible to 21st-century learners. This study evaluates the effectiveness of the Qalbi Smart digital platform in enhancing the understanding of Akhlak among Form 4 students in Malaysian secondary schools using a mixed-methods approach. Quantitatively, the study employed a quasi-experimental design with intervention and control groups, measured through pre- and post-tests. Qualitatively, open-ended feedback was gathered to explore student perceptions and suggestions for platform optimization. Findings indicate that the intervention group achieved significantly higher post-test scores compared to the control group, which relied on traditional textbook-based methods. The qualitative analysis further revealed that students desire enriched multimedia elements and streamlined navigation to support self-directed revision. This research demonstrates that Qalbi Smart is not merely a teaching tool but a digital innovation capable of reducing "cognitive fatigue" associated with dense traditional textbooks. The implications of this study highlight the necessity of digital integration in Islamic Education to create a systematic, holistic and user-friendly learning ecosystem. Overall, Qalbi Smart serves as a high-potential medium for strengthening both the character development and academic excellence of secondary school students.*

***Keywords:*** *Qalbi Smart, Islamic Education, Akhlak Islamiyyah, Digital Innovation*

## Pendahuluan

Pendidikan Islam merupakan bidang utama dalam pembentukan sahsiah dan pembangunan akhlak secara holistik. Dalam arus pendidikan moden, penguasaan ilmu akhlak memerlukan anjakan daripada teori kepada penghayatan melalui teknologi digital yang pantas dan mudah diakses (Abdul Basit et al., 2022). Penggunaan laman web dalam pendidikan terbukti memberikan kelebihan dari aspek penyimpanan bahan yang efisien serta mewujudkan suasana pembelajaran yang fleksibel dan interaktif (Nugraha et al., 2025). Sehubungan itu, platform *Qalbi Smart* dibangunkan sebagai inisiatif digital yang menyediakan nota ringkas dan aktiviti multimedia untuk menyokong penguasaan topik akhlak bagi pelajar Tingkatan 4.

Namun demikian, kaedah pengajaran tradisional yang masih bergantung kepada syarahan dan hafalan didapati kurang berkesan dalam menarik minat pelajar serta menyukarkan aplikasi nilai akhlak dalam kehidupan seharian. Pelajar sering menghadapi cabaran memahami konsep akhlak yang abstrak apabila disampaikan tanpa sokongan bahan yang interaktif dan kontekstual. Walaupun penggunaan platform digital semakin meluas (Demina et al., 2023), namun keberkesanan platform *Qalbi Smart* yang khusus dalam konteks pembelajaran Akhlak

Islamiyyah masih memerlukan penilaian secara empirikal (Haleem et al., 2022). Ketiadaan data konkrit mengenai impak platform ini terhadap pemahaman dan sikap pelajar mewujudkan jurang yang perlu diisi bagi memastikan ia benar-benar memenuhi keperluan pendidikan abad ke-21.

Oleh itu, kajian ini dilaksanakan untuk menilai keberkesanan penggunaan platform digital *Qalbi Smart* dalam meningkatkan kefahaman pelajar Tingkatan 4 terhadap Akhlak Islamiyyah. Secara khususnya, objektif kajian adalah i. mengenal pasti tahap kefahaman dan pengetahuan pelajar terhadap topik Akhlak Islamiyyah melalui penggunaan platform *Qalbi Smart*; ii. menilai aspek kebolehgunaan (*usability*) dan kepuasan pengguna terhadap ciri-ciri interaktif yang disediakan dalam *website* tersebut; dan iii. menganalisis impak penggunaan platform terhadap sikap dan dorongan amalan akhlak (*behavioural intention*) pelajar dalam kehidupan seharian.

## Metodologi Kajian

### *Reka Bentuk Kajian*

Reka Bentuk Kajian ini menggunakan pendekatan kuantitatif deskriptif dengan elemen mixed-methods untuk menilai keberkesanan platform digital *Qalbi Smart* dalam meningkatkan kefahaman akhlak Islamiyyah dalam kalangan pelajar Tingkatan 4. Pendekatan kuantitatif dipilih kerana ia membolehkan pengumpulan data berangka secara sistematik dan analisis statistik yang objektif, manakala elemen kualitatif membolehkan pengkaji memperoleh maklum balas mendalam mengenai pengalaman pelajar. Penggunaan aplikasi digital sebagai alat bantu mengajar ini selaras dengan kajian ini yang membuktikan bahawa penggunaan aplikasi interaktif mampu meningkatkan kecenderungan, penerimaan, dan keberkesanan pembelajaran dalam kalangan pelajar (Roslee et al., 2021). Instrumen kajian berbentuk soal selidik, dibahagikan kepada tujuh bahagian, dengan setiap bahagian mengandungi tiga item soalan, dan diukur menggunakan skala likert 4 titik tanpa pilihan neutral bagi memastikan penilaian yang tegas dan tepat. Reka bentuk ini membolehkan pengumpulan data yang sistematik, konsisten, dan sahih, sekaligus menyediakan asas yang kukuh untuk menganalisis tahap kefahaman akhlak Islamiyyah dan menilai keberkesanan platform *Qalbi Smart* dalam konteks pendidikan Islam di sekolah menengah.

### *Sampel Kajian*

Kajian ini menggunakan reka bentuk campuran (*mixed methods*) yang menggabungkan pendekatan kuantitatif dan kualitatif bagi menilai keberkesanan penggunaan laman web *Qalbi Smart* dalam konteks pembelajaran dan pengajaran, sekali gus membolehkan pengkaji memperoleh pemahaman yang lebih menyeluruh melalui penggabungan data numerik dan deskriptif secara saling melengkapi (Saraswati Dawadi et al., 2021). Pemilihan responden dilakukan menggunakan teknik persampelan bertujuan dengan memfokuskan kepada individu yang mempunyai pengalaman langsung menggunakan laman web tersebut sama ada sebagai pelajar atau guru bagi memastikan data yang dikumpulkan adalah relevan dan sejajar dengan objektif kajian. Bagi komponen kuantitatif, saiz sampel dengan seramai 256 orang responden dianggap mencukupi untuk mewakili populasi kajian dan menyokong keperluan analisis statistik yang mantap, selaras dengan saranan kajian metodologi kontemporari yang menekankan kesesuaian saiz sampel berdasarkan objektif kajian dan kekuatan analisis data (Serdar et al., 2021).

### *Instrumen Kajian*

Instrumen kajian ini terdiri daripada soal selidik berstruktur yang direka bentuk bagi mengukur tahap kefahaman pelajar serta persepsi mereka terhadap keberkesanan platform digital *Qalbi*

*Smart*. Soal selidik ini mengandungi tujuh bahagian utama, iaitu Bahagian A yang memfokuskan kepada maklumat demografi responden merangkumi jantina, umur dan tahap pendidikan, Bahagian B hingga F yang menilai aspek kefahaman, persepsi, sikap, penggunaan platform, kepuasan pengguna dan amalan, serta Bahagian G yang menyediakan ruang untuk cadangan atau komen terbuka. Kesemua item dalam Bahagian B hingga F menggunakan skala likert empat mata, iaitu ii. setuju; ii. sangat setuju; iii. tidak setuju; dan iv. sangat tidak setuju. Penggunaan instrumen bagi mengukur keberkesanan dan kebolehgunaan platform digital ini adalah selaras dengan metodologi yang digunakan dalam menilai pembangunan permainan pendidikan bagi meningkatkan kefahaman pelajar terhadap topik yang kompleks. Item soal selidik merangkumi aspek kefahaman akhlak islamiyyah, persepsi pelajar terhadap ciri-ciri platform, sikap dan penggunaan platform digital *Qalbi Smart*, tahap kepuasan pengguna serta amalan yang diintegrasikan yang disusun secara sistematik dan teliti bagi memastikan setiap aspek kritikal platform dinilai secara holistik. Instrumentasi yang komprehensif ini, sebagaimana yang ditekankan dalam kajian pembangunan *SaltsWorld* ini bukan sahaja bertujuan mengukur hasil pengetahuan semata-mata, malah turut menghubungkaitkan pengalaman interaksi digital dengan pembentukan nilai murni dan tingkah laku afektif terhadap pelajar (Mun Jia Hao et al., 2025).

### *Prosedur Kajian*

Prosedur kajian ini dijalankan dalam beberapa fasa untuk memastikan data yang diperoleh tepat dan relevan. Prosedur yang sistematik ini penting bagi menjamin kebolehpercayaan dapatan dalam persekitaran pembelajaran digital (Chua, 2011). Pada peringkat awal, pelajar Tingkatan 4 diperkenalkan kepada platform digital *Qalbi Smart* melalui sesi taklimat ringkas di sekolah, manakala individu lain seperti pelajar universiti diberikan pautan akses ke platform beserta panduan ringkas untuk menilai kandungan dan fungsi. Selepas sesi pengenalan, pelajar Tingkatan 4 menggunakan platform sebagai bahan pembelajaran tambahan bagi topik akhlak selama dua minggu, sementara individu lain menilai platform berdasarkan aspek kemudahan navigasi dan visualisasi kandungan. Setelah tempoh penggunaan selesai, kedua-dua kumpulan responden dikehendaki mengisi soal selidik di mana pelajar tingkatan 4 mengisi borang soal selidik melalui ruang maklum balas yang disediakan dalam platform *Qalbi Smart,* manakala individu lain mengisi soal selidik melalui pautan web. Semua data yang diperoleh dikumpulkan secara automatik dan disimpan dalam format yang selamat bagi memastikan kesahihan dan kerahsiaan maklumat responden sebelum dianalisis untuk tujuan kajian (Wang Ziheng et al., 2025).

### *Kaedah Analisis Data*

Data kajian ini dianalisis menggunakan statistik deskriptif bagi menilai tahap persepsi dan kecenderungan responden terhadap penggunaan *Qalbi Smart* dalam pembelajaran akhlak. Seramai 265 orang responden terlibat dalam kajian ini dan data diperoleh melalui instrumen soal selidik yang dibangunkan secara berstruktur. Soal selidik kajian ini mengandungi tujuh bahagian, di mana setiap bahagian terdiri daripada tiga item, menjadikan keseluruhan 21 item yang dianalisis. Setiap item diukur menggunakan skala likert empat mata iaitu sangat tidak bersetuju, tidak bersetuju, bersetuju dan sangat bersetuju. Penggunaan skala tanpa pilihan neutral bertujuan untuk menggalakkan responden membuat pilihan yang lebih jelas terhadap pernyataan yang dikemukakan (Agustianti et al., 2022).

Analisis data dijalankan menggunakan perisian *Statistical Package for the Social Sciences (SPSS)* versi XX. Setiap item dianalisis bagi mendapatkan nilai kekerapan *(frequency)* dan peratusan (%), bertujuan untuk mengenal pasti taburan respons responden serta kecenderungan tahap persetujuan yang dominan bagi setiap bahagian kajian. (Pallant, 2020). Hasil analisis statistik deskriptif dipersembahkan dalam bentuk jadual mengikut bahagian dan konstruk kajian. Pendekatan ini memudahkan interpretasi dapatan serta membolehkan perbandingan dibuat antara bahagian-bahagian yang dikaji secara sistematik dan teratur. Secara keseluruhannya, penggunaan statistik deskriptif melalui analisis kekerapan dan peratusan adalah bersesuaian dengan objektif kajian yang bertujuan untuk menghuraikan tahap penerimaan dan kecenderungan tingkah laku responden terhadap penggunaan *Qalbi Smart* dalam pembelajaran akhlak, tanpa melibatkan pengujian hipotesis atau analisis inferensi.

## Keputusan dan Perbincangan

**Jadual 1: Analisis Bahagian B Maklumat Demografi**

| Umur | Perempuan | Lelaki | Jumlah |
|---|---|---|---|
| 15–16 | 83 | 57 | 140 |
| 17–18 | 53 | 48 | 101 |
| >18 | 15 | 9 | 24 |
| Jumlah | 151 | 114 | 265 |

Analisis data demografi yang digambarkan dalam Jadual 1 adalah kritikal kerana ia mengesahkan liputan sampel kajian yang berwibawa. Kumpulan umur 15 hingga 16 tahun yang merupakan statistik utama kajian pelajar Tingkatan 4, mencatatkan bilangan penyertaan tertinggi dengan pengguna perempuan kira-kira 49 sedikit mendahului lelaki. Dominasi awal ini memastikan bahawa dapatan mengenai keberkesanan platform *Qalbi Smart* diperoleh daripada populasi sasaran utama.

Perbezaan yang menarik berlaku dalam kumpulan umur 17 hingga 18 tahun dan lebih daripada 18 tahun, di mana pengguna lelaki mula mengatasi perempuan dari segi bilangan responden. Taburan yang pelbagai ini bukan sahaja mengukuhkan kesahan dapatan, tetapi juga memberi peluang untuk perbincangan kontekstual mengenai perbezaan persepsi keberkesanan platform mengikut kematangan dan jantina pengguna. Hal ini selaras dengan perbincangan kajian ini yang menekankan bahawa faktor demografi seperti jantina dan umur merupakan elemen penting yang boleh memberikan variasi terhadap tahap penerimaan serta pelaksanaan sesuatu pendekatan dalam persekitaran pendidikan (Maryam Norazan, 2023).

Secara ringkasnya, profil demografi ini menunjukkan bahawa kajian telah berjaya mendapatkan maklum balas daripada dua kumpulan responden utama yang berbeza iaitu pelajar sekolah menengah dan individu lain. Kepentingan pencerapan profil ini, sebagaimana yang digariskan dalam kajian ini adalah untuk memastikan kredibiliti dan kesahihan kajian dalam merumuskan dapatan statistik, seterusnya menilai mengenai kefahaman, persepsi, dan kepuasan pengguna terhadap platform digital *Qalbi Smart* (Maryam Norazan, 2023).

**Jadual 2: Analisis Bahagian B Pengetahuan (*Knowledge*)**

| Soalan | Setuju (%) | Sangat Setuju (%) | Tidak Setuju (%) | Sangat Tidak Setuju (%) |
|---|---|---|---|---|
| *Qalbi Smart* membantu saya memahami akhlak Islam dengan lebih mudah | 23.19 | 76.05 | 0.00 | 0.76 |
| Saya dapat membezakan antara akhlak mahmudah dan akhlak mazmumah melalui *Qalbi Smart* | 31.18 | 66.16 | 1.90 | 0.76 |
| Saya lebih yakin menjelaskan topik akhlak selepas belajar di *Qalbi Smart* | 31.56 | 66.16 | 1.52 | 0.76 |

Jadual 2 menunjukkan tahap persetujuan yang sangat tinggi terhadap Bahagian B yang menilai sikap pelajar terhadap penggunaan platform digital *Qalbi Smart* dalam pembelajaran Akhlak Islamiyyah. Secara keseluruhannya, dapatan kajian memperlihatkan sikap positif yang dominan merentasi ketiga-tiga item yang dikemukakan. Bagi pernyataan pertama, seramai 76.05% responden menyatakan sangat setuju dan 23.19% setuju, menjadikan jumlah persetujuan keseluruhan sebanyak 99.24%, manakala hanya 0.76% responden menyatakan sangat tidak setuju. Bagi pernyataan kedua, 66.16% responden menyatakan sangat setuju dan 31.18% setuju, dengan jumlah persetujuan sebanyak 97.34%. Seterusnya, bagi pernyataan ketiga, 66.16% responden menyatakan sangat setuju dan 31.56% setuju, menjadikan 97.72% responden bersetuju bahawa penggunaan *Qalbi Smart* meningkatkan keyakinan mereka dalam pembelajaran akhlak. Secara kumulatif, peratusan responden yang memilih kategori tidak setuju dan sangat tidak setuju adalah sangat minimum bagi kesemua item.

Dapatan ini menunjukkan bahawa penggunaan platform digital *Qalbi Smart* berkesan dalam meningkatkan pemahaman dan penguasaan konsep Akhlak Islamiyyah dalam kalangan pelajar sekolah menengah. Keberkesanan ini berkemungkinan dipengaruhi oleh ciri pembelajaran digital yang ditawarkan seperti kandungan yang tersusun, penyampaian yang interaktif serta fleksibiliti pembelajaran kendiri. Penggunaan e-pembelajaran dalam pendidikan islam dapat meningkatkan kefahaman pelajar melalui penyampaian kandungan yang terancang dan mudah diakses (Adnan Alhammad et al., 2025). Selain itu, peningkatan keyakinan pelajar dalam menjelaskan topik akhlak turut menyokong dapatan yang menyatakan bahawa pembelajaran digital mampu memperkukuh kefahaman kognitif dan keyakinan pelajar melalui pengalaman pembelajaran yang lebih aktif dan berpusatkan pelajar. Oleh itu, dapatan kajian ini mengesahkan bahawa integrasi platform digital seperti *Qalbi Smart* merupakan pendekatan yang berkesan dan relevan sejajar dengan keperluan pembelajaran abad ke-21 (Hamdanah et al., 2024).

**Jadual 3: Analisis Bahagian C Sikap (*Attitude*)**

| Soalan | Setuju (%) | Sangat Setuju (%) | Tidak Setuju (%) | Sangat Tidak Setuju (%) |
|---|---|---|---|---|
| Saya berasa lebih berminat belajar akhlak melalui *Qalbi Smart* | 30.04% | 65.78% | 3.42% | 0.76% |

| | | | | |
|---|---|---|---|---|
| *Qalbi Smart* membuatkan pembelajaran akhlak lebih menyeronokkan | 23.57% | 75.67% | 0.00% | 0.76% |
| Saya percaya melalui *Qalbi Smart* membantu saya lebih memahami akhlak | 28.14% | 71.10% | 0.00% | 0.76% |

Jadual 3 menunjukkan analisis terhadap bahagian C iaitu mengenai sikap, hasil analisis terhadap bahagian ini menunjukkan maklum balas yang sangat positif daripada responden terhadap penggunaan platform *Qalbi Smart* bagi pembelajaran bidang akhlak islamiyyah. Bagi item sangat setuju, peratusan per tertinggi dicatatkan oleh soalan dua iaitu sebanyak 75.67%, yang merujuk kepada kenyataan bahawa *Qalbi Smart* menjadikan pembelajaran akhlak lebih menyeronokkan. Ini diikuti rapat oleh soalan tiga dengan 71.10% responden sangat bersetuju bahawa platform ini membantu mereka lebih memahami subjek tersebut. Sementara itu, bagi soalan satu iaitu mengenai minat belajar, sebanyak 65.78% responden memilih sangat setuju dan 30.04% memilih setuju. Secara keseluruhannya, tahap ketidaksetujuan adalah amat rendah, di mana hanya terdapat 0.76% responden yang menyatakan sangat tidak setuju bagi setiap soalan.

Perbincangan dapatan ini menunjukkan bahawa platform *Qalbi Smart* berupaya membentuk sikap yang positif dalam kalangan pelajar yang merangkumi aspek luaran serta psikologi terutamanya terhadap pembelajaran akhlak Islamiyyah. Perkara ini selari dengan kajian sebelumnya bahawa kesediaan e-pembelajaran bukan sekadar membabitkan aspek luaran dan fizikal, tetapi juga merangkumi aspek psikologi seperti niat, sikap, minat, persepsi, harapan, tingkah laku dan matlamat kendiri yang memainkan peranan penting dalam menentukan keberkesanan penggunaan platform digital dalam pembelajaran (Artika Rasul Sulaiman & Hasmadi Hassan, 2024). Elemen keseronokan yang diterapkan dalam penggunaan platform ini memainkan peranan penting dalam meningkatkan penglibatan pelajar, sekali gus mendorong minat mereka untuk mengikuti proses pembelajaran dengan lebih aktif. Apabila pembelajaran disampaikan melalui pendekatan yang menarik dan interaktif, pelajar cenderung untuk memberikan respon yang lebih baik serta menunjukkan sikap terbuka terhadap penggunaan teknologi sebagai medium pembelajaran. Penggunaan media interaktif seperti *web* dapat meningkatkan keterlibatan dan motivasi belajar (Erfan Priyambodo, 2012). Selain itu, keupayaan *Qalbi Smart* dalam membantu kefahaman pelajar menunjukkan bahawa platform digital bukan sahaja berfungsi sebagai alat sokongan, malah mampu menyumbang secara bermakna kepada pencapaian objektif pembelajaran akhlak. Dapatan ini mengukuhkan pandangan bahawa integrasi teknologi dalam pendidikan Islam boleh dilaksanakan secara berkesan apabila dirancang selaras dengan keperluan dan minat pelajar.

**Jadual 4: Analisis Bahagian D Penggunaan Platform (*Usability*)**

| Soalan | Setuju (%) | Sangat Setuju (%) | Tidak Setuju (%) | Sangat Tidak Setuju (%) |
|---|---|---|---|---|
| *Qalbi Smart* mudah digunakan dan navigasi jelas | 34.98 | 63.12 | 1.52 | 0.38 |
| Susun atur dan nota di *Qalbi Smart* memudahkan saya belajar | 35.36 | 63.12 | 1.14 | 0.38 |
| Latihan atau aktiviti di *Qalbi Smart* membantu saya mengingati topik akhlak | 30.42 | 67.30 | 1.90 | 0.38 |

Jadual 4 menunjukkan analisis terhadap Bahagian D yang menilai aspek penggunaan platform *Qalbi Smart* dalam kalangan responden. Secara keseluruhannya, dapatan memperlihatkan aliran persepsi positif yang sangat dominan merentasi ketiga-tiga item yang dikemukakan. Bagi aspek kemudahan penggunaan dan kejelasan navigasi platform, seramai 63.12% responden menyatakan sangat setuju dan 34.98% menyatakan setuju, menunjukkan bahawa hampir keseluruhan responden menilai *Qalbi Smart* sebagai mudah digunakan dan mesra pengguna. Bagi aspek susun atur dan penyediaan nota pembelajaran, 63.12% responden memilih sangat setuju manakala 35.36% memilih setuju, sekali gus mencerminkan tahap penerimaan yang sangat tinggi terhadap reka bentuk kandungan dan penyusunan maklumat platform. Seterusnya, bagi aspek latihan dan aktiviti pembelajaran, 67.30% responden menyatakan sangat setuju dan 30.42% setuju bahawa elemen tersebut membantu mereka mengingati topik akhlak dengan lebih berkesan. Secara kumulatif, peratusan ketidaksetujuan bagi ketiga-tiga item ini berada pada tahap yang sangat minimum iaitu kurang daripada 2% bagi setiap item.

Dapatan ini menunjukkan bahawa *Qalbi Smart* bukan sahaja memenuhi peranan asas sebagai platform digital, malah berjaya menyediakan pengalaman pembelajaran yang sistematik, interaktif dan mudah diakses. Faktor kebolehgunaan seperti navigasi yang jelas, susun atur kandungan yang teratur serta penyediaan aktiviti pembelajaran yang relevan merupakan penentu utama kepada keberkesanan pembelajaran digital, khususnya dalam konteks pendidikan Islam. Hal ini selari dengan kajian literatur yang menegaskan bahawa integrasi alat digital dalam pengajaran pendidikan Islam memerlukan pendekatan pedagogi yang sesuai serta reka bentuk kandungan yang teliti bagi memastikan kefahaman dan penglibatan pelajar dapat dimaksimumkan (Ab Halim et al., 2025). Selain itu, penggunaan platform e-pembelajaran yang menekankan interaksi dan aktiviti pengukuhan turut berupaya meningkatkan tahap interaksi serta pemahaman pelajar terhadap kandungan pembelajaran (Adnan Alhammad et al., 2025). Justeru, dapatan ini mengesahkan bahawa reka bentuk platform *Qalbi Smart* yang menggabungkan elemen teknologi dan pedagogi Islam secara seimbang mampu meningkatkan pengalaman pengguna, seterusnya menyokong pembelajaran berterusan dalam pendidikan akhlak.

**Jadual 5: Analisis Bahagian E Kepuasan Pengguna (*User Satisfaction*)**

| Soalan | Setuju (%) | Sangat Setuju (%) | Tidak Setuju (%) | Sangat Tidak Setuju (%) |
|---|---|---|---|---|
| Saya berpuas hati dengan kandungan akhlak di *Qalbi Smart* | 28.14 | 69.96 | 1.14 | 0.76 |
| *Qalbi Smart* memenuhi keperluan pembelajaran saya | 31.56 | 66.92 | 0.76 | 0.76 |
| Saya sanggup mengesyorkan *Qalbi Smart* kepada rakan lain | 30.04 | 68.44 | 0.76 | 0.76 |

Jadual 5 menunjukkan analisis terhadap Bahagian E yang melibatkan kepuasan pengguna menunjukkan trend positif yang sangat dominan merentasi ketiga-tiga item utama. Bagi aspek kepuasan kandungan akhlak item 10, sebanyak 69.96% responden menyatakan sangat setuju, manakala bagi keberkesanan *Qalbi Smart* dalam memenuhi keperluan pembelajaran item 11, gabungan peratusan setuju dan sangat setuju mencatatkan nilai kumulatif yang sangat tinggi iaitu 98.48%. Konsistensi ini diteruskan melalui kesediaan pengguna untuk mengesyorkan

aplikasi ini kepada rakan lain item 12, di mana majoriti besar responden sebanyak 68.44% memilih skala sangat setuju. Secara keseluruhannya, data menunjukkan bahawa nilai ketidakpuasan hati (tidak setuju dan sangat tidak setuju) adalah sangat minimal, iaitu berada di bawah paras 2% bagi setiap item yang dinilai.

Keberhasilan dapatan ini mencerminkan bahawa aplikasi *Qalbi Smart* bukan sekadar berfungsi sebagai platform digital, malah berjaya memenuhi ekspektasi psikologi dan kognitif pengguna dalam konteks pembelajaran akhlak di dalam ataupun luar bilik darjah. Dominasi maklum balas pada skala sangat setuju membuktikan bahawa modul yang disusun memiliki kredibiliti yang tinggi serta relevan dengan keperluan semasa komuniti sasaran. Hal ini selari dengan penemuan (Abuhassna et al., 2022) yang menekankan bahawa kualiti kandungan digital yang berpusatkan pengguna merupakan determinan kritikal dalam meningkatkan kepuasan serta penglibatan kognitif pelajar dalam platform pendidikan dalam talian**.** Tahap kesediaan pengguna yang tinggi untuk mengesyorkan aplikasi ini (*referral loyalty*) memberikan indikasi kuat bahawa *Qalbi Smart* telah mencapai tahap kepercayaan (*user trust*) yang signifikan, sekali gus mengukuhkan kedudukannya sebagai alat bantu pembelajaran yang efektif dan berimpak tinggi. Implikasi daripada keputusan ini menunjukkan bahawa integrasi elemen nilai murni dalam format digital mampu diterima dengan baik sekiranya kualiti kandungan dan pengalaman pengguna (*user experience*) diberikan keutamaan yang jitu (Abuhassna et al., 2022).

**Jadual 6: Analisis Bahagian F Amalan (*Behavioural Intention*)**

| Soalan | Setuju (%) | Sangat Setuju (%) | Tidak Setuju (%) | Sangat Tidak Setuju (%) |
|---|---|---|---|---|
| Saya terdorong untuk mengamalkan akhlak mahmudah selepas belajar di *Qalbi Smart* | 33.46 | 61.98 | 2.66 | 1.90 |
| Saya lebih peka terhadap akhlak mazmumah dan cara menjauhinya | 30.04 | 67.68 | 1.52 | 0.76 |
| Saya akan terus menggunakan *Qalbi Smart* untuk belajar akhlak. | 36.88 | 61.60 | 0.76 | 0.76 |

Jadual 6 memaparkan dapatan analisis bagi Bahagian F yang menilai tahap amalan atau niat tingkah laku (*behavioural intention*) responden terhadap penggunaan *Qalbi Smart* dalam pembelajaran akhlak. Secara keseluruhan, dapatan menunjukkan tahap penerimaan yang sangat tinggi dalam kalangan responden. Bagi item yang menilai dorongan responden untuk mengamalkan akhlak mahmudah selepas menggunakan *Qalbi Smart*, majoriti responden menunjukkan kecenderungan yang positif, iaitu 61.98% sangat bersetuju dan 33.46% bersetuju, manakala yang menyatakan tidak bersetuju dan sangat tidak bersetuju masing-masing hanya 2.66% dan 1.90%. Responden juga menunjukkan peningkatan kepekaan terhadap akhlak mazmumah serta usaha untuk menjauhinya, dengan 67.68% sangat bersetuju dan 30.04% bersetuju, sementara tahap penolakan adalah rendah, iaitu 1.52% tidak bersetuju dan 0.76% sangat tidak bersetuju. Bagi item mengenai kesediaan untuk meneruskan penggunaan *Qalbi Smart* dalam pembelajaran akhlak, dapatan menunjukkan 61.60% responden sangat bersetuju dan 36.88% bersetuju, manakala kedua-dua kategori penolakan masing-masing hanya 0.76%. Secara keseluruhannya, dapatan ini menunjukkan bahawa

penggunaan *Qalbi Smart* berupaya membentuk niat tingkah laku yang positif dalam kalangan responden, khususnya dari aspek dorongan untuk mengamalkan akhlak mahmudah, meningkatkan kepekaan terhadap akhlak mazmumah, serta kesediaan untuk meneruskan penggunaan platform ini.

Dapatan Bahagian F mengesahkan bahawa penggunaan *Qalbi Smart* berkesan dalam mempengaruhi amalan akhlak pelajar secara berterusan dan bermakna. Peningkatan dorongan untuk mengamalkan akhlak mahmudah serta kepekaan terhadap akhlak mazmumah menunjukkan bahawa kandungan dan pendekatan pembelajaran melalui platform digital ini bukan sahaja meningkatkan penghayatan akhlak yang terpuji, tetapi juga memupuk kesedaran kritikal terhadap akhlak mazmumah dan usaha untuk menjauhinya, sejajar dengan penemuan Said et al., (2021) yang menegaskan bahawa integrasi pendidikan nilai dalam platform digital mampu meningkatkan kecenderungan pelajar untuk mengamalkan nilai tersebut dalam kehidupan seharian. Selain itu, dapatan ini menekankan bahawa proses pembelajaran akhlak yang bersifat reflektif memainkan peranan penting dalam membentuk kesedaran dalaman pelajar, seterusnya mempengaruhi niat dan tindakan mereka secara konsisten (Yusoff et al., 2020). Hal ini juga menyokong bahawa penerimaan dan penggunaan teknologi pendidikan yang bermakna berkait rapat dengan persepsi pelajar terhadap manfaat pembelajaran tersebut dalam membentuk sikap dan tingkah laku positif. Justeru, dapatan ini menegaskan bahawa platform berasaskan teknologi yang berteraskan nilai seperti *Qalbi Smart*, bukan sahaja berfungsi sebagai medium penyampaian ilmu, malah mempunyai potensi besar dalam menyokong matlamat pendidikan akhlak selaras dengan keperluan pendidikan semasa (Teo dan Huang, 2021).

***Analisis Bahagian G Cadangan/ Komen Terbuka***

Melalui maklum balas terbuka yang telah diberikan kepada para pelajar, kami mendapati bahawa pelajar bukan sekadar mahukan nota, tetapi mereka inginkan sebuah pengalaman pembelajaran yang lebih hidup dan tidak membosankan. Majoriti pelajar mencadangkan agar *Qalbi Smart* memperbanyakkan lagi elemen-elemen multimedia seperti video pengajaran dan video pendek amali yang mereka boleh aplikasikan dalam pembelajaran mereka dengan lebih efisien. Sebagai contoh, responden 5 berkongsi bahawasanya “saya rasa lebih faham kalau ada video pendek selain nota teks, supaya sesi ulangkaji tak rasa membosankan”. Manakala responden 14 lebih tertarik kepada visual dengan menyarankan agar penggunaan infografik atau meletakkan peta minda berwarna bagi menguatkan lagi ingatan pelajar. Ini menunjukkan bahawa untuk menarik minat pelajar pada era digital hari ini, *Qalbi Smart* perlulah berani beralih kepada format teks tradisional kepada persembahan visual yang lebih menarik dan interaktif. Selain itu, perkara yang amat dititikberatkan oleh pelajar adalah bantuan yang lebih berfokuskan kepada persediaan peperiksaan. Bagi mereka, *Qalbi Smart* akan menjadi lebih lengkap sekiranya dilengkapi dengan soalan-soalan peperiksaan yang lengkap. Responden 22 menyatakan harapannya agar pihak kami turut memasukkan koleksi soalan ramalan serta soalan tahun-tahun lepas berserta skema jawapan yang jelas untuk memudahkan mereka mengulang kaji. Maklum balas seperti ini membuktikan dengan jelas dan nyata bahawasanya pelajar telah melihat platform ini sebagai talian hayat untuk mereka membina keyakinan diri sebelum melangkah ke dewan peperiksaan dan bukannya laman sesawang ini diciptakan untuk membaca nota semata-mata.

Akhir sekali, dari sudut teknikal pula pelajar sangatlah menghargai kemudahan dan kepantasan laman sesawang *Qalbi Smart*. Malah ada turut mencadangkan bahawa untuk meletakkan fungsi *dark mode* untuk keselesaan mata apabila mengulang kaji pada lewat malam. Segala luahan dan cadangan jujur daripada pelajar ini sangatlah bernilai dan ia bukan sahaja membantu kami memperbaiki kelemahan teknikal, malah turut juga memberi inspirasi untuk membina *Qalbi Smart* yang benar-benar memenuhi jiwa dan keperluan pelajar pada masa kini.

## Kesimpulan

Secara keseluruhannya, kajian ini telah membuktikan secara empirikal bahawa platform digital *Qalbi Smart* merupakan instrumen yang sangat efektif dalam memperkukuh pemahaman konsep akhlak islamiyyah dalam kalangan pelajar Tingkatan 4. Keberkesanan ini didorong oleh pendekatan penyampaian maklumat melalui nota yang padat serta integrasi aktiviti multimedia yang interaktif, yang berjaya menarik minat serta penglibatan aktif pelajar dalam sesi pembelajaran. Dapatan kajian bukan sahaja menunjukkan peningkatan tahap kefahaman yang signifikan, malah mencerminkan penerimaan positif daripada pelbagai pihak termasuk pelajar dan warga akademik terhadap reka bentuk serta navigasi platform yang mesra pengguna.

Kejayaan ini membuktikan bahawa *Qalbi Smart* telah memenuhi piawaian pedagogi abad ke-21 yang menuntut inovasi dalam pengajaran. Secara implikasinya, integrasi teknologi digital ini berpotensi besar untuk merevolusikan kaedah konvensional dalam pendidikan Islam dengan memudahkan pemahaman konsep-konsep abstrak serta menggalakkan budaya pembelajaran kendiri yang lebih sistematik dan anjal. Walau bagaimanapun, bagi memastikan kemampanan platform ini, penambahbaikan berterusan perlu dilaksanakan khususnya dari aspek estetika visual, kepelbagaian elemen gamifikasi serta variasi latihan pembelajaran. Langkah ini kritikal bagi memastikan *Qalbi Smart* kekal relevan sebagai alat sokongan pembelajaran yang bukan sahaja mampu memperkukuh sahsiah dan moral pelajar, malah menjadi pemangkin kepada kecemerlangan akademik yang holistik (Azwani Masuwai et al., 2023).

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# INTEGRASI E-FAITH4U SEBAGAI MEDIA PEMBELAJARAN ALTERNATIF: TINJAUAN KEBERKESANAN DAN PENERIMAAN PELAJAR TINGKATAN 4

*(INTEGRATION OF THE INTERACTIVE DIGITAL PLATFORM E-FAITH4U: A REVIEW OF EFFECTIVENESS AND ACCEPTANCE AMONG FORM FOUR STUDENTS)*

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***Abstrak:*** *Pembelajaran digital semakin menjadi keperluan dalam pendidikan abad ke-21, khususnya bagi meningkatkan akses pelajar kepada bahan pembelajaran yang fleksibel dan mudah dicapai. Kajian ini membincangkan pembangunan dan penilaian e-Faith4U, sebuah platform pembelajaran atas talian yang direka untuk membantu pelajar Tingkatan Empat menguasai topik Akidah dalam subjek Pendidikan Islam. Kajian ini dijalankan dengan dua objektif utama, iaitu menilai keberkesanan platform e-Faith4U dalam membantu pelajar memahami topik Akidah melalui pembelajaran atas talian, dan menganalisis tahap penerimaan pelajar terhadap penggunaan e-Faith4U sebagai platform pembelajaran kendiri. Dari segi metodologi, pengkaji menggunakan pendekatan berbentuk kuantitatif yang menggunakan soal selidik untuk memperoleh data bagi menilai keberkesanan kandungan dan ciri interaktif e-Faith4U. Kajian ini dijalankan secara umum meliputi semua pelajar Tingkatan Empat, guru dan lain-lain. Sebanyak 20 set soalan telah diedarkan kepada responden. Dapatan kajian menunjukkan respons yang sangat positif, di mana majoriti pelajar sebanyak 95% bersetuju bahawa e-Faith4U membantu pelajar memahami topik Akidah dengan lebih jelas, manakala 92% menyatakan platform ini menjadikan ulang kaji lebih mudah dan menarik. Guru turut melaporkan peningkatan minat dan penglibatan aktif pelajar dalam sesi PdP apabila e-Faith4U digunakan sebagai bahan sokongan tambahan. Kesimpulannya, e-Faith4U berpotensi menjadi platform pembelajaran digital yang efektif dalam membantu pelajar menguasai pembelajaran Akidah secara kendiri dan fleksibel. Implikasi kajian*

*menekankan keperluan untuk memperluaskan penggunaan platform digital dalam Pendidikan Islam, di samping menggalakkan guru mengintegrasikan sumber interaktif seperti e-Faith4U bagi meningkatkan pemahaman dan motivasi pelajar.*

***Kata Kunci:*** *Pembelajaran digital; PAK-21; Pembelajaran Kendiri; Keberkesanan Platform Interaktif; Akidah Tingkatan Empat*

***Abstract:*** *Digital learning is increasingly becoming a necessity in 21st-century education, especially to improve students' access to flexible and easily accessible learning materials. This study discusses the development and evaluation of e-Faith4U, an online learning platform designed to help Form Four students master the topic of Aqidah in the Islamic Education subject. The study is conducted with two main objectives: to assess the effectiveness of the e-Faith4U platform in helping students understand the topic of Aqidah through online learning, and to analyse the level of student acceptance of using e-Faith4U as a self-learning platform. In terms of methodology, the researcher uses a quantitative approach employing questionnaires to obtain data for evaluating the effectiveness of the content and interactive features of e-Faith4U. The study is broadly conducted involving all Form Four students, teachers, and others. A total of 20 sets of questions were distributed to respondents. The findings show a very positive response, with 95% of students agreeing that e-Faith4U helps them understand the Aqidah topic more clearly, while 92% state that the platform makes revision easier and more interesting. Teachers also reported increased student interest and active involvement in teaching and learning sessions when e-Faith4U was used as supplementary material. In conclusion, e-Faith4U has the potential to be an effective digital learning platform in helping students master Aqidah learning independently and flexibly. The study's implications emphasize the need to expand the use of digital platforms in Islamic Education, while encouraging teachers to integrate interactive resources such as e-Faith4U to enhance students' understanding and motivation.*

***Keywords:*** *Digital Learning; PAK-21; Self-learning; Effectiveness of Interactive Platform; Form Four Aqidah*

## Pengenalan

Dalam era perkembangan teknologi maklumat yang semakin pesat, integrasi platform digital dalam bidang pendidikan telah menjadi satu keperluan utama pada abad ke-21 bagi meningkatkan kualiti proses pembelajaran. Penggunaan teknologi digital bukan sahaja menawarkan kemudahan proses pengajaran dan pembelajaran (PdP) tetapi juga mampu menjadikan pembelajaran lebih interaktif dan menarik. Di peringkat sekolah menengah, penggunaan platform digital dijangka dapat membantu meningkatkan pemahaman serta motivasi pembelajaran mereka.

Oleh itu, pengkaji telah membangunkan laman web digital e-Faith4U untuk menyokong pengajaran dan pembelajaran subjek Pendidikan Islam khususnya bagi topik Akidah tingkatan empat. Pembangunan platform ini berasaskan pendekatan pembelajaran digital dan pembelajaran abad ke-21 yang menekankan penggunaan teknologi sebagai medium penyampaian ilmu secara interaktif dan berpusatkan pelajar. Ini disokong oleh kajian Mohd Maziz Al-Hadi et al. (2021) menegaskan bahawa kaedah interaktif digital meningkatkan kefahaman pelajar dalam Pendidikan Islam. Selaras dengan perkembangan teknologi

maklumat dalam bidang pendidikan, e-Faith4U direka bentuk sebagai persekitaran pembelajaran maya yang membolehkan pelajar mengakses kandungan pembelajaran tanpa terikat kepada ruang dan masa pembelajaran formal. Menurut Al Mulhem (2025), pembelajaran mudah alih menyokong fleksibiliti dan kesinambungan pembelajaran.

Platform e-Faith4U menyediakan pelbagai bentuk kandungan pembelajaran yang merangkumi nota digital berstruktur, bahan multimedia seperti video, infografik dan animasi serta latihan dan kuiz interaktif bagi menyokong pengukuhan kefahaman pelajar. Ini selari Zuraihah et al., (2021) yang mengatakan integrasi elemen multimedia ini bertujuan memperkayakan pengalaman pembelajaran yang pelbagai yang boleh meningkatkan keberkesanan platform. Selain itu, reka bentuk yang responsif dan mesra pengguna membolehkan platform ini dapat diakses melalui pelbagai peranti digital termasuk telefon pintar dan tablet. Pendekatan ini mendorong pelajar untuk terlibat secara aktif, melibatkan diri dalam proses penyelesaian masalah dan mengembangkan pemikiran kritis, yang seterusnya dapat meningkatkan kefahaman serta kemahiran mereka (Abdul, 2023).

Dari sudut pedagogi, e-Faith4U mengaplikasikan prinsip teori konstruktivisme John Piaget yang menekankan pembinaan pengetahuan secara aktif melalui interaksi pelajar dengan bahan pembelajaran. Kandungan laman web disusun secara berperingkat penerokaan konsep asas, pengukuhan kefahaman melalui latihan, seterusnya penerapan kefahaman melalui kuiz serta soalan berbentuk reflektif. Pendekatan berpusatkan pelajar ini membolehkan mereka mengurus pembelajaran kendiri, melakukan ulangkaji dan menilai kefahaman secara berterusan.

Menurut Mohd Fairuz (2020), pelajar lebih bersedia melaksanakan pembelajaran secara bersemuka kerana masih belum mampu mengadaptasi sepenuhnya pembelajaran dalam talian. Halangan ini menunjukkan tahap pendedahan dan kesediaan pelajar dan guru terhadap pendigitalan pendidikan masih rendah telah menjejaskan keberkesanan pelaksanaan pembelajaran digital di sekolah. Keadaan ini menjelaskan bahawa peralihan daripada kaedah pembelajaran tradisional kepada pembelajaran berasaskan teknologi memerlukan sokongan pedagogi yang sesuai serta medium pembelajaran yang mesra pelajar. Sehubungan itu, Kementerian Pendidikan Malaysia (KPM) telah menggesa guru-guru untuk menyesuaikan kaedah dan teknik pengajaran dengan memberi penekanan kepada penggunaan teknologi, digital dan automasi dalam pengajaran dan pembelajaran bagi memastikan pembelajaran lebih relevan dengan keperluan abad ke-21 (Khalissafri Mohd Haslin & Mohd Isa Hamzah, 2023). Namun demikian, keberkesanan ini bergantung kepada ketersediaan platform digital yang sistematik dan sokongan teknikal yang baik (Qalam Rabiah et al., 2023).

Objektif kajian yang ingin dicapai adalah: i. menilai platform e-Faith4U dalam membantu pelajar memahami topik Akidah melalui pembelajaran atas talian; ii. mengenal pasti tahap penerimaan pelajar terhadap penggunaan laman web sebagai medium pembelajaran kendiri.

## Sorotan Literatur

Kajian lepas menegaskan bahawa Pembelajaran Abad ke-21 (PAK21) berperanan penting dalam membentuk pelajar yang holistik melalui penerapan kemahiran 4C iaitu komunikasi, kolaborasi, pemikiran kritis dan kreativiti dalam proses pengajaran dan pembelajaran. Pendekatan berpusatkan pelajar terbukti meningkatkan kefahaman serta keupayaan megaplikasikan pengetahuan melalui pembelajar aktif, penyelesaian masalah dan kolaboratif

(Amir Mohd Nason, 2019). Menurut Azam et al. (2024), peralihan daripada kaedah pengajaran tradisional kepada pembelajaran yang bersifat *hands-on* dan kendiri selari dengan keperluan global yang menuntut pelajar berfikir secara fleksibel, inovatif dan kreatif. Selari dengan ini, pelajar diberi autonomi untuk mengakses bahan pembelajaran seperti nota, mengulang tayang video, serta menjawab kuiz mengikut kadar dan gaya pembelajaran masing-masing sebagai salah satu kemahiran penting dalam PAK21 (Aselawati Che Ab Adziz et al., 2025). Dalam konteks Pendidikan Islam, integrasi pendekatan PAK21 turut dikenal pasti berpotensi meningkatkan kefahaman konsep serta penghayatan nilai agama selaras dengan Falsafah Pendidikan Kebangsaan (Rohani, 2017).

Di samping itu, pembelajaran digital dikenal pasti sebagai medium sokongan utama kepada pelaksanaan PAK21 yang berkesan (Jahidih & Muhamad Suhaimi, 2024). Menurut Shabibah Shaufit Affandi et al., (2021), penggunaan multimedia seperti video, kuiz interaktif serta animasi juga membantu meningkatkan tumpuan, pemahaman serta keupayaan pelajar mengawal kadar pembelajaran kendiri. Justeru, pembelajaran digital juga dilihat lebih responsif berbanding pendekatan bersemuka sepenuhnya (Mohd Hafifi & Rosseni, 2021). Strategi pembelajaran kendiri seperti ini dapat memberikan impak positif terhadap pencapaian akademik pelajar (Ahmad Faza & Ilyana Agri Lestari, 2025), serta perkembangan metakognitif melalui akses sumber yang pelbagai (Nurdiyana Tasripin et al., 2022) Tambahan pula, ibu bapa menunjukkan tahap penerimaan yang tinggi terhadap pembelajaran digital (Nur Syaheera Atan et al., 2021).

Dalam era pembelajaran digital, guru perlu memastikan aksesibiliti, relevansi serta keberkesanan sumber digital supaya pelajar dapat mengawal proses pembelajaran secara lebih berkesan, selari dengan kajian Navas Bonilla et al. (2025) yang menekankan sokongan teknologi digital dan AI membolehkan pelajar mengawal proses pembelajaran mereka secara lebih berkesan. Menurut Ahmad Firdaus & Khairunnisa (2019), guru perlu mahir dalam teknologi untuk mengoptimumkan interaksi dua hala dengan pelajar, selari dengan matlamat pendidikan abad ke-21 yang menekankan kemahiran digital dan literasi maklumat. Pengenalan ini menjadi asas kepada subtopik peranan guru sebagai fasilitator, kepentingan kreativiti serta cabaran dalam platform seperti e-Faith4U, yang menyediakan nota, kuiz dan soalan interaktif untuk pengukuhan pembelajaran (Arman Berkat & Debora Sitinjak, 2022). Sanita Wati & Nurhasannah (2024) menegaskan bahawa guru sebagai fasilitator perlu mengembangkan kompetensi digital melalui pelatihan berterusan untuk mengintegrasikan sumber dalam talian, seterusnya mengatasi rintangan literasi digital di kalangan pelajar.

Dalam konteks e-Faith4U, guru memanfaatkan ciri nota dan kuiz untuk memfasilitasi pembelajaran fleksibel yang berpusatkan pelajar, di mana pelajar boleh mengakses bahan secara bebas mengikut masa dan keperluan mereka sambil menerima bimbingan guru secara maya, termasuk maklum balas serta-merta dan kolaborasi dalam kumpulan digital.Pernyataan ini turut disokong oleh kajian daripada Khalissafri Mohd Haslin & Mohd Isa Hamzah (2023) yang menegaskan pembelajaran digital ini dapat menyediakan pembelajaran yang lebih fleksibel kepada pelajar. Kepentingan kreativiti dan kompetensi guru dalam merancang aktiviti digital tidak boleh dipandang remeh, kerana ia menjadi pemangkin kepada inovasi pedagogi yang menarik dan berkesan.

## Metodologi Kajian

### *Rekabentuk kajian*

Kajian ini merupakan kajian tinjauan yang menggunakan pendekatan kuantitatif bagi menilai keberkesanan dan tahap penerimaan penggunaan platform pembelajaran atas talian e-Faith4U dalam pembelajaran topik Akidah bagi subjek Pendidikan Islam Tingkatan Empat dalam kalangan pelajar dan guru sekolah menengah harian di daerah Kuala Nerus. Reka bentuk kajian tinjauan dipilih kerana ia sesuai untuk memperoleh gambaran awal yang sistematik berkaitan persepsi, tahap kefahaman serta pengalaman pengguna terhadap penggunaan platform digital dalam proses pembelajaran. Kajian ini menggunakan borang soal selidik sebagai instrumen utama untuk mengumpul data berkenaan keberkesanan kandungan, ciri interaktif serta kebolehgunaan e-Faith4U sebagai medium pembelajaran kendiri dan sokongan pengajaran dan pembelajaran (PdP).

### *Populasi dan sampel kajian*

Populasi Kajian ini terdiri daripada pelajar dan guru yang berkhidmat di sekolah menengah harian sekitar daerah Kuala Nerus. Pemilihan responden adalah berdasarkan persetujuan penyertaan dan kesediaan mereka untuk terlibat dalam kajian ini.

Menurut jadual penentuan saiz sampel oleh Krejcie dan Morgan (1970), bagi populasi seramai 245 orang, saiz sampel yang sesuai ialah 150 responden. Sehubungan itu, kajian ini melibatkan seramai 150 orang responden yang terdiri daripada pelajar, guru dan ibu bapa. Majoriti responden adalah pelajar Tingkatan 3, iaitu seramai 123 orang, diikuti oleh 22 orang guru, manakala selebihnya seramai 5 orang terdiri daripada ibu bapa. Agihan sampel ini menunjukkan penekanan kajian terhadap perspektif pelajar sebagai pengguna utama platform pengajaran dan pembelajaran, di samping mengambil kira pandangan guru dan ibu bapa bagi memberikan gambaran yang lebih menyeluruh terhadap keberkesanan penggunaan laman web e-Faith4U dalam pengajaran dan pembelajaran Pendidikan Islam.

### *Instrumen kajian*

Kajian ini menggunakan borang soal selidik sebagai instrumen kajian bagi mengumpul data dan maklum balas daripada responden. Borang soal selidik ini dibina oleh pengkaji dan mengandungi sebanyak 20 item soalan yang merangkumi 3 bahagian dalam kesemua set soalan yang telah disediakan iaitu bahagian A merupakan maklumat demografi responden, manakala bahagian B menilai keberkesanan platform e-Faith4U dalam membantu pelajar mempelajari topik akidah melalui pembelajaran atas talian. Bahagian C pula adalah menganalisis tahap penerimaan pelajar terhadap penggunaan e-Faith4U sebagai platform pembelajaran kendiri. Item soal selidik ini menggunakan skala Likert empat mata. Instrumen ini digunakan bagi menilai sejauh mana platform e-Faith4U membantu meningkatkan kefahaman pelajar terhadap topik Akidah serta kesesuaiannya sebagai medium pembelajaran kendiri yang fleksibel dan menarik.

**Jadual 1: Skala Dan Empat Aras Persetujuan**

| Skala | Aras Persetujuan |
|---|---|
| 1 | Sangat tidak setuju |
| 2 | Tidak setuju |
| 3 | Setuju |
| 4 | Sangat setuju |

## Keputusan dan Perbincangan

***Dapatan Kajian Objektif 1***

**Jadual 2: Analisis Keberkesanan Platform**

| Bil | Pernyataan Item | Min Pelajar | Min (Guru) | Min (Ibu Bapa) |
|---|---|---|---|---|
| **1.** | Platform ini membantu pelajar memahami topik Akidah dengan lebih jelas | 3.63 | 3.82 | 4.00 |
| **2.** | Nota yang disediakan dalam e-Faith4U mudah difahami. | 3.67 | 3.64 | 3.60 |
| **3.** | Adakah reka bentuk dan susun atur laman web memudahkan anda mencari maklumat. | 3.64 | 3.55 | 3.60 |
| **4.** | Set soalan dan latihan dalam e-Faith4U membantu saya menguji kefahaman saya | 3.71 | 3.59 | 3.60 |
| **5.** | Bahan seperti video infografik atau kuiz membantu meningkatkan kefahaman. | 3.64 | 3.68 | 4.00 |
| **6.** | Pelajar dapat mengulang kaji topik Akidah dengan lebih berkesan menggunakan e-Faith4U. | 3.72 | 3.64 | 3.60 |
| **7.** | Adakah pembelajaran atas talian melalui laman web ini meningkatkan minat terhadap topik akidah? | 3.67 | 3.59 | 3.80 |
| **8.** | Adakah laman web ini memenuhi ciri-ciri pembelajaran abad ke 21 yang berasaskan teknologi? | 3.67 | 3.68 | 3.80 |
| **9.** | Pelajar dapat menghubungkan isi pembelajaran Akidah dengan situasi harian melalui bahan di e-Faith4U. | 3.60 | 3.55 | 3.60 |
| **10.** | Adakah anda berpendapat laman web ini sesuai digunakan sebagai bahan bantu mengajar atau bahan sokongan pembelajaran? | 3.60 | 3.55 | 4.00 |

Sumber: Hasil dapatan google form

## Keputusan dan Perbincangan

Berdasarkan respon yang telah diterima, jadual 2 di atas menunjukkan bahawa majoriti responden terdiri daripada pelajar iaitu sebanyak 123 responden (82%), guru seramai 22 responden (14.7%) manakala ibu bapa 5 responden (3.3%). Hal ini telah menunjukkan bahawa penggunaan platform pembelajaran digital e-Faith4U telah mendapat sambutan dalam kalangan pelajar. Bagi min yang tertinggi untuk pelajar, dapat dilihat pada item 6 sebanyak 3.72, iaitu pelajar dapat mengulang kaji topik Akidah dengan lebih berkesan menggunakan e-Faith4U. Min sederhana dapat dilihat pada item 3 dan 5 sebanyak 3.64, iaitu reka bentuk dan

susun atur laman web memudahkan anda mencari maklumat dan bahan seperti video infografik atau kuiz membantu meningkatkan kefahaman. Manakala bagi min terendah untuk pelajar, dapat dilihat pada item 9 sebanyak 3.55, iaitu pelajar dapat menghubungkan isi pembelajaran Akidah dengan situasi harian melalui bahan di e-Faith4U dan item 10, iaitu laman web ini sesuai digunakan sebagai bahan bantu mengajar atau bahan sokongan pembelajaran.

Bagi min tertinggi untuk guru, dapat dilihat pada item 1 sebanyak 3.82, iaitu platform ini membantu pelajar memahami topik Akidah dengan lebih jelas. Min sederhana pula di item 5 dan 8 sebanyak 3.68, iaitu bahan seperti video infografik atau kuiz membantu meningkatkan kefahaman dan laman web ini memenuhi ciri-ciri pembelajaran abad ke 21 yang berasaskan teknologi. Untuk min terendah pula, boleh difokuskan pada item 3,9 dan 10 sebanyak 3.55, iaitu reka bentuk dan susun atur laman web memudahkan anda mencari maklumat, pelajar dapat menghubungkan isi pembelajaran Akidah dengan situasi harian melalui bahan di e-Faith4U, dan pendapat mengenai laman web ini sesuai digunakan sebagai bahan bantu mengajar atau bahan sokongan pembelajaran.

Bagi min tertinggi untuk kategori ibu bapa, dapat difokuskan pada item 1,2 dan 10 sebanyak 4.00, iaitu platform ini membantu pelajar memahami topik Akidah dengan lebih jelas, nota yang disediakan dalam e-Faith4U, mudah difahami dan pendapat laman web ini sesuai digunakan sebagai bahan bantu mengajar atau bahan sokongan pembelajaran. Min sederhana pula dilihat pada item 7 dan 8 sebanyak 3.80 iaitu pembelajaran atas talian melalui laman web ini meningkatkan minat terhadap topik akidah serta laman web ini memenuhi ciri-ciri pembelajaran abad ke 21 yang berasaskan teknologi. Min terendah dapat dilihat pada item 2,3,4,6 dan 9, iaitu nota yang disediakan dalam e-Faith4U mudah difahami, reka bentuk dan susun atur laman web memudahkan anda mencari maklumat, set soalan dan latihan dalam e-Faith4U membantu saya menguji kefahaman saya, pelajar dapat mengulang kaji topik Akidah dengan lebih berkesan menggunakan e-Faith4U dan pelajar dapat menghubungkan isi pembelajaran Akidah dengan situasi harian melalui bahan di e-Faith4U.

Platform digital interaktif e-Faith4U terbukti berkesan sebagai media pembelajaran alternatif bagi pelajar Tingkatan 4, dengan dapatan menunjukkan penerimaan yang positif daripada pelajar, guru, dan ibu bapa. Keberkesanan ini selari dengan kajian pendidikan Islam abad ke-21 yang menekankan integrasi teknologi sebagai pemangkin motivasi dan kefahaman (Jahidih & Muhamad Suhaimi, 2024). Dari sudut penerimaan pelajar, analisis menunjukkan majoriti pelajar (82%) menjadi responden utama, dengan nilai min tertinggi pada item 6 (3.72) iaitu keberkesanan ulang kaji topik Akidah menggunakan e-Faith4U. Hal ini membuktikan bahawa platform digital ini bukan sahaja berfungsi sebagai alat bantu pembelajaran, tetapi juga sebagai medium pengukuhan pengetahuan (Khalissafri, 2023). Kajian oleh Mohd Maziz Al-Hadi et al. (2021) menegaskan bahawa kaedah interaktif digital meningkatkan kefahaman pelajar dalam Pendidikan Islam kerana ia menyediakan pengalaman pembelajaran yang lebih jelas dan terarah kepada pelajar.

Selain itu, e-Faith4U sesuai dengan keperluan Pembelajaran Abad ke-21 (PAK-21) yang menekankan pembelajaran kendiri, kolaboratif dan literasi teknologi. Ia menggunakan teknologi, mempunyai akses internet dan kemudahan belajar di mana-mana sahaja (Amir Mohd Nason, 2019). Pelajar boleh membaca nota, mengulang tayang video serta menjawab kuiz mengikut kadar dan gaya mereka sendiri, mengikut prinsip pembelajaran berpusatkan murid. Pelajar mendapat kebertanggungjawaban terhadap proses pembelajaran, yang

merupakan kemahiran penting dalam PAK-21, melalui bantuan ciri ini (Aselawati Che Ab Adziz et al., 2025).

Menurut perspektif guru, mereka menilai platform ini dengan min tertinggi pada item 1 (3.82), iaitu keberkesanan dalam membantu pelajar memahami topik Akidah. Walaupun terdapat min sederhana pada aspek reka bentuk laman (3.55), dapatan ini menunjukkan guru melihat potensi besar e-Faith4U sebagai sokongan PdP. Ahmad Firdaus dan Khairunnisa (2019) menegaskan bahawa penguasaan teknologi dalam kalangan guru amat penting bagi memperkukuh interaksi dua hala dengan pelajar, sejajar dengan matlamat pendidikan abad ke-21 yang menitikberatkan kemahiran digital dan literasi maklumat. Seiring dengan itu, guru Pendidikan Islam perlu menyesuaikan kurikulum dengan cabaran abad ke-21, termasuk penggunaan teknologi interaktif untuk memastikan keberkesanan PdP (Rohani, 2017).

Menurut pandangan ibu bapa pula, mereka memberikan skor tertinggi 4.00 pada item 1, 2, dan 10, menandakan keyakinan bahawa e-Faith4U membantu anak-anak memahami Akidah, menyediakan nota mudah difahami, dan sesuai sebagai bahan sokongan pembelajaran. Sokongan ibu bapa ini amat penting kerana ia menunjukkan penerimaan masyarakat terhadap integrasi teknologi dalam pendidikan agama (Jahidih et al., 2025). Kajian oleh Nurdiyana Tasripin et al. (2022) turut menekankan bahawa aplikasi pembelajaran interaktif memberi manfaat kepada perkembangan kognitif dan motivasi pelajar, sekali gus meningkatkan sokongan keluarga terhadap penggunaannya. Secara keseluruhan, nilai min bagi pelajar, guru, dan ibu bapa berada dalam lingkungan 3.55-4.00, menunjukkan tahap setuju yang tinggi terhadap keberkesanan platform.

Walaupun terdapat aspek yang boleh dipertingkat seperti reka bentuk laman dan penghubungan isi dengan kehidupan harian, dapatan ini membuktikan bahawa e-Faith4U berjaya memenuhi ciri-ciri Pembelajaran Abad ke-21 (PAK-21) yang berasaskan teknologi. Menurut Shabibah Shaufit Affandi et al., (2021), elemen multimedia seperti video, kuiz, dan infografik bukan sahaja meningkatkan kefahaman, malah turut menyumbang kepada peningkatan minat pelajar terhadap subjek Akidah.

Integrasi platform digital interaktif e-Faith4U sebagai media pembelajaran alternatif telah membuktikan keberkesanannya dalam meningkatkan kefahaman, minat, dan sokongan terhadap pembelajaran Akidah di sekolah menengah. Penerimaan positif daripada pelajar, guru, dan ibu bapa menegaskan bahawa platform ini berpotensi menjadi media pembelajaran alternatif yang relevan dan berkesan dalam konteks Pendidikan Islam abad ke-21. Platform ini bukan sahaja berfungsi sebagai alat bantu utama dalam pengajaran dan pembelajaran, tetapi juga sebagai medium yang menyokong pembelajaran kendiri, pengulangan topik, serta penghubungan isi dengan kehidupan seharian (Mohd Hafifi & Rosseni, 2021). Sokongan daripada guru dan ibu bapa memperkukuh lagi keberkesanan platform ini kerana ia menunjukkan penerimaan masyarakat terhadap penggunaan teknologi dalam pendidikan agama (Aselawati Che Ab Adziz et al., 2025). Hal ini penting kerana keberkesanan sesuatu inovasi pendidikan tidak hanya bergantung kepada pelajar semata-mata, tetapi turut dipengaruhi oleh sokongan komuniti pendidikan secara menyeluruh.

Namun begitu, terdapat ruang penambahbaikan yang boleh diberi perhatian, khususnya dalam aspek reka bentuk laman web, motivasi jangka panjang, dan penghubungan isi pembelajaran dengan kehidupan harian. Penambahbaikan melalui integrasi gamifikasi, reka

bentuk antara muka yang lebih mesra pengguna, serta penyediaan bahan multimedia yang lebih interaktif boleh membantu meningkatkan lagi keberkesanan platform ini (Zuraihah et al., 2021). Sekiranya perubahan ini dapat dilaksanakan dengan teliti, e-Faith4U boleh menjadi lebih efektif dan berkesan daripada sekadar platform yang hanya menyampaikan maklumat dan bertukar menjadi satu ekosistem pembelajaran akidah yang benar-benar menyokong pertumbuhan afektif, kognitif dan sahsiah pelajar. Platform ini membolehkan pelajar memahami kepentingan akidah serta mengaplikasikannya secara praktikal dalam kehidupan seharian.

***Dapatan Objektif Kajian 2***

Jadual 3 menunjukkan analisis tahap penerimaan pelajar, guru, dan ibu bapa terhadap penggunaan e-Faith4U sebagai platform pembelajaran kendiri.

**Jadual 3: Tahap Penerimaan Pelajar, Guru, Dan Ibu Bapa Terhadap Penggunaan e-Faith4U Sebagai Platform Pembelajaran Kendiri.**

| Bil | Pernyataan Item | Min Pelajar | Min (Guru) | Min (Ibu Bapa) |
|---|---|---|---|---|
| **1.** | Adakah laman web pembelajaran ini mudah digunakan. | 3.63 | 3.73 | 4.00 |
| **2.** | Laman web ini membantu memudahkan proses pembelajaran kendiri. | 3.68 | 3.91 | 4.00 |
| **3.** | Laman web ini menyediakan bahan yang jelas dan mudah difahami. | 3.65 | 3.82 | 3.60 |
| **4.** | Penggunaan laman web ini menjimatkan masa dan lebih fleksibel. | 3.71 | 3.96 | 3.60 |
| **5.** | Penggunaan laman web ini boleh meningkatkan motivasi untuk belajar. | 3.64 | 3.86 | 3.80 |
| **6.** | Laman web ini menjadi pilihan kerana boleh diakses melalui telefon pintar dan tablet. | 3.72 | 4.00 | 4.00 |
| **7.** | Proses ulang kaji menggunakan laman web ini lebih diminati berbanding bahan tradisional (buku teks). | 3.65 | 3.82 | 3.80 |
| **8.** | Platform ini mempunyai ciri interaktif yang menarik perhatian pelajar untuk belajar secara kendiri. | 3.68 | 3.91 | 3.80 |
| **9.** | Proses untuk membuka, menonton, atau membaca bahan pembelajaran berjalan dengan lancar. | 3.61 | 3.77 | 3.80 |
| **10.** | Adakah anda berpuas hati dengan penggunaan keseluruhan laman web ini. | 3.60 | 3.91 | 4.00 |

Sumber: Hasil dapatan google form

**Keputusan dan Perbincangan**

Analisis hasil dapatan jadual 3 mendapati bahawa majoriti responden terdiri daripada pelajar seramai 123 orang (82%), diikuti oleh guru seramai 22 orang (14.7%) dan ibu bapa seramai 5 orang (3.3%). Hal ini jelas menunjukkan bahawa penggunaan platform pembelajaran digital e-

Faith4U telah mendapat sambutan yang tinggi dalam kalangan pelajar sebagai pengguna utama.

Bagi kategori pelajar, min tertinggi dapat dilihat pada item 6 (3.72) iaitu pelajar menilai bahawa e-Faith4U mudah diakses melalui telefon pintar dan tablet, sekali gus memudahkan mereka mengulang kaji topik Akidah dengan lebih berkesan. Min sederhana dapat dilihat pada item 3 (3.65) dan item 5 (3.64), iaitu bahan yang disediakan jelas serta susun atur laman web memudahkan pencarian maklumat, manakala bahan interaktif seperti video infografik dan kuiz membantu meningkatkan motivasi serta kefahaman. Min terendah dicatatkan pada item 9 (3.61) dan item 10 (3.60), iaitu pelajar menilai proses akses bahan masih boleh dipertingkatkan dan laman web ini sesuai digunakan sebagai bahan sokongan pembelajaran.

Bagi kategori guru, min tertinggi dicatatkan pada item 6 (4.00) iaitu guru menilai e-Faith4U sebagai platform yang sangat mudah diakses melalui telefon pintar dan tablet, sekaligus menyokong pembelajaran kendiri. Min sederhana dapat dilihat pada item 9 (3.77), iaitu guru menilai kelancaran proses membuka dan menonton bahan pembelajaran masih boleh dipertingkatkan. Walaupun begitu, semua skor min bagi guru berada pada tahap tinggi melebihi 3.70, menunjukkan keyakinan guru terhadap keberkesanan e-Faith4U dalam menyokong pembelajaran abad ke-21.

Bagi kategori ibu bapa, min tertinggi dicatatkan pada item 1, 2, 6 dan 10 (4.00), iaitu ibu bapa menilai e-Faith4U sebagai mudah digunakan, membantu pembelajaran kendiri, boleh diakses melalui telefon pintar dan tablet, serta memberi kepuasan keseluruhan. Min sederhana dapat dilihat pada item 5, 7, 8 dan 9 (3.80), iaitu ibu bapa menilai bahan interaktif dan proses ulang kaji atas talian meningkatkan minat anak-anak terhadap topik Akidah. Min terendah dicatatkan pada item 3 dan 4 (3.60), iaitu ibu bapa menilai bahan pembelajaran masih boleh diperkemaskan dari segi kejelasan dan fleksibiliti.

Secara keseluruhan, dapatan kajian menunjukkan bahawa tahap penerimaan terhadap e-Faith4U berada pada kategori tinggi bagi ketiga-tiga kumpulan responden. Pelajar menekankan aspek fleksibiliti dan akses mudah, guru menekankan kebolehcapaian melalui peranti mudah alih, manakala ibu bapa menekankan kemudahan penggunaan dan kepuasan keseluruhan.

Dapatan kajian menunjukkan bahawa tahap penerimaan pelajar, guru, dan ibu bapa terhadap penggunaan e-Faith4U sebagai platform pembelajaran kendiri berada pada kategori tinggi. Hal ini dapat dilihat melalui skor min yang konsisten melebihi 3.60 bagi ketiga-tiga kumpulan responden. Pelajar menekankan aspek fleksibiliti dan kebolehcapaian melalui telefon pintar, guru menekankan kebolehcapaian serta kepuasan keseluruhan, manakala ibu bapa menekankan kemudahan penggunaan dan keberkesanan e-Faith4U dalam menyokong pembelajaran anak-anak mereka. Penemuan ini juga selaras dengan pandangan Azam et al. (2024) yang menekankan bahawa perubahan daripada pendekatan pengajaran tradisional kepada pembelajaran berasaskan pengalaman langsung dan kendiri adalah sejajar dengan tuntutan global yang memerlukan pelajar berfikir secara anjal, inovatif dan kreatif.

Perkara ini selari dengan dapatan kajian oleh Aselawati Che Ab Adziz et al. (2025) yang menegaskan bahawa tahap penerimaan guru dan murid terhadap platform digital adalah tinggi kerana ia membantu meningkatkan keberkesanan pembelajaran kendiri. Kajian tersebut menunjukkan bahawa penggunaan platform digital bukan sahaja memudahkan akses kepada

bahan pembelajaran tetapi juga meningkatkan motivasi pelajar untuk belajar secara kendiri. Hal ini juga selari dengan Abdul (2023) yang menegaskan bahawa laman web yang menyediakan pelbagai bentuk kandungan digital seperti video, infografik dan kuiz interaktif dapat menyokong pengukuhan kefahaman pelajar, sekali gus menjadikan platform ini mudah diterima sebagai medium pembelajaran kendiri.

Selain itu, inisiatif Kementerian Pendidikan Malaysia (KPM) melalui pelantar DELIMa yang diperkenalkan dalam Pelan Pembangunan Pendidikan Malaysia (PPPM 2013–2025) turut menyokong dapatan ini. DELIMa menyediakan akses percuma kepada e-buku, video pembelajaran, podcast dan gamifikasi yang menjadikan proses PdP lebih interaktif. Hal ini menunjukkan bahawa e-Faith4U berada dalam aliran yang sama dengan usaha nasional untuk memperkukuh integrasi teknologi dalam pendidikan.

Bagi pelajar, skor min tertinggi pada aspek fleksibiliti dan kebolehcapaian melalui telefon pintar (3.72) menunjukkan bahawa mereka menghargai pembelajaran yang boleh dilakukan di mana sahaja. Kajian oleh Khalissafri Mohd Haslin & Mohd Isa Hamzah (2023) turut menegaskan bahawa pendigitalan pendidikan memberi kesan positif kepada murid kerana ia menyediakan peluang pembelajaran yang lebih fleksibel dan sesuai dengan keperluan abad ke-21.

Guru pula memberikan skor maksimum pada aspek kebolehcapaian melalui telefon pintar (4.00), menandakan bahawa mereka melihat e-Faith4U sebagai platform yang menyokong pembelajaran kendiri dengan baik. Walaupun begitu, skor min yang sedikit lebih rendah pada aspek kelancaran akses (3.77) menunjukkan bahawa terdapat ruang penambahbaikan dari segi teknikal. Kajian oleh Qalam Rabiah et al. (2023) turut menekankan cabaran guru dalam melaksanakan PdP atas talian, khususnya dari segi kestabilan capaian internet dan sokongan teknikal.

Hasil daripada dapatan kajian juga menunjukkan bahawa ibu bapa memberikan skor maksimum pada beberapa item, khususnya berkaitan kemudahan penggunaan dan kepuasan keseluruhan. Hal ini selari dengan kajian oleh Nur Syaheera Atan et al. (2021) yang mendapati ibu bapa semakin bersedia menerima pembelajaran maya semasa pandemik COVID-19, walaupun pada awalnya menghadapi cabaran dari segi adaptasi. Kesediaan ibu bapa terhadap platform digital menunjukkan sokongan yang kuat terhadap pembelajaran anak-anak di rumah. Cadangan penambahbaikan yang relevan dari segi aspek teknikal, walaupun skor min menunjukkan tahap penerimaan yang tinggi, terdapat skor item yang rendah pada aspek kelancaran akses, khususnya dalam kalangan pelajar (min=3.61) dan guru (min=3.77). Hal ini menunjukkan keperluan untuk memperkukuh kestabilan sistem dan kelajuan capaian.

Penambahbaikan boleh dilakukan melalui peningkatan kapasiti pelayan, penggunaan teknologi *cloud computing*, serta pengoptimuman kelajuan capaian laman web. Kajian oleh Qalam Rabiah et al. (2023) menekankan bahawa kestabilan internet dan sokongan teknikal adalah faktor kritikal dalam memastikan keberkesanan pembelajaran digital. Selain itu, e-Faith4U perlu terus mengekalkan reka bentuk mesra mudah alih kerana dapatan menunjukkan skor maksimum pada aspek kebolehcapaian melalui telefon pintar dan tablet (guru=4.00, ibu bapa=4.00). Kajian oleh Al Mulhem (2025) turut menegaskan bahawa pembelajaran mudah alih kekal relevan selepas pandemik kerana ia menyokong pembelajaran fleksibel dan berterusan. Penambahbaikan teknikal juga boleh dilakukan dengan mengintegrasikan

teknologi terkini seperti kecerdasan buatan (AI) untuk mencadangkan bahan pembelajaran yang bersesuaian dengan tahap pencapaian pelajar. Kajian oleh Navas Bonilla et al. (2025) menekankan bahawa sokongan teknologi digital dan AI membolehkan pelajar mengawal proses pembelajaran mereka secara lebih berkesan.

Dari sudut pedagogi, e-Faith4U boleh memperkukuh lagi keberkesanan dengan menambah variasi bahan pembelajaran. Walaupun ibu bapa memberikan skor sederhana pada item kejelasan bahan (min=3.60), hal ini menunjukkan keperluan untuk menambah bahan interaktif seperti video, kuiz gamifikasi, infografik, dan simulasi. Kajian oleh Arman Berkat & Debora Sitinjak (2022) mendapati bahawa penggunaan media interaktif meningkatkan minat dan kefahaman pelajar. Selain itu, e-Faith4U boleh menambah ciri pembelajaran kendiri berstruktur seperti penetapan matlamat, pemantauan progres, dan refleksi kendiri. Kajian oleh Ahmad Faza & Ilyana Agri Lestari (2025) menekankan bahawa strategi pembelajaran kendiri seperti ini meningkatkan pencapaian akademik. Tambahan pula, e-Faith4U boleh mengintegrasikan pedagogi abad ke-21 dengan menambah elemen kolaboratif seperti forum perbincangan, ruang refleksi, dan tugasan berasaskan projek. Kajian oleh Khalissafri Mohd Haslin & Mohd Isa Hamzah (2023) menyoroti bahawa pendigitalan pendidikan perlu selari dengan kemahiran abad ke-21 seperti komunikasi, kolaborasi, dan pemikiran kritis.

Dari segi sokongan ibu bapa dan komuniti, walaupun ibu bapa memberikan skor tinggi pada aspek kemudahan penggunaan dan kepuasan keseluruhan, kajian oleh Nur Syaheera Atan et al. (2021) menunjukkan bahawa sesetengah ibu bapa masih menghadapi cabaran adaptasi terhadap pembelajaran maya. e-Faith4U boleh menyediakan ruang komunikasi dua hala antara ibu bapa dan guru bagi meningkatkan sokongan pembelajaran di rumah. Kajian oleh Penang Institute (2025) menekankan kepentingan merapatkan jurang digital dengan melibatkan semua pihak dalam ekosistem pendidikan.

Secara keseluruhan, dapatan kajian ini membuktikan bahawa e-Faith4U mempunyai potensi besar sebagai platform pembelajaran kendiri yang mampu memenuhi keperluan pelbagai pihak dalam ekosistem pendidikan. Ia bukan sahaja selari dengan usaha KPM memperkukuh integrasi teknologi dalam pendidikan, tetapi juga menyokong dapatan kajian antarabangsa yang menekankan kepentingan literasi digital dan efikasi kendiri dalam pembelajaran. Cadangan penambahbaikan yang dinyatakan juga menunjukkan bahawa e-Faith4U bukan sahaja perlu mengekalkan kekuatan teknikal dan kebolehcapaian, tetapi juga memperkukuh aspek pedagogi yang berkesan dalam menyokong pembelajaran abad ke-21.

## Kesimpulan

Kesimpulannya, pembangunan dan pelaksanaan platform pembelajaran digital e-Faith4U telah membuktikan keberkesanannya sebagai medium alternatif dalam meningkatkan penguasaan pelajar terhadap topik Akidah. Dapatan kajian mendapati platform ini diterima baik, dengan nilai min berada pada tahap tinggi bagi kebanyakan item yang dinilai. Pelajar menunjukkan tahap penerimaan yang positif, terutamanya dari aspek kebolehcapaian melalui telefon pintar, fleksibiliti penggunaan serta keberkesanan dalam ulang kaji. Guru pula menilai e-Faith4U sebagai platform yang membantu meningkatkan kefahaman pelajar, selari dengan keperluan pedagogi abad ke-21 yang menekankan penggunaan teknologi secara interaktif. Sokongan ibu bapa turut memperkukuh dapatan dengan menilai nota, bahan multimedia dan kemudahan navigasi laman web sebagai elemen yang memudahkan pembelajaran anak-anak

mereka.Secara keseluruhan, e-Faith4U bukan sahaja memenuhi ciri-ciri Pembelajaran Abad ke-21, malah menawarkan pengalaman pembelajaran yang lebih menarik, interaktif dan fleksibel. Walaupun terdapat beberapa aspek yang masih boleh ditambah baik seperti reka bentuk laman dan kelancaran akses bahan, platform ini tetap berpotensi besar sebagai inovasi pembelajaran Pendidikan Islam yang relevan dengan perkembangan teknologi masa kini.

## Penghargaan

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## Rujukan

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# ANALISIS IMPAK PENGGUNAAN SMART AKHLAQ SEBAGAI PLATFORM PEMBELAJARAN DIGITAL DALAM SUBJEK PENDIDIKAN ISLAM TINGKATAN 1

*AN ANALYSIS OF THE IMPACT OF USING SMART AKHLAQ AS A DIGITAL LEARNING PLATFORM IN FORM ONE ISLAMIC EDUCATION*

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***Abstrak***: *Kajian ini membentangkan pembangunan dan menilai keberkesanan laman sesawang "Smart Akhlaq" yang merupakan satu inisiatif digital direka untuk memenuhi keperluan pembelajaran akhlak dalam kalangan pelajar Tingkatan Satu secara sistematik, berkesan dan selaras dengan Pembelajaran Abad Ke-21. Laman sesawang ini berfungsi sebagai platform holistik yang menghimpunkan bahan rujukan, modul interaktif dan sumber visual yang menarik untuk pembangunan karakter. Kajian ini menggunakan kaedah campuran (mixed-method) yang menggabungkan pendekatan kuantitatif dan kualitatif bagi menilai tahap penerimaan serta keberkesanan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar dalam pembelajaran akhlak. Seramai 213 orang pelajar Tingkatan Satu di dua buah Sekolah Menengah Harian Daerah Kuala Nerus telah dipilih sebagai sampel kajian menggunakan kaedah persampelan mudah. Data dikumpulkan melalui borang soal selidik "Google Form" yang menggunakan skala Likert empat mata. Dapatan kajian menunjukkan respons yang sangat positif daripada responden di mana hampir keseluruhan pelajar menganggap laman sesawang ini mesra pengguna dan berkesan untuk pembelajaran kendiri. Majoriti pelajar 96% sangat setuju atau setuju bahawa laman sesawang ini membantu mereka memahami topik akhlak dengan lebih mudah berbanding buku teks. Secara keseluruhannya, pembangunan "Smart Akhlaq" menandakan anjakan paradigma yang signifikan dalam*

*Pendidikan Islam yang berupaya mengukuhkan pemahaman konsep dan memupuk penghayatan nilai serta pembangunan karakter secara holistik.*

***Kata Kunci**: Smart Akhlaq, Pembelajaran Digital, Platform berasaskan web, Pendidikan Islam.*

***Abstract**: This research presents the development and evaluation of the Smart Akhlaq Website which is a digital initiative designed to fulfill the systematic, effective and 21st-Century Learning (21CL) aligned needs of Islamic ethics (Akhlak) education among Form One students. The website serves as a holistic platform that compiles reference materials, interactive modules and engaging visual resources for character development. A mixed-method research design, integrating quantitative and qualitative approaches, was employed to examine students' acceptance and the effectiveness of the "Smart Akhlaq" website as a teaching and learning aid in akhlaq education. A total of 213 Form One students from two daily secondary schools in the Kuala Nerus district were selected as a sample using convenience sampling method. Data were collected via a Google Form questionnaire utilizing a four-point Likert scale. The study's findings indicate a highly positive response from respondents where almost all students considered the website user-friendly and effective for self-learning. The majority of students 96% strongly agree or agree that the website helped them understand Akhlaq topics more easily compared to textbooks. In conclusion, the development of Smart Akhlaq signifies a significant paradigm shift in Islamic Education, capable of strengthening conceptual understanding and fostering the holistic internalization of values and character development.*

***Keywords:** Smart Akhlaq, Digital Learning, Web-Based Platform, Islamic Education.*

## Pengenalan

### *Latar Belakang kajian*

Dalam mendepani arus pendidikan moden, integrasi teknologi dan maklumat telah menjadi keperluan mendesak untuk memastikan proses pengajaran dan pembelajaran (PdP) terus kekal relevan khususnya dalam bidang Pendidikan Islam. Penggunaan laman sesawang dilihat sebagai satu transformasi penting bagi menarik minat pelajar terhadap subjek yang dianggap tradisional (Hussin, 2017). Kajian ini memfokuskan kepada pembangunan inovasi digital "Smart Akhlaq," sebuah laman sesawang pembelajaran untuk topik Tingkatan Satu.

Penggunaan medium berasaskan laman sesawang membolehkan penerapan elemen interaktif yang lebih berkesan kaedah konvensional. Menurut Mohd. Efendi dan Khairiyah (2019), elemen interaktif dalam reka bentuk instruksional berasaskan internet memainkan peranan penting dalam meningkatkan keterlibatan pelajar dan membantu proses pemahaman maklumat dengan lebih pantas. Pendekatan ini juga menyokong pembelajaran kendiri, dimana pelajar boleh mengakses bahan pembelajaran mengikut kesesuaian masa pelajar selaras dengan dapatan Mohamad dan Halim (2021) yang mendapati penerimaan pelajar terhadap laman sesawang sebagai medium pembelajaran kendiri adalah tinggi.

***Pernyataan masalah.***

Walaupun kurikulum Pendidikan Islam menekankan pembentukan sahsiah, kaedah penyampaian yang kurang menarik sering menjadi penghalang kepada penghayatan murid. Ab. Halim Tamuri et al. (2018) menegaskan bahawa terdapat keperluan untuk membangunkan modul bersepadu yang lebih segar dalam Pendidikan Islam bagi menangani isu keberkesanan pembentukan akhlak dalam kalangan remaja. Masalah utama yang dikenal pasti adalah kebergantungan kepada bahan cetak statik yang sering gagal mengekalkan fokus murid.

Selain itu, kejayaan sesebuah sistem e-pembelajaran bukan hanya bergantung kepada kandungan, tetapi juga kepada kualiti sistem dan maklumat yang dipaparkan. Al-Fraihat et al. (2020) dalam kajian empirikal mereka mendapati bahawa kualiti sistem adalah faktor kritikal yang menentukan kejayaan e-pembelajaran. Tanpa reka bentuk visual dan teknikal yang baik, motivasi pelajar untuk menggunakan bahan bantu mengajar digital akan merosot. Oleh itu, kajian ini dijalankan untuk membangunkan "Smart Akhlaq" yang bukan sahaja memenuhi keperluan kurikulum, tetapi juga menepati ciri-ciri kejayaan sistem e-pembelajaran untuk meningkatkan kefahaman pelajar.

***Objektif kajian***

Objektif kajian ini dijalankan ialah untuk i. Membangunkan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar digital bagi topik Akhlak dalam subjek Pendidikan Islam,ii. Menilai tahap kebolehgunaan laman sesawang "Smart Akhlaq" dari aspek reka bentuk visual, kandungan dan navigasi,iii. Mengenal pasti tahap penerimaan dan minat murid terhadap penggunaan aplikasi "Smart Akhlaq" dalam sesi pembelajaran.

**Metodologi Kajian**

Metodologi kajian ini dibangunkan bagi menerangkan kaedah dan prosedur yang digunakan untuk menilai keberkesanan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar dalam pembelajaran akhlak. Fokus utama metodologi ini adalah menjelaskan pendekatan penyelidikan, teknik pemilihan sampel, instrumen soal selidik yang digunakan dan kaedah pengumpulan data bagi memastikan dapatan kajian adalah sahih dan boleh dipercayai. Pendekatan metodologi yang digunakan dalam kajian ini membolehkan penyelidik mengenal pasti tahap kepuasan pengguna, keberkesanan pembelajaran serta cadangan penambahbaikan berdasarkan maklum balas pelajar yang menggunakan laman sesawang tersebut. Penyelidikan berasaskan pengalaman sebenar pengguna ini selaras dengan keperluan kajian pendidikan masa kini yang menekankan penilaian terhadap keberkesanan bahan pengajaran digital dalam meningkatkan pemahaman pelajar (Mohamad & Halim, 2021).

***Reka Bentuk Kajian***

Kajian ini menggunakan kaedah campuran (mixed-method) yang menggabungkan pendekatan kuantitatif dan kualitatif bagi menilai tahap penerimaan serta keberkesanan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar dalam pembelajaran akhlak. Pendekatan mixed-method dipilih kerana ia membolehkan pengkaji memperoleh kefahaman yang lebih menyeluruh melalui gabungan data berbentuk angka dan data naratif, sekaligus memberi gambaran yang lebih holistik tentang fenomena yang dikaji (Ismail & Ahmad, 2020). Dengan

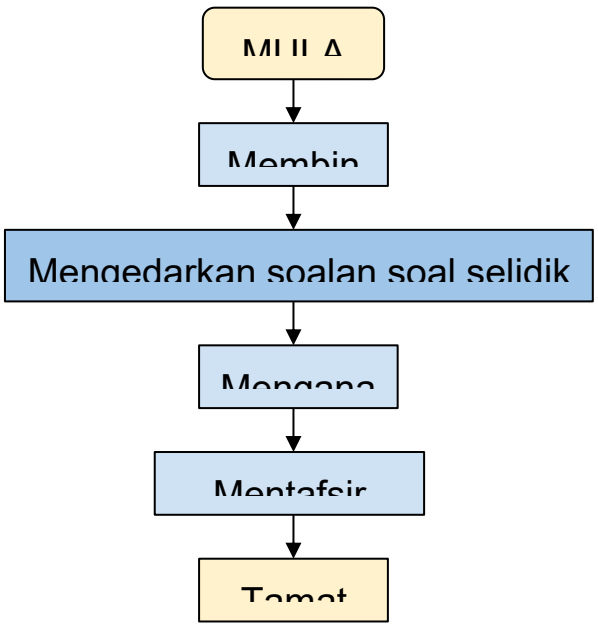
menggabungkan kedua-dua pendekatan ini, kajian bukan sahaja menilai trend umum responden tetapi juga memberi ruang untuk menjelaskan dan mendalami pengalaman serta pandangan mereka (Rahman & Aziz, 2019).

Bagi komponen kuantitatif, reka bentuk tinjauan *survey* digunakan melalui borang soal selidik atas talian menggunakan "Google Form". Soal selidik ini dibahagikan kepada dua bahagian iaitu bahagian pertama mengumpul maklumat demografi responden, manakala bahagian kedua menilai aspek seperti reka bentuk laman web, kefungsian, kemesraan pengguna dan keberkesanan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar. Di samping itu, borang soal selidik turut mengandungi soalan terbuka untuk meminta responden memberikan cadangan penambahbaikan terhadap laman sesawang tersebut bagi tujuan memahami cara meningkatkan kualiti dan kesesuaian laman sesawang dalam konteks pembelajaran (Salleh & Yunus, 2021).

Bagi komponen kualitatif, data diperoleh daripada jawapan terbuka dalam "Google Form". Data kualitatif ini berfungsi untuk memberi konteks kepada hasil kuantitatif dan menerangkan fenomena di sebalik persepsi atau pilihan responden seterusnya membantu dalam mentafsirkan keputusan secara holistik (Mansor & Zainal, 2019).

Seramai 213 orang pelajar Tingkatan Satu telah terlibat sebagai responden dalam kajian ini melalui kaedah pensampelan mudah (convenience sampling), iaitu pemilihan responden berdasarkan kesediaan mereka untuk menjawab selepas mencuba laman sesawang tersebut. Responden terdiri daripada pelajar lelaki dan perempuan dari kelas yang berbeza, serta mempunyai tahap kemahiran dan pendedahan teknologi yang berbeza. Kepelbagaian ini membantu mengumpul maklum balas yang lebih mencerminkan pengalaman sebenar pengguna dari pelbagai latar belakang.

***Carta Alir Proses Kajian***



### *Populasi dan Sampel*

Populasi kajian ini terdiri daripada 213 orang pelajar Tingkatan Satu di dua buah Sekolah Menengah Harian Daerah Kuala Nerus yang telah menggunakan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar dalam pembelajaran akhlak. Populasi ini dipilih kerana mereka merupakan kumpulan sasaran utama bagi penggunaan laman sesawang tersebut dalam konteks pengajaran Pendidikan Islam yang menekankan penerapan nilai dan akhlak mulia dalam kalangan pelajar.

Berdasarkan Jadual Penentuan Saiz Sampel Krejcie dan Morgan (1970), bagi populasi seramai 213 orang, jumlah sampel minimum yang disarankan ialah sekitar 132 orang responden untuk mewakili populasi dengan tahap ketepatan yang munasabah. Walau bagaimanapun, kajian ini telah berjaya melibatkan 213 orang pelajar sebagai responden. Bilangan ini melebihi saiz sampel minimum yang disyorkan, sekali gus memperkukuh kesahan serta kebolehpercayaan dapatan kajian.

Sampel kajian dipilih menggunakan kaedah pensampelan mudah (convenience sampling), iaitu pemilihan responden berdasarkan kesediaan mereka untuk menjawab soal selidik selepas sesi penggunaan laman sesawang "Smart Akhlaq". Kaedah ini sesuai digunakan kerana ia memudahkan pengumpulan data dalam persekitaran sekolah dan membolehkan pengkaji menilai persepsi pelajar terhadap laman sesawang dengan lebih cepat dan praktikal (Ismail & Ahmad, 2020).

Responden terdiri daripada pelajar lelaki dan perempuan daripada kelas berbeza, termasuk Ibnu Khaldun dan Ibnu Sina, yang mempunyai tahap kemahiran serta pengalaman digital yang berbeza. Kepelbagaian ini memberikan gambaran yang lebih menyeluruh terhadap penerimaan dan keberkesanan penggunaan laman web dalam konteks sebenar pembelajaran (Hassan & Ibrahim, 2022).

### *Instrumen Kajian*

Instrumen yang digunakan dalam kajian ini ialah borang soal selidik digital melalui "Google Form" yang dibina khusus untuk menilai tahap kepuasan, penerimaan dan keberkesanan penggunaan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar dalam pembelajaran akhlak. Soal selidik ini digunakan sebagai instrumen utama bagi komponen kuantitatif, manakala soalan terbuka dalam borang yang sama berfungsi sebagai instrumen kualitatif bagi mendapatkan maklum balas mendalam tentang pengalaman pengguna serta cadangan penambahbaikan.

Seramai 213 orang pelajar Tingkatan Satu di dua buah Sekolah Menengah Harian Daerah Kuala Nerus telah dipilih sebagai responden untuk mengisi borang soal selidik ini. Soal selidik dibahagikan kepada tiga bahagian utama.

### *Soal Selidik*

Soal selidik ini mengandungi tiga bahagian utama iaitu Bahagian A (demografi), Bahagian B (kepenggunaan sistem) dan Bahagian C (mesra pengguna & keberkesanan pembelajaran).

Semua item dalam Bahagian B dan C menggunakan Skala Likert Empat Mata iaitu tidak setuju, kurang setuju, setuju dan sangat setuju.

***Soalan Soal Selidik***

***Bahagian A: Maklumat Demografi***

Dalam bahagian ini, responden diminta untuk memberikan maklumat demografi mereka termasuk nama, tingkatan dan jantina. Selain itu, mereka juga ditanya sama ada mereka pernah menggunakan laman sesawang pembelajaran lain sebelum ini, dengan pilihan jawapan "Ya" atau "Tidak".

***Bahagian B: Kepenggunaan Sistem***

Bahagian ini menilai kepenggunaan sistem laman sesawang. Responden diminta menilai sejauh mana butang dalam laman sesawang jelas dan mudah difahami, reka bentuk laman sesawang dari segi warna, ikon dan susun atur adalah menarik dan sesuai, serta setiap butang dan fungsi bertindak balas dengan baik. Mereka juga diminta memberikan maklum balas mengenai kestabilan sistem laman sesawang seperti sama ada ia beroperasi tanpa gangguan seperti freeze atau error serta sejauh mana arahan dalam laman sesawang mudah difahami.

***Bahagian C: Mesra Pengguna & Keberkesanan Pembelajaran***

Bahagian ini menumpukan kepada aspek mesra pengguna dan keberkesanan pembelajaran. Responden diminta menilai sejauh mana laman sesawang ini mesra pengguna dan mudah digunakan, kesesuaian digunakan ketika guru "relief" serta sejauh mana ia dapat membantu mereka memahami topik akhlak dengan lebih mudah. Selain itu, mereka juga menilai kesesuaian kandungan laman sesawang tersebut dengan tahap pembelajaran mereka dan keberkesanan "Smart Akhlaq" berbanding buku teks serta kesesuaian laman sesawang ini untuk aktiviti dalam dan luar kelas.

***Bahagian D: Komen Terbuka***

Responden diberi peluang untuk memberikan cadangan atau komen tambahan bagi penambahbaikan laman sesawang "Smart Akhlaq" di ruangan yang disediakan.

***Prosedur Pengumpulan Data***

Proses pengumpulan data bermula dengan sesi pendedahan laman sesawang "Smart Akhlaq" kepada pelajar. Pelajar diberikan masa untuk meneroka modul, aktiviti, nota dan elemen interaktif lain di laman web. Selepas itu, mereka menjawab soal selidik melalui pautan "Google Form" yang dibekalkan. Semua respons direkodkan secara automatik dan disimpan dalam sistem "Google Form" sebelum dieksport untuk analisis.

***Memproses dan Mempersembahkan Data***

Data yang diperoleh melalui "Google Form" dipindahkan ke dalam Microsoft Excel untuk tujuan pemprosesan awal. Setiap respons disemak semula bagi memastikan tiada data yang

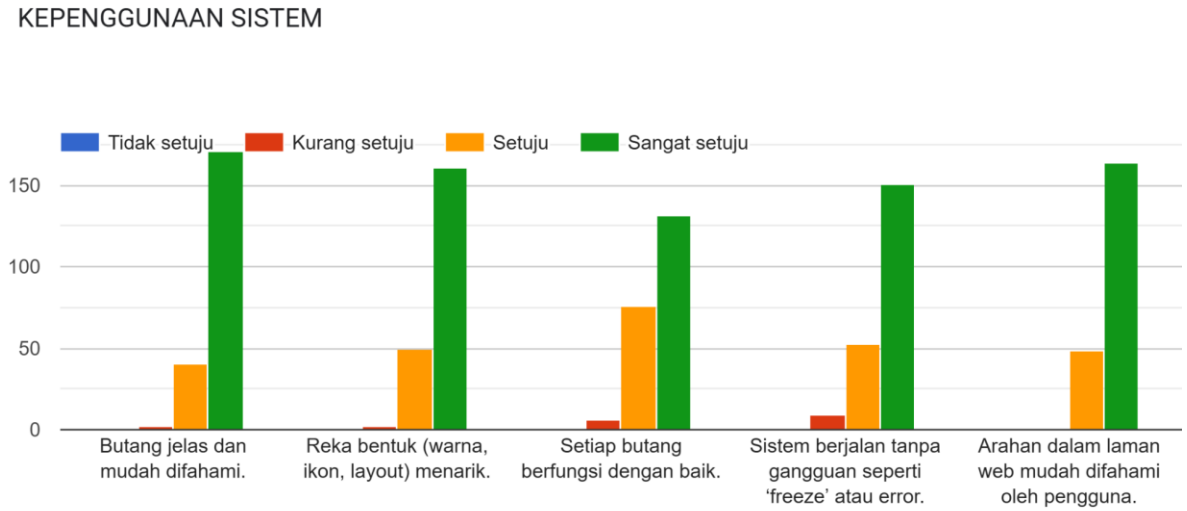
tertinggal, tidak lengkap atau rosak. Semakan data ini penting bagi menjamin ketepatan analisis dan mengurangkan kesilapan pemprosesan selaras dengan dapatan kajian yang menekankan kepentingan pemeriksaan data sebelum analisis dijalankan (Mohd Safwan & Osman, 2020).

Bagi data kuantitatif yang diperoleh melalui item tertutup, analisis deskriptif dijalankan dengan mengira kekerapan, iaitu bilangan responden dan peratusan bagi setiap kategori jawapan seperti sangat setuju, setuju, kurang setuju dan tidak setuju untuk semua item soal selidik. Analisis deskriptif menggunakan kekerapan dan peratusan merupakan teknik asas yang sesuai untuk data tinjauan kerana ia dapat memberikan gambaran umum tentang pola respons dan tahap penerimaan responden terhadap item yang dikaji (Abdullah & Hashim, 2021).

Setelah data diproses, hasil analisis kuantitatif dipersembahkan dalam bentuk graf seperti graf bar bagi memberikan gambaran visual yang lebih jelas serta memudahkan pembaca mengenal pasti pola persetujuan atau ketidaksetujuan dengan lebih cepat. Penggunaan visualisasi seperti graf membantu meningkatkan kefahaman pembaca terhadap dapatan kajian dan menjadikan persembahan data lebih efektif (Zulkifli & Shukri, 2023). Selain itu, paparan graf juga membantu memperkemas interpretasi dapatan dan memudahkan pembaca membuat perbandingan antara item yang dianalisis (Idris & Samad, 2024).

Data kualitatif dikumpulkan melalui cadangan penambahbaikan yang diberikan oleh responden menerusi soalan terbuka dalam “Google Form”. kemudian, jawapan responden dikumpulkan dan disusun mengikut tema. Proses ini dilakukan melalui pengelasan respons yang mempunyai maksud yang hampir sama, seterusnya membentuk beberapa tema utama seperti cadangan penambahbaikan reka bentuk, kandungan pembelajaran, ciri interaktif dan kefungsian laman sesawang. Analisis tema ini membantu pengkaji memahami pandangan responden secara lebih mendalam dan menyokong dapatan kuantitatif agar penilaian terhadap laman sesawang "Smart Akhlaq" menjadi lebih menyeluruh.

## Dapatan Kajian Dan Perbincangan




**Rajah 1**

Berdasarkan Rajah 1, dapatan kajian menunjukkan bahawa penggunaan laman sesawang "Smart Akhlaq" mendapat respons yang sangat positif daripada 213 orang pelajar Tingkatan Satu. Bagi aspek kejelasan dan kefahaman butang navigasi, seramai 171 pelajar (80.3%) sangat setuju dan 40 pelajar (18.8%) setuju manakala hanya 2 pelajar (0.9%) kurang setuju. Dari segi reka bentuk laman web, 161 pelajar (75.6%) sangat setuju dan 50 pelajar (23.5%) setuju bahawa reka bentuknya menarik dan sesuai, dengan hanya 2 pelajar (0.9%) kurang setuju. Seterusnya, bagi kefungsian butang, 131 pelajar (61.5%) sangat setuju dan 76 pelajar (35.7%) setuju, manakala 6 pelajar (2.8%) kurang setuju. Selain itu, 151 pelajar (70.9%) sangat setuju dan 53 pelajar (24.9%) setuju bahawa sistem berjalan tanpa gangguan, manakala 9 pelajar (4.2%) kurang setuju. Bagi kefahaman arahan, 164 pelajar (77.0%) sangat setuju dan 49 pelajar (23.0%) setuju bahawa arahan yang disediakan adalah mudah difahami. Secara keseluruhannya, dapatan ini menunjukkan tahap kebolehgunaan laman sesawang "Smart Akhlaq" adalah tinggi.

Secara keseluruhannya, dapatan ini memperlihatkan bahawa sistem mempunyai tahap kebolehgunaan yang tinggi serta diterima secara positif oleh majoriti pengguna. Keseluruhan dapatan ini selari dengan Teori Beban Kognitif oleh Sweller (1998), yang menegaskan bahawa bahan digital yang tersusun dengan navigasi yang jelas dapat mengurangkan beban mental pelajar, sekali gus membolehkan mereka menumpukan perhatian sepenuhnya kepada isi kandungan pembelajaran tanpa terganggu oleh masalah UI/UX. Selain itu, penggunaan warna, ikon dan susun atur visual yang teratur turut menyokong Teori Multimedia Mayer (2001), yang menyatakan bahawa penyampaian maklumat melalui elemen visual yang tersusun mampu meningkatkan kefahaman dan pengekalan ilmu dalam kalangan pelajar. Dapatan ini juga disokong oleh beberapa kajian lepas berkaitan kebolehgunaan dan keberkesanan UI/UX dalam e-pembelajaran. Pengguna yang berkesan perlu menekankan konsistensi dari segi susun atur, ikon, warna dan label kerana elemen visual yang seragam membantu pengguna mengenal pasti fungsi dengan cepat tanpa kekeliruan (Nielsen, 1994). Prinsip ini jelas tercermin dalam penilaian pelajar yang menyatakan bahawa reka bentuk visual laman sesawang "Smart Akhlaq" adalah menarik, jelas dan mudah difahami. Selanjutnya, kualiti reka bentuk antara muka, khususnya navigasi yang jelas serta penyampaian arahan yang mudah difahami, merupakan faktor penting yang mempengaruhi kepuasan dan pengalaman pengguna dalam e-pembelajaran (Sun et al., 2008). Penemuan mereka sejajar dengan dapatan kajian ini yang menunjukkan pelajar menilai butang, arahan dan fungsi laman web sebagai responsif dan mesra pengguna. Tambahan pula, kejayaan sistem e-pembelajaran bergantung pada kebolehgunaan antara muka, kestabilan teknikal serta responsif sistem (Al-Fraihat, Joy dan Sinclair, 2020). Huraian mereka bertepatan dengan hasil kajian ini, khususnya apabila majoriti pelajar tidak melaporkan sebarang gangguan teknikal seperti ‘freeze’ atau ralat. Kesemua rujukan ini mengukuhkan bahawa reka bentuk UI/UX yang konsisten, jelas dan stabil memainkan peranan penting dalam meningkatkan keberkesanan pembelajaran dalam talian.




**Rajah 2**

Berdasarkan Rajah 2, dapatan kajian menunjukkan bahawa penggunaan laman sesawang "Smart Akhlaq" sebagai bahan bantu mengajar dalam subjek Pendidikan Islam Tingkatan Satu mendapat respons yang sangat positif daripada 213 orang pelajar Tingkatan Satu di dua buah Sekolah Menengah Harian Daerah Kuala Nerus. Analisis menunjukkan bahawa hampir keseluruhan pelajar menganggap laman web ini mesra pengguna. Hal ini dapat dilihat apabila seramai 165 pelajar (77.5%) sangat setuju dan 48 pelajar (22.5%) setuju sekaligus menggambarkan bahawa medium digital tersebut mudah diakses, jelas serta tidak membebankan pengguna. Dari aspek keberkesanan laman web digunakan semasa guru relief, seramai 170 pelajar (79.8%) sangat setuju dan 40 pelajar (18.8%) setuju bahawa laman web tersebut membantu mereka belajar secara kendiri tanpa bimbingan langsung guru manakala hanya 3 pelajar (1.4%) kurang setuju. Tambahan pula, seramai 167 pelajar (78.4%) sangat setuju dan 46 pelajar (21.6%) setuju bahawa laman web ini membantu mereka memahami topik akhlak dengan lebih mudah sementara 173 pelajar (81.2%) sangat setuju dan 40 pelajar (18.8%) setuju bahawa isi kandungannya sesuai dengan tahap pembelajaran Tingkatan Satu. Dari segi perbandingan dengan buku teks pula seramai 163 pelajar (76.5%) sangat setuju dan 48 pelajar (22.5%) setuju bahawa laman web lebih mudah difahami manakala hanya 2 pelajar (0.9%) kurang setuju dan kesesuaian penggunaannya untuk aktiviti pembelajaran dalam serta luar kelas turut mendapat sokongan apabila 161 pelajar (75.6%) sangat setuju dan 50 pelajar (23.5%) setuju serta hanya 2 pelajar (0.9%) kurang setuju.

Keberkesanan penggunaan laman sesawang "Smart Akhlaq" seperti yang digambarkan melalui Rajah 2 dapat dijelaskan melalui integrasi beberapa teori pendidikan utama khususnya Teori Kecerdasan Pelbagai Howard Gardner dan Teori Konstruktivisme. Selaras dengan Teori Kecerdasan Pelbagai, reka bentuk laman web ini yang menggabungkan nota bertulis, audio pengajaran, modul soalan interaktif serta permainan digital berupaya memenuhi keperluan murid yang mempunyai kecerdasan berbeza. Sebagai contoh, nota bertulis menyokong kecerdasan linguistik-verbal, audio pengajaran merangsang kecerdasan auditori manakala modul soalan dan aktiviti interaktif menggalakkan kecerdasan logik-matematik serta intrapersonal melalui refleksi kendiri. Selain itu, permainan digital pula memberi ruang kepada murid yang mempunyai kecerdasan visual-ruang dan kinestetik untuk terlibat secara aktif dalam pembelajaran yang lebih menyeronokkan. Pendekatan ini bukan sahaja mempelbagaikan gaya penyampaian malah sejajar dengan prinsip "*fun learning*" yang terbukti mampu

meningkatkan motivasi dan penglibatan murid dalam pembelajaran berasaskan digital. Dalam masa yang sama, Teori Konstruktivisme turut menjelaskan keberkesanan laman web ini kerana ia menyediakan pengalaman pembelajaran yang membolehkan murid meneroka maklumat, melaksanakan tugasan interaktif, menerima maklum balas segera dan melakukan refleksi sekaligus menyokong pembinaan pengetahuan secara aktif apabila murid menghubungkan maklumat baharu dengan pengetahuan sedia ada melalui pengalaman bermakna. Keberkesanan pendekatan digital ini turut disokong oleh kajian terdahulu yang menunjukkan strategi pembelajaran berasaskan Kecerdasan Pelbagai dalam persekitaran digital mampu meningkatkan kecerdasan interpersonal, intrapersonal dan naturalis pelajar serta menyokong variasi gaya pembelajaran. Di samping itu, bahan pembelajaran digital interaktif juga didapati dapat meningkatkan rasa ingin tahu dan motivasi murid melalui interaksi aktif dengan kandungan pembelajaran (Fatin, 2019) manakala penggunaan teknologi digital menjadikan proses pembelajaran lebih menyeronokkan dan meningkatkan penglibatan murid secara signifikan. Secara keseluruhannya, dapatan ini selari dengan kajian “Smart Akhlaq” yang menunjukkan integrasi elemen nota, audio, modul soalan dan permainan digital bukan sahaja membantu murid memahami konsep akhlak dengan lebih jelas malah menyediakan pengalaman pembelajaran yang lebih inklusif, interaktif dan menarik seterusnya menyumbang kepada pembentukan nilai murni serta pengukuhan sahsiah murid secara holistik dalam konteks Pendidikan Islam Tingkatan Satu.

## Kesimpulan

Kajian ini merumuskan bahawa laman sesawang "Smart Akhlaq" merupakan inovasi bahan bantu mengajar yang sangat berkesan dan mempunyai tahap kebolehgunaan yang tinggi dalam kalangan pelajar Pendidikan Islam Tingkatan Satu. Dapatan kajian membuktikan bahawa reka bentuk UI/UX yang konsisten, stabil, dan mesra pengguna berjaya mengurangkan beban kognitif pelajar, sekali gus memudahkan proses navigasi serta pemahaman arahan. Integrasi elemen multimedia yang variatif seperti audio, nota interaktif, dan permainan digital bukan sahaja menyokong Teori Kecerdasan Pelbagai dan Konstruktivisme, malah memupuk budaya pembelajaran kendiri yang menyeronokkan serta bermakna. Keselarasan antara kestabilan teknikal dengan kepelbagaian pedagogi digital ini secara signifikan meningkatkan motivasi dan penglibatan murid, sekali gus menjadikan laman sesawang "Smart Akhlaq" sebagai instrumen pendidikan yang relevan dalam memperkukuh kefahaman akhlak dan sahsiah pelajar secara holistik selari dengan keperluan pendidikan abad ke-21.

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# KEBERKESANAN LAMAN WEB FIQHUP SEBAGAI MEDIUM PEMBELAJARAN DIGITAL PENDIDIKAN ISLAM

## *THE EFFECTIVENESS OF THE FIQHUP WEBSITE AS A DIGITAL LEARNING MEDIUM FOR ISLAMIC EDUCATION*

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***Abstrak:*** *Kemajuan teknologi digital telah mengubah corak pembelajaran masa kini, termasuk dalam pendidikan Islam. Namun, kaedah pengajaran tradisional yang bergantung kepada buku teks sahaja kurang menarik minat pelajar dan tidak interaktif dalam penyampaian konsep fiqh. Justeru, kajian ini menilai keberkesanan laman web FiqhUp sebagai medium pembelajaran digital dalam meningkatkan kefahaman pelajar serta menyokong guru dalam pengajaran fiqh. Kajian menggunakan pendekatan kuantitatif melalui soal selidik berskala Likert lima mata melibatkan 200 murid, pelajar dan guru sekolah menengah di daerah Kuala Nerus. Instrumen merangkumi empat komponen utama: tahap penggunaan, persepsi keberkesanan, kebolehaksesan dan penerimaan pengguna. Data dianalisis menggunakan statistik deskriptif melibatkan nilai min dan sisihan piawai. Dapatan menunjukkan penggunaan dan penerimaan FiqhUp pada tahap sederhana tinggi (Min=3.92, SP=0.58). Majoriti responden (88%) bersetuju bahawa FiqhUp mudah digunakan, mesra pengguna, dan meningkatkan pemahaman fiqh melalui bahan interaktif dan tersusun. Walau bagaimanapun, cabaran seperti capaian internet, kemahiran digital dan ketersediaan peranti turut dikenal pasti. Kesimpulannya, FiqhUp merupakan platform pembelajaran digital yang berkesan dalam pendidikan Islam dan berpotensi diperkembangkan melalui sokongan infrastruktur teknologi serta latihan pengguna. Implikasi kajian membuktikan integrasi digital mampu memperkukuh pengajaran fiqh abad ke-21 dan menyokong pembelajaran aktif serta berpusatkan pelajar.*


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***Kata Kunci:*** *FiqhUp, Pembelajaran Digital, Pendidikan Islam, Penerimaan Pengguna, Kebolehaksesan*

***Abstract:*** *The advancement of digital technology has transformed contemporary learning practices, including in Islamic education. However, traditional teaching methods that rely solely on textbooks are often less engaging for students and lack interactivity in delivering fiqh concepts. Therefore, this study evaluates the effectiveness of the FiqhUp website as a digital learning medium in enhancing students' understanding and supporting teachers in fiqh instruction. The study employed a quantitative approach using a five-point Likert scale questionnaire involving 200 secondary school students and teachers in the Kuala Nerus district. The instrument consisted of four main components: usage level, perceived effectiveness, accessibility, and user acceptance. Data were analysed using descriptive statistics involving mean scores and standard deviations. The findings indicate that the level of usage and acceptance of FiqhUp is moderately high (M=3.92, SD=0.58). The majority of respondents (88%) agreed that FiqhUp is easy to use, user-friendly, and improves their understanding of fiqh through interactive and well-structured materials. However, several challenges were identified, including internet accessibility, digital literacy differences, and device availability. In conclusion, FiqhUp is an effective digital learning platform for Islamic education and holds significant potential for wider implementation with the support of technological infrastructure and user training. The study's implications indicate that digital integration can strengthen fiqh instruction in the 21st-century context, supporting active, autonomous, and student-centred learning.*

***Keywords:*** *FiqhUp, Digital Learning, Islamic Education, User Acceptance, Accessibilit*

## 1.0 Pendahuluan

Perkembangan pesat teknologi digital telah membawa transformasi signifikan dalam pendidikan, termasuk Pendidikan Islam. Generasi pelajar masa kini lebih cenderung menggunakan medium digital kerana sifatnya yang interaktif, mudah diakses, dan selaras dengan gaya hidup abad ke-21. Penggunaan teknologi secara berhemah dapat meningkatkan keberkesanan pengajaran dan pembelajaran, serta memupuk motivasi dan penglibatan pelajar secara aktif (Siti Mariam Sukis 2023). Selain itu, teknologi digital membolehkan bahan pembelajaran disampaikan dalam pelbagai format, termasuk animasi, audio, dan grafik, menjadikan proses PdP lebih menarik dan mudah difahami oleh pelajar.

Walaupun potensi teknologi digital diakui, pendidikan di Malaysia masih banyak bergantung kepada kaedah tradisional, khususnya penggunaan buku teks sebagai sumber utama. Buku teks menyediakan maklumat lengkap dan tersusun, tetapi kurang menarik minat generasi pelajar kini yang lebih terbuka kepada pembelajaran digital interaktif. Kekangan ini menyebabkan penglibatan pelajar dalam PdP Pendidikan Islam masih rendah, manakala guru menghadapi cabaran menyesuaikan kaedah pengajaran tradisional dengan teknologi moden untuk memenuhi kehendak pelajar abad ke-21 (Zainab Hussin 2021). Oleh itu, terdapat keperluan mendesak untuk menyediakan platform pembelajaran digital yang mampu menyokong guru dan pelajar secara serentak.


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Kajian terdahulu menekankan bahawa penggunaan media interaktif, animasi, grafik, dan elemen digital lain dalam PdP dapat meningkatkan tumpuan, minat, dan motivasi pelajar. Elemen-elemen ini menyokong keberkesanan pengajaran yang lebih sistematik dan kreatif, serta membantu pelajar memahami konsep secara lebih mendalam (Nur Zafirah Abidin 2024). Integrasi teknologi membolehkan guru menyediakan bahan yang lebih fleksibel dan berstruktur, sementara pelajar mendapat pengalaman pembelajaran yang lebih menarik dan mudah diingati. Dengan perkembangan multimedia, penggunaan elemen interaktif dalam pengajaran dapat meningkatkan keberkesanan PdP dan mengekalkan perhatian pelajar sepanjang sesi pembelajaran.

Dalam konteks Pendidikan Islam, walaupun sumber tetap berteraskan al-Quran dan al-Hadis, kaedah penyampaian perlu diinovasikan untuk memenuhi keperluan generasi digital. Justeru, pembangunan laman web FiqhUp dijalankan sebagai satu usaha menyediakan platform pembelajaran digital yang interaktif, mesra pengguna, dan menarik. Platform ini bukan sahaja membantu guru menyampaikan PdP dengan lebih kreatif, malah memudahkan pelajar memahami dan mengukuhkan konsep melalui latihan dan bahan multimedia. Disediakan juga ruang interaksi dua hala untuk membolehkan pelajar bertanya soalan dan mendapatkan maklum balas secara langsung, sekali gus meningkatkan kefahaman mereka secara lebih efektif.

Kajian ini bertujuan menilai tahap penggunaan, persepsi keberkesanan, dan kebolehgunaan FiqhUp dalam kalangan pelajar dan guru sekolah menengah, serta mengenal pasti hubungannya dengan motivasi pembelajaran pelajar. Selain itu, kajian ini menyediakan cadangan penambahbaikan bagi memastikan platform ini relevan dan efektif dalam menyokong PdP Pendidikan Islam abad ke-21. Hasil kajian dijangka memberi impak positif terhadap pengajaran guru, pemahaman pelajar, dan pembangunan Pendidikan Islam yang lebih digital, kreatif, serta berkesan. Dengan demikian, FiqhUp diharapkan menjadi medium pembelajaran digital yang relevan, menyeluruh, dan selari dengan keperluan pendidikan masa kini.

## 2.0 Sorotan Kajian

Konsep pembelajaran berpandukan perisian khusus multimedia merupakan satu pendekatan baru dan mula berkembang semenjak konsep Sekolah Bestari diperkenalkan Siti Fadzilah Mat Noor dan Shereena Mohd Arif (2002). Dalam meningkatkan taraf pendidikan di negara kita pendekatan cara pembelajaran berasaskan teknologi multimedia telah diperkenalkan di sekolah bermula penubuhan Sekolah Bestari.

Dengan kehadiran teknologi seperti multimedia ia telah menukar teknik pengajaran dan pembelajaran antara guru dan pelajar. Teknologi multimedia adalah salah satu teknologi baru dalam komuter yang memiliki kebolehan untuk menjadikan media pembelajaran lebih lengkap. Multimedia merangkumi media dalam satu perisian sehingga memudahkan guru untuk menyampaikan bahan pengajaran dan pelajar berasa terlibat dalam proses pembelajaran kerana teknologi multimedia membolehkan berlakunya interaktiviti.

Penggunaan multimedia dalam proses pengajaran dan pembelajaran dapat meningkatkan kecekapan dan keberkesanan hasil pembelajaran. Ini kerana guru dapat membuat persiapan


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bersedia dengan lebih awal menjalankan proses pengajaran dan pembelajaran. Melalui cara ini guru dapat mencari maklumat-maklumat berkenaan dengan pengajaran dengan lebih baik seterusnya dapat menyampaikan kepada pelajar secara berkesan. Melalui penggunaan alat multimedia sebagai alat bantu mengajar maka proses pengajaran dan pembelajaran akan lebih menarik dan akan berkesan contohnya menggunakan alat seperti powerpoint, flash, video dan visual mereka hanya perlu mengaplikasikan alatan tersebut ke dalam proses pengajaran dan pembelajaran. Melalui cari ini proses pengajaran dan pembelajaran dapat dijalankan dengan mudah, ringkas dan padat kerana pelajar akan didedahkan dengan gambaran dan persembahan menarik serta untuk difahami. Justeru itu pelajar tidak akan mudah merasa jemu dan bosan dalam menjalani proses pengajaran dan pembelajaran kerana tertarik dengan gaya persembahan yang ditunjukkan melalui pengajaran menggunakan multimedia.

## 3.0 Metodologi

### *3.1 Reka Bentuk Kajian*

Kajian ini menggunakan pendekatan kuantitatif berbentuk tinjauan (survey research design) bagi mendapatkan data empirikal mengenai tahap penerimaan, keberkesanan, dan penggunaan laman web FiqhUp sebagai platform PdP dalam kalangan pelajar dan guru sekolah menengah harian di daerah Kuala Nerus. Pendekatan ini dipilih kerana ia sesuai dalam mengukur poingkah laku pembelajaran, sikap, dan persepsi pengguna terhadap teknologi pendidikan secara objektif.

### *3.2 Populasi dan Sampel Kajian*

Populasi kajian ini terdiri daripada pelajar dan guru yang berkhidmat di sekolah menengah harian sekitar daerah Kuala Nerus. Pemilihan responden adalah berdasarkan persetujuan penyertaan dan kesediaan mereka untuk terlibat dalam kajian ini.

Berdasarkan jadual Krejcie dan Morgan (1970), bagi populasi kajian yang berjumlah 200 orang, bilangan sampel yang sesuai dan mencukupi untuk mewakili populasi tersebut ialah seramai 127 orang responden, yang telah berjaya dikumpulkan.

**Jadual 1 Menunjukkan Pecahan Sampel Kajian Mengikut Kategori.**

| Kategori Responden | Bilangan | Peratus (%) |
|---|---|---|
| Pelajar tingkatan 3 | 123 orang | 96.85% |
| Guru Pendidikan Islam | 4 orang | 3.15% |
| **Jumlah** | **127 orang** | **100%** |

Berdasarkan Jadual 1, daripada populasi kajian seramai 200 orang, sejumlah 127 orang responden telah dipilih sebagai sampel kajian selaras dengan cadangan Krejcie dan Morgan (1970). Majoriti responden terdiri daripada pelajar Tingkatan 3, iaitu seramai 123 orang atau 96.85%, manakala selebihnya melibatkan 4 orang guru Pendidikan Islam yang mewakili 3.15% daripada keseluruhan sampel. Agihan sampel ini menunjukkan penekanan kajian terhadap perspektif pelajar sebagai pengguna utama platform pengajaran dan pembelajaran, di samping mengambil kira pandangan guru bagi memberikan gambaran yang lebih menyeluruh terhadap keberkesanan penggunaan laman web FiqhUp dalam pengajaran dan pembelajaran Pendidikan Islam.


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### *3.3 Instrumen Kajian*

Instrumen soal selidik dibangunkan secara digital menggunakan Google Form dan merangkumi empat bahagian utama:

#### *3.3.1 Bahagian A: Maklumat Demografi*

Bahagian A soal selidik ini bertujuan untuk mengumpulkan maklumat demografi responden bagi mendapatkan gambaran umum tentang latar belakang mereka. Maklumat yang dikumpulkan merangkumi umur dan jantina responden, serta status mereka sama ada sebagai pelajar atau guru. Selain itu, bahagian ini turut meneliti kekerapan penggunaan internet dalam kehidupan seharian bagi memahami tahap pendedahan responden terhadap teknologi digital. Pengalaman responden dalam menggunakan aplikasi pembelajaran dalam talian juga dikumpulkan bagi menilai tahap kebiasaan dan penglibatan mereka dengan pembelajaran berasaskan teknologi. Maklumat demografi ini penting sebagai asas untuk menganalisis perbezaan dan kecenderungan responden berdasarkan latar belakang masing-masing dalam kajian ini.

#### 3.3.2 Bahagian B: Tahap Penggunaan FiqhUp

Bahagian B soal selidik ini bertujuan untuk menilai tahap penggunaan aplikasi FiqhUp dalam kalangan responden. Bagi tujuan pengukuran, skala Likert lima mata digunakan, iaitu 1 mewakili *Tidak Pernah*, 2 *Jarang*, 3 *Kadang-kadang*, 4 *Kerap* dan 5 *Sangat Kerap*. Item-item dalam bahagian ini menilai kekerapan responden menggunakan laman web FiqhUp bagi menyemak topik-topik berkaitan Pendidikan Islam, khususnya sebagai sumber rujukan pembelajaran. Selain itu, bahagian ini turut meneliti penggunaan FiqhUp sebagai medium sokongan semasa proses ulang kaji dan persediaan menghadapi peperiksaan. Dapatan daripada bahagian ini penting bagi mengenal pasti sejauh mana aplikasi FiqhUp dimanfaatkan dalam konteks pembelajaran Pendidikan Islam.

#### *3.3.3 Bahagian C: Persepsi Keberkesanan & Kebolehgunaan*

Bahagian C soal selidik ini bertujuan untuk menilai persepsi responden terhadap keberkesanan dan kebolehgunaan platform FiqhUp sebagai medium pembelajaran. Skala Likert lima mata digunakan bagi mengukur tahap persetujuan responden, iaitu 1 merujuk kepada *Sangat Tidak Setuju*, 2 *Tidak Setuju*, 3 *Tidak Pasti*, 4 *Setuju* dan 5 *Sangat Setuju*. Item-item dalam bahagian ini menilai sejauh mana kandungan laman web FiqhUp mudah difahami serta kesesuaiannya dengan silibus Pendidikan Islam. Selain itu, aspek penggunaan animasi, grafik dan elemen multimedia turut dinilai bagi melihat peranannya dalam meningkatkan fokus dan keberkesanan pembelajaran. Bahagian ini juga meneliti tahap motivasi responden untuk belajar melalui platform digital seperti FiqhUp. Dapatan daripada bahagian ini penting bagi menilai keberkesanan FiqhUp sebagai alat sokongan pembelajaran yang mesra pengguna dan berimpak positif terhadap pengalaman pembelajaran responden.

#### *3.3.4 Bahagian D: Maklum Balas Terbuka*


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Bahagian D soal selidik ini bertujuan untuk mendapatkan maklum balas terbuka daripada responden berkaitan pengalaman mereka menggunakan platform FiqhUp. Soalan-soalan dalam bahagian ini memberi peluang kepada responden untuk menyatakan pandangan secara bebas mengenai bahagian atau ciri FiqhUp yang paling membantu dalam proses pembelajaran mereka. Selain itu, responden juga diminta mengemukakan cadangan penambahbaikan terhadap laman web FiqhUp dari segi kandungan, reka bentuk, fungsi atau elemen pembelajaran yang lain. Maklum balas kualitatif yang diperoleh melalui bahagian ini penting bagi memberikan gambaran yang lebih mendalam tentang kelebihan dan kekangan platform FiqhUp serta menjadi asas kepada penambahbaikan pada masa hadapan.

### *3.4 Kesahan dan Kebolehpercayaan Instrumen*

Kajian rintis dijalankan ke atas 20 responden awal dan menghasilkan nilai Cronbach's Alpha = 0.89, menunjukkan tahap kebolehpercayaan yang sangat baik dan konsisten.
Panel pakar (2 pensyarah Pendidikan Islam) turut menilai kandungan soal selidik, menjadikan instrumen ini sah dari segi kesesuaian item terhadap objektif kajian.

### *3.5 Prosedur Kajian*

Prosedur kajian ini dimulakan dengan memperoleh kebenaran rasmi daripada Pejabat Pendidikan Daerah Kuala Nerus bagi memastikan pelaksanaan kajian mematuhi garis panduan dan etika penyelidikan yang ditetapkan. Setelah kebenaran diperoleh, borang soal selidik diedarkan kepada responden yang terdiri daripada pelajar dan guru melalui kod QR serta pautan digital bagi memudahkan akses dan penyertaan. Proses pengumpulan data dijalankan dalam tempoh 14 hari bagi memberi masa yang mencukupi kepada responden untuk memberikan maklum balas secara menyeluruh dan teratur. Data yang dikumpulkan sepanjang tempoh ini seterusnya dianalisis bagi mencapai objektif kajian yang telah ditetapkan.

### *3.6 Kaedah Analisis Data*

#### *Analisis Deskriptif*

**Jadual 2 Digunakan Untuk Mengukur Min , Peratusan, Dan Sisihan Piawai.**

| Pembolehubah | Min | Sisihan Piawai | Interpretasi |
|---|---|---|---|
| Kebolehgunaan laman web | | | |
| Keberkesanan PdP | | | |
| Minat terhadap pembelajaran digital | | | |

Berdasarkan jadual 2 di atas, jadual ini memaparkan analisis deskriptif bagi tiga pembolehubah utama yang dikaji, iaitu kebolehgunaan laman web, keberkesanan pengajaran dan pembelajaran (PdP), serta minat terhadap pembelajaran digital. Setiap pembolehubah dihuraikan berdasarkan nilai min dan sisihan piawai yang diperoleh daripada responden, bagi menggambarkan tahap persepsi umum pengguna terhadap aspek-aspek tersebut. Analisis ini membantu menunjukkan gambaran awal tentang sejauh mana laman web digunakan, keberkesanannya dalam PdP, serta


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kecenderungan pengguna terhadap pendekatan pembelajaran berasaskan digital.

**Analisis Inferensi**
***Ujian-t Sampel Bebas***

**Jadual 3 Digunakan Untuk Melihat Perbezaan Persepsi Antara Pelajar Dan Guru.**

| Kumpulan Perbandingan | Nilai p | Keputusan |
|---|---|---|
| Pelajar vs Guru | | |

Berdasarkan Jadual 3 diatas, bahagian ini membentangkan keputusan ujian-t sampel bebas yang dijalankan bagi menilai perbezaan persepsi antara dua kumpulan responden, iaitu pelajar dan guru, terhadap pembolehubah yang dikaji. Ujian ini digunakan untuk menentukan sama ada wujud perbezaan yang signifikan dari sudut kebolehgunaan laman web, keberkesanan PdP, dan minat terhadap pembelajaran digital antara kedua-dua kumpulan. Melalui analisis ini, penyelidik dapat mengenal pasti sama ada perbezaan yang diperoleh berlaku secara kebetulan atau benar-benar wujud dalam populasi, seterusnya menyokong kesimpulan yang lebih tepat mengenai penerimaan dan keberkesanan penggunaan laman web sebagai medium PdP.

**Ujian Korelasi Pearson**

**Jadual 4 Digunakan Untuk Melihat Hubungan Antara Kekerapan Penggunaan Dan Motivasi Pembelajaran.**

| Pembolehubah | r | Interpretasi |
|---|---|---|
| Kekerapan penggunaan ↔ Motivasi | | |

Berdasarkan jadual 4 diatas, bahagian ini memaparkan keputusan ujian korelasi Pearson yang digunakan bagi menentukan hubungan antara pembolehubah yang dikaji, khususnya hubungan antara kekerapan penggunaan laman web dan tahap motivasi pembelajaran responden. Ujian ini dijalankan untuk mengenal pasti sama ada kedua-dua pembolehubah mempunyai hubungan yang positif, negatif atau tiada hubungan langsung. Melalui analisis ini, penyelidik dapat melihat sejauh mana peningkatan dalam penggunaan laman web berkait dengan perubahan motivasi pelajar terhadap pembelajaran digital, sekali gus memberikan gambaran yang lebih jelas tentang keberkesanan laman web sebagai alat sokongan pembelajaran.

***3.7 Pertimbangan Etika***

Semua responden memberikan persetujuan termaklum, data dirahsiakan, penyertaan bersifat sukarela dan bebas ditarik diri pada bila-bila masa.

**4.0 Hasil & Perbincangan Kajian**


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Bahagian ini membentangkan dapatan kajian berdasarkan analisis data kuantitatif yang diperoleh daripada 200 orang responden yang terdiri daripada pelajar dan guru sekolah menengah harian di daerah Kuala Nerus. Analisis dijalankan menggunakan statistik deskriptif dan inferensi bagi menjawab objektif kajian berkaitan tahap penggunaan, persepsi keberkesanan, dan hubungan penggunaan laman web FiqhUp terhadap motivasi pembelajaran.

### *4.1 Profil Responden*

Seramai 127 orang responden terlibat sebagai sampel dalam kajian ini, yang terdiri daripada pelajar Tingkatan 3 dan guru. Dapatan menunjukkan bahawa majoriti responden, iaitu 96.85%, merupakan pelajar, manakala selebihnya sebanyak 3.15% terdiri daripada guru. Komposisi responden ini menunjukkan bahawa data kajian lebih banyak mencerminkan persepsi kumpulan sasaran utama pengguna laman web FiqhUp, iaitu pelajar sekolah menengah, khususnya dalam konteks pengajaran dan pembelajaran Pendidikan Islam


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### *4.2 Tahap Penggunaan Laman Web FiqhUp*

Analisis statistik deskriptif menunjukkan tahap penggunaan laman web FiqhUp dalam kalangan responden adalah pada tahap tinggi.

**Jadual 5 Menunjukkan Skor Penggunaan Laman Web Fiqhup Berdasarkan Kekerapan Interaksi Pelajar Dan Guru.**

| Konstruk | Min | Sisihan Piawai | Interpretasi |
|---|---|---|---|
| Kekerapan penggunaan | 4.09 | 0.71 | Tinggi |
| Kesesuaian sebagai platform pembelajaran | 4.24 | 0.66 | Tinggi |
| Kebiasaan menggunakan platform digital | 4.52 | 0.49 | Sangat Tinggi |

Berdasarkan jadual 5 diatas, skor min tertinggi (M=4.52) menunjukkan majoriti responden selesa dengan penggunaan platform pembelajaran dalam talian, sekaligus mengesahkan bahawa pembelajaran berasaskan teknologi selari dengan keperluan generasi pelajar masa kini.
Berdasarkan hasil perbincangan kajian, tahap penggunaan laman web FiqhUp dalam kalangan responden berada pada tahap tinggi hingga sangat tinggi. Dapatan ini menunjukkan bahawa responden mempunyai kesediaan yang baik dalam menggunakan platform pembelajaran berasaskan teknologi. Menurut Davis (1989), tahap penerimaan pengguna terhadap sesuatu sistem teknologi dipengaruhi oleh persepsi terhadap kemudahan penggunaan dan keberkesanan sistem tersebut. Sehubungan itu, skor min yang tinggi bagi penggunaan laman web FiqhUp mencerminkan bahawa platform ini dianggap mudah digunakan serta berkesan sebagai medium pembelajaran, sekali gus menyokong pelaksanaan pengajaran dan pembelajaran Pendidikan Islam secara digital.

### *4.3 Persepsi Terhadap Kebolehgunaan dan Keberkesanan FiqhUp*

Dapatan seterusnya menilai persepsi responden terhadap aspek reka bentuk, navigasi, kandungan, dan fungsi interaktif dalam laman web.

**Jadual 6 Merupakan Hasil Analisis Yang Menunjukkan Keseluruhan Persepsi Pengguna Berada Pada Tahap Tinggi Hingga Sangat Tinggi.**

| Aspek Dinilai | Min | Sisihan Piawai | Tahap |
|---|---|---|---|
| Kemudahan navigasi | 4.33 | 0.58 | Tinggi |
| Kejelasan dan kualiti nota | 4.40 | 0.55 | Tinggi |
| Elemen multimedia (audio, animasi, kuiz) | 4.19 | 0.64 | Tinggi |
| Mesra pengguna (user-friendly) | 4.31 | 0.62 | Tinggi |
| Keberkesanan PdP | 4.18 | 0.70 | Tinggi |

Berdasarkan jadual 6 diatas, secara keseluruhannya skor purata min ialah 4.28 (SD=0.62), menunjukkan bahawa FiqhUp memenuhi ciri pedagogi digital yang berkesan, menarik dan mudah digunakan oleh pengguna.Berdasarkan hasil perbincangan kajian, persepsi responden terhadap aspek reka bentuk, navigasi, kandungan dan fungsi interaktif laman web FiqhUp berada pada tahap


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tinggi hingga sangat tinggi, dengan skor purata min keseluruhan sebanyak 4.28 (SD = 0.62). Dapatan ini menunjukkan bahawa elemen seperti kemudahan navigasi, kejelasan kandungan nota serta penggunaan multimedia menyumbang kepada pengalaman pembelajaran yang positif dan berkesan. Menurut Siti Fadzilah Mat Noor dan Shereena Mohd Arif (2002), integrasi elemen multimedia dan reka bentuk yang mesra pengguna dalam persekitaran pembelajaran digital mampu meningkatkan kefahaman, minat serta keberkesanan proses pengajaran dan pembelajaran. Oleh itu, skor min yang tinggi bagi semua aspek yang dinilai membuktikan bahawa laman web FiqhUp memenuhi ciri pedagogi digital yang berkesan serta sesuai digunakan sebagai sokongan pembelajaran Pendidikan Islam.

### *4.4 Perbezaan Persepsi antara Pelajar dan Guru*

Analisis inferensi menggunakan ujian-t sampel bebas dilakukan bagi mengenal pasti sama ada wujud perbezaan signifikan antara pelajar dan guru terhadap keberkesanan laman web FiqhUp. Keputusan menunjukkan nilai $p = 0.041 < 0.05$, yang bermaksud terdapat perbezaan signifikan.
Guru memberikan skor min lebih tinggi (M=4.36) berbanding pelajar (M=4.21), menunjukkan guru lebih melihat potensi FiqhUp sebagai alat bantu mengajar yang menyokong objektif PdP secara formal dan sistematik.

### *4.5 Hubungan antara Tahap Penggunaan dan Motivasi Pembelajaran*

**Jadual 7 Menunjukkan Analisis Korelasi Pearson Dijalankan Bagi Melihat Hubungan Antara Tahap Penggunaan Laman Web Fiqhup Dengan Motivasi Pembelajaran Responden.**

| Pembolehubah | Pekali Korelasi (r) | Interpretasi |
|---|---|---|
| Penggunaan ↔ Motivasi | r = 0.67 | Hubungan positif sederhana–kuat |

Berdasarkan jadual 7 diatas, dapatan ini menunjukkan bahawa semakin kerap responden menggunakan laman web FiqhUp, semakin meningkat tahap motivasi mereka terhadap pembelajaran Pendidikan Islam. Hubungan ini memberi gambaran bahawa elemen interaktif, visual dan akses mudah memberi kesan positif terhadap minat serta penglibatan pelajar.
Berdasarkan hasil perbincangan kajian, analisis korelasi Pearson menunjukkan terdapat hubungan positif sederhana hingga kuat antara tahap penggunaan laman web FiqhUp dengan motivasi pembelajaran responden (r = 0.67). Dapatan ini membuktikan bahawa peningkatan kekerapan penggunaan laman web pembelajaran berkait secara langsung dengan peningkatan motivasi pelajar dalam pembelajaran Pendidikan Islam. Menurut Abidin (2024), penggunaan aplikasi dan platform digital yang bersifat interaktif, mudah diakses serta menarik dari segi visual berupaya meningkatkan minat dan motivasi pelajar untuk terus terlibat secara aktif dalam proses pembelajaran. Oleh itu, hubungan positif yang signifikan ini menunjukkan bahawa laman web FiqhUp berpotensi menjadi medium pembelajaran yang efektif dalam merangsang motivasi serta penglibatan pelajar secara berterusan.

### *4.6 Dapatan Analisis Soalan Terbuka*


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Daripada maklum balas kualitatif ringkas, tiga tema utama dikenal pasti:

**Jadual 8 Menunjukkan Penerimaan Positif Terhadap Fiqhup, Namun Masih Wujud Permintaan Untuk Ciri Digital Tambahan.**

| Tema Utama | Bilangan Responden (n) | Contoh Petikan Responden |
|---|---|---|
| Membantu pemahaman topik | 75 | "Saya lebih cepat faham sebab nota ringkas dan contoh jelas." – Pelajar Tingkatan 3 |
| Mesra pengguna dan menarik | 31 | "Reka bentuk laman web mudah digunakan, tak serabut." – Guru |
| Cadangan penambahbaikan | 21 | "Tambah lebih banyak video bab fiqh dan game kuiz." – Pelajar Tingkatan 3 |

Berdasarkan Jadual 8 di atas, dapatan menunjukkan bahawa majoriti responden memberikan maklum balas positif terhadap penggunaan laman web FiqhUp. Tema utama yang paling dominan ialah membantu pemahaman topik, diikuti oleh aspek mesra pengguna dan menarik, manakala sebahagian responden turut mengemukakan cadangan penambahbaikan seperti penambahan video dan elemen permainan kuiz. Dapatan ini menggambarkan bahawa FiqhUp bukan sahaja menyokong pemahaman pembelajaran, malah mempunyai potensi untuk diperkukuhkan melalui penambahan ciri digital interaktif.

Berdasarkan hasil perbincangan kajian, maklum balas kualitatif responden menunjukkan bahawa laman web FiqhUp berperanan membantu meningkatkan kefahaman pelajar melalui penyampaian kandungan yang ringkas, jelas dan mudah diakses. Menurut Sanmugam et al. (2019), penggunaan teknologi pendidikan yang mengintegrasikan elemen interaktif dan visual dapat meningkatkan penglibatan serta pengalaman pembelajaran pelajar secara lebih bermakna. Oleh itu, penerimaan positif terhadap aspek mesra pengguna dan reka bentuk yang menarik, di samping cadangan penambahbaikan yang dikemukakan, menunjukkan bahawa FiqhUp mempunyai asas yang kukuh sebagai platform pembelajaran digital serta berpotensi untuk terus ditambah baik selaras dengan keperluan pengguna.

### *4.7 Rumusan Hasil Kajian*

Secara keseluruhannya, dapatan kajian ini menunjukkan bahawa tahap penggunaan laman web FiqhUp dalam kalangan pelajar dan guru berada pada tahap yang tinggi, sekali gus mencerminkan penerimaan yang baik terhadap integrasi teknologi digital dalam pengajaran dan pembelajaran Pendidikan Islam. Selain itu, FiqhUp turut dinilai sebagai sebuah platform pembelajaran digital yang berkesan, khususnya dalam menyokong proses pembelajaran yang lebih sistematik, interaktif dan berpusatkan pengguna. Analisis kajian juga mendapati wujud perbezaan signifikan dari segi persepsi antara pelajar dan guru terhadap penggunaan laman web tersebut, di mana guru menunjukkan tahap penilaian yang lebih tinggi berbanding pelajar. Seterusnya, penggunaan laman web FiqhUp didapati mempunyai hubungan positif yang signifikan dengan motivasi pembelajaran, yang menandakan peranannya dalam meningkatkan minat dan keterlibatan pengguna dalam


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pembelajaran. Secara tuntasnya, dapatan ini membuktikan bahawa FiqhUp berpotensi untuk diketengahkan sebagai salah satu platform pembelajaran digital yang relevan, berkesan dan selari dengan keperluan serta cabaran pendidikan masa kini.

## 5.0 Kesimpulan

Kajian ini menunjukkan bahawa laman web FiqhUp berpotensi menjadi platform pembelajaran digital yang berkesan dalam Pendidikan Islam di peringkat sekolah menengah. Tahap penerimaan dan penggunaan FiqhUp oleh pelajar dan guru berada pada tahap tinggi, mencerminkan kesesuaian platform ini dengan kehendak generasi abad ke-21 yang cenderung kepada pembelajaran digital dan interaktif. Analisis deskriptif mendapati bahawa aspek kebolehgunaan, keberkesanan PdP, serta minat terhadap pembelajaran digital berada pada tahap tinggi hingga sangat tinggi, manakala ujian inferensi menunjukkan perbezaan signifikan persepsi antara pelajar dan guru, dengan guru menilai laman web ini lebih tinggi dari segi potensi pedagogi. Selain itu, korelasi positif sederhana kuat antara kekerapan penggunaan FiqhUp dan motivasi pembelajaran menandakan bahawa penggunaan platform digital ini mampu meningkatkan penglibatan, minat, dan kesungguhan pelajar dalam mempelajari Pendidikan Islam. Dapatan soalan terbuka turut mengesahkan bahawa platform ini mesra pengguna, interaktif, dan membantu pemahaman topik secara lebih sistematik, walaupun masih terdapat permintaan untuk penambahbaikan seperti penambahan video, kuiz, dan elemen multimedia lain. Secara keseluruhannya, FiqhUp bukan sahaja menyokong pelajar dalam pembelajaran kendiri, tetapi juga membantu guru dalam merancang dan melaksanakan sesi PdP yang lebih menarik dan berkesan. Kajian ini membuktikan bahawa integrasi teknologi digital dalam pendidikan Islam dapat memperkukuh kualiti pembelajaran, meningkatkan motivasi, serta memupuk penglibatan aktif pelajar. Dengan sokongan infrastruktur teknologi, latihan pengguna, dan penambahbaikan berterusan, FiqhUp berpotensi dijadikan medium pembelajaran rasmi atau sokongan dalam sistem pendidikan negara, sejajar dengan perkembangan pendidikan moden dan keperluan generasi digital.

## 6.0 Penghargaan

Segala puji dan syukur dipanjatkan ke hadrat Allah SWT kerana dengan izin-Nya, penyelidikan ini dapat disempurnakan. Penghargaan disampaikan kepada Pusat Pengajian Pendidikan, Fakulti Pengajian Kontemporari Islam, Universiti Sultan Zainal Abidin, para pensyarah, rakan penyelidik, dan semua pihak yang telah memberikan sokongan, bimbingan, dan pandangan ilmiah. Ucapan terima kasih juga ditujukan kepada keluarga atas dorongan moral yang berterusan sehingga kajian ini berjaya diselesaikan.

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# DOES BOARD SIZE HAVE AN IMPACT ON THE CAPITAL STRUCTURE OF THE FIRM?: EVIDENCE FROM AN EMERGING ECONOMY

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***Abstract:*** *The board of directors are entrusted with the overall governance responsibility of the company and for taking important strategic level decisions of the company. One of these key decisions is to decide upon the capital structure of the company. These decisions of the boards may be influenced by the way the board is structured and how big and resourceful the board is because these directors are expected and known for bringing access to resources for the company. This paper attempts to examine the impact of board size and its independence on the capital structure of firms, in an emerging economy context of Pakistan. This research study uses a sample of companies listed on the PSX in the essential products and services categories of pharmaceutical, food and personal care sectors and employs the regression technique for analysis. Interestingly, the result of this research provides evidence that there is a statistically insignificant impact of the size of the board on the capital structure of the company. These results have policy implications for the board and corporate decision-makers.*

***Keywords:*** *Board Size; CG; Capital Structure; Emerging Economy; Pakistan.*

## Introduction

One of the major reasons for corporate failure is the agency conflict between the principal and the agents. This conflict is created due to the non-alignment of interests between both these parties (Bashir et al. 2020), as these agents are sometimes not so watchful about the costs and resources of the company as of their own (Letza et al. 2004). Researchers around the world have suggested various measures to reduce this agency conflict. One of the measures to reduce this conflict is to create a strong and resourceful supervisory board that can protect the interests of the shareholders.

The board's opinion and style have a big impact on the top management's operational decisions. Shareholders appoint the board of directors and so, the major objective of the board is to maximize shareholder wealth. Further, the board ensures that the agency issue between shareholders and management is minimized so that the right decisions are taken at the right time to develop a basis for sustainable shareholder wealth maximization.

The composition, structure and style of the boardroom also impact the company's performance. While staggered boards are linked with low debt-to-capital ratio (Jiraporn & Liu, 2008); companies with small boards are linked with taking risky investments (Wang, 2012). The board style is also linked with many key performance indicators including return on equity and assets.

## Literature Review



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With the advent of technology, the corporate world is becoming increasingly dynamic. Not only consumer preferences are changing but business models are also completely being revamped. These changes also impact the way the boards and their directors operate and their role and responsibilities towards the company and the shareholders. For example, in the world of increasing globalization, the bureaucratic companies are becoming "hallmarks of modern society" (Zald, 1969). The board of directors of these companies, consequently, have great potential power.

The primary role of the board of directors is to protect shareholders' interests. The board serves as an important internal control for the company as it closely monitors management's performance and takes part in strategic decision-making (Baysinger & Hoskisson, 1990). This helps to minimize the agency issue between management and the owners of the company. Furthermore, even the profitability and market capitalization of the firm have an impact on key decisions like compensation decisions of the companies as well (Patel, Shamsi, and Asim, 2018).

There have been mixed results between the company's performance and board structure. According to Dalton, Daily, Ellstrand, and Johnson (1998), the board composition does not have any significant relationship with the firm's performance. Similarly, according to Patel (2018), sharing ownership by the directors and the performance of the firm has a significant negative relationship. Furthermore, the results showed that there existed a negative relationship between independent directors and firm performance. According to Guest (2009) size of the board has a negative impact on the profitability of the firms and concluded that problems related to poor communication and ineffective decision-making undermine the overall effectiveness of large boards. Sheikh, Wang, and Khan (2013) conducted a study in the context of Pakistan and found that the size of the board is associated with firm performance, whereas outside independent directors have a negative association with it.

## Methodology and Data Analysis

This research uses quantitative research methodology, as this methodology helps in uncovering the relationship and impact of board size on the capital structure decision of the firm. For this study, secondary data is manually extracted from the annual financial statements of the companies. The annual reports are downloaded from the company's official websites, annual report portals, and the official website of the PSX.

The following model specification is used for conducting this research study to examine the impact of board size on the capital structure of the company.

$$\text{Ln (LEV)}_{it} = \alpha + \beta_1 \ln (\text{BSIZE})_{it} + \beta_2 \ln (\text{BIND})_{it} + \beta_3 \ln (\text{ROE})_{it} + \beta_4 \ln (\text{FS})_{it} + \varepsilon_{it}$$

The regression results of the study show that the size of the board does not have any statistically significant impact on the dependent variable, i.e., debt to equity ratio of the company. This


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shows that the size of the board does not have any significant influence on the capital structuring of the company.

| | | | |
|---|---|---|---|
| BSIZE | -0.132 | 0.128 | 0.308 |
| BIND | 0.073 | 0.283 | 0.796 |
| ROE | 4.983 | 0.240 | 0.000 |
| FS | 2.37E-09 | 7.93E-10 | 0.005 |
| Adjusted R-squared | 0.932 | | |

## Conclusion

The purpose of this research is to find the impact of the board size and independence on the capital structure of the company. The results show that the board size is shown to have an insignificant impact on the capital structure of the company. This means that the debt-to-equity ratio of the companies is not affected by the size of the boards whether they are large or small.

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# UNDERSTANDING I-SARAAN ADOPTION INTENTION USING THE VALUE-BASED ADOPTION MODEL (VAM): EVIDENCE FROM DOMESTIC AND PART-TIME STUDENT WORKERS

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***Abstract:*** *Malaysia's aging population and the rise of informal employment underscore the need for greater participation in voluntary retirement savings schemes. This study uses the Value-Based Adoption Model (VAM) to examine factors influencing adoption intention toward i-Saraan among financially vulnerable groups at Universiti Utara Malaysia, including cleaners, part-time student workers and small informal earners. Survey data from 338 respondents show that perceived usefulness and enjoyment increase perceived value, while affordability constraints and technical challenges have stronger direct effects on adoption intention. Partial mediation through perceived value indicates that, although the benefits of i-Saraan are recognized, structural barriers such as limited financial capacity and digital complexity remain crucial. The findings extend the theoretical application of VAM to voluntary retirement savings and provide actionable recommendations, such as simplifying enrolment, offering targeted financial literacy and digital skills programs and enhancing government incentives to boost participation among underserved populations.*

***Keywords:*** *Adoption intention; i-Saraan; Value-Based Adoption Model; Voluntary retirement savings.*

## 1. Introduction

Malaysia is experiencing a rapid demographic transformation. Department of Statistics Malaysia (DOSM) stated that individuals aged 65 and above made up 7.7% of the population in 2024, a significant increase from just 3.1% in 1970 (DOSM, 2025). The proportion of older persons continues to rise and under current demographic projections, Malaysia is expected to attain "aged nation" status before 2030, with over 15% of the population aged 60 or older. Policymakers predict that by 2043, approximately 14% of Malaysians will be aged 65+ and by 2056, this share could surpass 20%, positioning Malaysia among the "super-aged" nations (Employees Provident Fund-EPF, 2025). This shift is expected to place significant pressure on both individuals and public systems to ensure adequate retirement income, especially as life expectancy rises and the working-age population shrinks.

These demographic trends, coupled with an evolving labor market marked by increasing informal employment and gig work, highlight a critical risk: many workers may face retirement without sufficient savings unless they participate in voluntary retirement-saving schemes. As noted by Rosmah (2024), the decline in fertility rates and the growing number of informal-


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sector workers necessitate urgent attention to alternative retirement savings options for these populations.

**Table 1: Key Demographic and Retirement-Savings**

| Indicator / Year | Value / Observation |
|---|---|
| % of population aged 65+ in 2024 | 7.7% |
| Projected % aged 65+ by 2043 | ~14% |
| Projected % aged 65+ by 2056 | >20% |
| The working-age population (15–64) in 2024 | ~70.1% |
| i-Saraan introduction year | 2018 (EPF voluntary scheme for informal workers) |
| i-Saraan matching incentive (post Budget 2025) | 20%, capped at RM 500/yr and RM5,000 lifetime |
| i-Saraan contributions in 2024 | RM2.6 billion, covering ~529,667 members |

*Source:* EPF (2025); DOSM (2025); Malay Mail (2025)

In response to the challenge of low retirement savings among informal-sector workers, the Employees Provident Fund (EPF) introduced the i-Saraan program in 2018. This voluntary retirement savings scheme was designed to target workers outside formal employment, such as self-employed individuals, gig workers and other informal-sector employees (see Table 1). Since its inception, the scheme has expanded progressively. Under Budget 2025, the government increased the matching incentive for i-Saraan contributions from 15% to 20%, with a maximum contribution of RM500 per year and a lifetime cap of RM5,000 per contributor (Business Today, 2024). By 2024, i-Saraan contributions had reached RM2.6 billion, benefiting over 529,000 members (Malay Mail, 2025).

Despite these efforts, participation remains low among underrepresented groups such as low-income informal workers, cleaners and part-time student workers. Key barriers to participation include irregular incomes, limited financial literacy and minimal engagement with formal financial planning mechanisms, which often discourage long-term commitment to retirement savings. Previous research on voluntary schemes has predominantly focused on formal-sector or middle-income workers, leaving a significant gap in understanding the behavioral determinants of adoption intention among informal and low-income groups (Nur Diyana Yusuf et al., 2024).

To address this research gap, this study applies the Value-Based Adoption Model (VAM) to examine the adoption intention of i-Saraan among domestic and part-time student workers at Universiti Utara Malaysia (UUM), Sintok, Kedah. By integrating perceived benefits, such as usefulness and enjoyment, with perceived sacrifices, including technical difficulty and fees, the VAM framework facilitates a comprehensive assessment of how perceived value influences behavioral intention to participate in voluntary retirement savings. The findings aim to make both theoretical contributions and practical recommendations, guiding policymakers in refining retirement-saving schemes to enhance financial inclusion and social protection for Malaysia's vulnerable informal-sector workforce amidst an aging population.


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## 2. Literature Review

### *2.1 From Technology Adoption to Retirement Savings Behavior*

The decision to participate in a voluntary retirement savings scheme, such as i-Saraan, can be framed as a form of adoption behavior, similar to the uptake of new technologies or financial services. The Value-Based Adoption Model (VAM) posits that adoption is driven by a user's evaluation of perceived benefits and perceived sacrifices, which are mediated through perceived value, ultimately influencing behavioral intention (Kim, Chan & Gupta, 2007). While VAM was initially developed in technology contexts, it is also applicable to retirement savings decisions, as these decisions involve trade-offs between potential gains, such as future financial security and costs, including fees and procedural complexity, much like technology adoption.

Retirement planning and pension uptake are influenced by various structural, behavioral and contextual factors beyond individual value perceptions. Recent empirical and conceptual studies suggest that financial literacy, financial behavior, risk tolerance, socioeconomic status and employment type (e.g., gig workers, informal sector, self-employed) strongly influence retirement savings behavior (Mahdzan et al., 2017; Kamarul Zaman et al., 2023; Ab Kadir et al., 2025). Integrating these determinants with VAM constructs creates a more comprehensive and realistic model to understand i-Saraan adoption, particularly among vulnerable populations such as informal workers and low-income earners.

### *2.2 Key Determinants in Retirement Planning and Savings Behavior*

#### *2.2.1 Financial Literacy and Financial Behavior*

A substantial body of research highlights the critical role of financial literacy and financial behavior in effective retirement planning. A large-scale study among Malaysian employees found that higher financial literacy significantly enhances preparedness for defined contribution pension schemes, especially when combined with positive behaviors like a proactive savings attitude and perceived control over finances (Wahab et al., 2022). Mahdzan et al. (2017) note that individuals with greater financial literacy and lower risk aversion are more likely to engage in retirement planning and allocate assets to riskier instruments with the potential for higher returns.

Structural factors, such as education level, income and anticipated healthcare costs, are key determinants in shaping retirement planning behavior. These factors can either mediate or moderate responses to retirement incentives, affecting an individual's ability to save and plan effectively (Ab Kadir et al., 2025). Studies focusing on self-employed or gig workers who share characteristics with informal-sector workers, also show that financial attitudes, financial knowledge and risk tolerance strongly influence retirement planning and savings behavior (Kamarul Zaman et al., 2025). Thus, the literature underscores that, beyond individual value perceptions, financial literacy, financial behavior and socioeconomic characteristics are central to shaping retirement savings decisions.

### *2.3 Attitudinal and Behavioral Models Beyond VAM*


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While VAM offers a valuable framework for understanding adoption through a cost- benefit lens, retirement planning behavior is also shaped by attitudes, social norms, perceived control and future orientation. Models such as the Theory of Planned Behavior (TPB) and behavioral finance frameworks also contribute valuable insights. For example, Ramli et al. (2023) demonstrate that saving intention, mediated by saving attitude and financial literacy, significantly impacts actual retirement planning behavior among young private-sector employees.

Kimiyagahlam et al. (2019) find that financial literacy, propensity to plan and future time orientation are direct predictors of retirement planning, with saving attitude partially mediating these relationships. These findings suggest that perceived value alone may not fully capture the psychological and social dynamics that influence retirement planning. Integrating VAM constructs with behavioral finance or TPB-derived constructs offers a more comprehensive model, providing greater explanatory power for understanding the adoption of retirement savings schemes like i-Saraan.

### *2.4 Contextual Realities: Vulnerable Groups, Informal Employment and Savings Gaps 2.5*

Applying the aforesaid frameworks to informal workers, gig economy participants, or low-income earners requires an understanding of the structural constraints and contextual realities faced by these groups. Studies on gig workers in Peninsular Malaysia highlight that irregular income streams, the absence of employer-based pensions and job instability significantly influence retirement planning behavior (Kamarul Zaman et al., 2025). Empirical evidence indicates that many Malaysian workers, even those covered by statutory schemes like the EPF, still lack adequate retirement savings (Ab Rahman & Mohd Juanda, 2022). This gap is particularly evident among employees nearing retirement age, where reliance on a single savings instrument has proven insufficient for long-term financial security (Ab Rahman & Mohd Juanda, 2022).

The challenges of rising life expectancy, increasing healthcare cost and broader economic uncertainties further amplify the need for comprehensive retirement planning. As the aging population grows, the financial pressures on informal-sector workers, gig workers and low-income earners intensify, underscoring the necessity for structural solutions in retirement savings models like i-Saraan. These models must address not only the perceived value and behavioral intentions of participants but also provide structural enablers and constraints, such as financial literacy support, accessible savings mechanisms and flexible contribution schemes.

### *2.5 Integrating VAM with Retirement-Planning Determinants: Proposed Conceptual Framework*

Based on the rich empirical and conceptual literature, an integrated conceptual framework is proposed for analyzing i-Saraan adoption among informal and vulnerable workers. This framework incorporates multiple layers of factors influencing adoption behavior. The key antecedents include financial literacy, income levels, employment types (informal/gig/self-employed), risk tolerance, demographic factors (such as age and education) and anticipated health costs. These elements shape an individual's approach to retirement planning and savings.


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The mediators in this framework involve perceived benefits, such as usefulness and enjoyment and perceived sacrifices, including technical complexity and fees. These mediators influence perceived value, which in turn is shaped by attitudinal and behavioral constructs, such as saving attitudes, future orientation and perceived behavioral control. These factors ultimately influence adoption intention, leading to actual participation or contributions in i-Saraan, thereby impacting retirement savings behavior and retirement preparedness.

This integrative framework aligns with recent calls in the literature for comprehensive models that move beyond simple cost-benefit analyses. It recognizes the importance of structural, behavioral and psychological determinants, all of which play crucial roles in shaping retirement savings decisions, especially among vulnerable groups (Mahdzan et al., 2017; Ab Kadir et al., 2025; Kamarul Zaman et al., 2023).

### *2.6 Research Gap & Contribution*

Despite extensive research on retirement planning and financial literacy in Malaysia, few studies have explicitly applied VAM or adoption-based models to voluntary pension schemes targeting informal, low-income, or underrepresented groups, such as gig workers, asnaf and part-time workers. Existing frameworks, particularly those developed for civil servants or gig workers, often fail to integrate both perceived value trade-offs and structural constraints simultaneously (Amirludin et al., 2024). This gap highlights the need for a more comprehensive approach to understanding adoption behaviors among vulnerable groups. By adopting VAM and augmenting it with key determinants like financial literacy, income dynamics and behavioral attitudes, this study contributes a novel perspective. It bridges technology adoption theory with the literature on financial inclusion and retirement security, offering a holistic understanding of the factors that drive the uptake of voluntary savings schemes like i-Saraan. This approach enhances the understanding of how marginalized and vulnerable workers navigate the decision to participate in retirement savings schemes, with significant implications for policy and practice.

## 3. VAM Framework

The Value-Based Adoption Model (VAM) conceptualizes adoption behavior as a function of users' evaluation of perceived benefits and perceived sacrifices, which together shape perceived value, ultimately influencing behavioral intention (Kim, Chan, & Gupta, 2007). In the context of i-Saraan, perceived benefits include perceived usefulness and perceived enjoyment, while perceived sacrifices include perceived technicality and perceived fees. Perceived value serves as a mediating variable, linking these factors to adoption intention. Table 2 presents the operational definitions of the VAM constructs as applied in this study.

**Table 2: Te Definition of VAM Items**

| Construct | Definition | Source |
|---|---|---|
| Perceived Usefulness | The extent to which individuals believe that participating in i-Saraan will enhance their retirement security and financial preparedness. | Kim, Chan, & Gupta, (2007) |


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| | | |
|---|---|---|
| Perceived Enjoyment | The degree of psychological satisfaction and intrinsic pleasure individuals experience from actively saving for retirement via i-Saraan. | Kim, Chan, & Gupta, (2007) |
| Perceived Technicality | The level of complexity individuals perceives when registering, navigating, or managing i-Saraan contributions. | Kim, Chan, & Gupta, (2007) |
| Perceived Fee | The perceived financial burden associated with making voluntary contributions into i-Saraan. | Kim, Chan, & Gupta, (2007) |
| Perceived Value | The overall evaluation of i-Saraan is based on weighing perceived benefits (usefulness, enjoyment) against perceived sacrifices (technicality, fee). | Kim, Chan, & Gupta, (2007) |
| Adoption Intention | The individual's willingness and intention to adopt or continue using i-Saraan. | Kim, Chan, & Gupta, (2007) |

The following paragraphs explain each construct of the VAM as applied to i-Saraan:

- Perceived Usefulness refers to how individuals evaluate the practical benefits of participating in i-Saraan, such as improving retirement security and ensuring long-term financial stability. In the VAM, perceived usefulness is a key factor shaping perceived value (Kim, Chan, & Gupta, 2007). Research consistently demonstrates that individuals are more likely to adopt services when they perceive clear advantages like financial gain, convenience, or efficiency (Davis, 1989; Venkatesh & Davis, 2000; Lusardi & Mitchell, 2014). Thus, the usefulness of i-Saraan plays a significant role in motivating individuals to participate in the scheme.
- Perceived Enjoyment captures the intrinsic satisfaction or emotional pleasure derived from engaging in a behavior, regardless of practical benefits (Venkatesh, Thong, & Xu, 2012). For i-Saraan, perceived enjoyment reflects the psychological fulfillment individuals experience when actively saving for their future. Enjoyment contributes to perceived value and strengthens adoption intention, particularly in emotionally engaging contexts like financial planning. Research indicates that enjoyment can be a powerful motivator in contexts where individuals feel emotionally invested in their decisions (Kim, Chan, & Gupta, 2007; Venkatesh et al., 2012).
- Perceived Technicality refers to the level of complexity or difficulty individuals associate with using a system. High complexity can discourage adoption, especially among those with limited digital or financial literacy. For informal workers or part-time employees, i-Saraan may seem difficult to understand or manage. In VAM, technical complexity is considered a perceived sacrifice (Kim, Chan, & Gupta, 2007). Research shows that systems perceived as easy to use tend to experience higher adoption rates and complexity is often a barrier in financial services for low-income groups (Davis, 1989; Lusardi & Mitchell, 2011; OECD, 2020). Thus, making i-Saraan easy to understand and use is critical to enhancing adoption among vulnerable populations.
- Perceived Fee represents the financial cost of participating in i-Saraan. For low-income or vulnerable groups, even small contributions can be a significant challenge. Perceived fee is considered a sacrifice, reducing overall value when costs outweigh the benefits (Kim, Chan, & Gupta, 2007). Studies show that affordability strongly influences


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retirement savings behavior, especially among financially constrained populations (Zeithaml, 1988; Lusardi & Mitchell, 2014). Reducing financial barriers to entry could thus significantly enhance participation in i-Saraan, particularly among low-income workers.

At the core of the VAM is perceived value, which represents the overall assessment after weighing benefits (usefulness and enjoyment) against sacrifices (technicality and fees). In the context of i-Saraan, perceived value captures whether individuals believe the long-term financial and psychological benefits of saving outweigh the difficulties and costs. As a strong mediator of adoption in both technology and financial contexts, perceived value plays a crucial role in determining whether individuals will follow through with their adoption intentions (Kim et al., 2007; Venkatesh et al., 2012).

Finally, adoption intention refers to an individual's willingness or likelihood to adopt or continue using a service. In the VAM, adoption intention is shaped by perceived value, which integrates both benefits and sacrifices. A higher adoption intention indicates greater readiness and confidence to participate in voluntary retirement savings like i-Saraan (Davis, 1989; Venkatesh et al., 2012). Adoption intention serves as a strong predictor of actual participation, marking the transition from intention to concrete action. While VAM has been widely applied in technology and financial services research, its application to voluntary retirement schemes among informal workers remains limited. This study extends existing research by examining the behavioral drivers of i-Saraan participation among underrepresented groups, such as cleaners and part-time student workers. By applying VAM to this context, the study offers both theoretical contributions to the VAM literature and practical insights for enhancing financial inclusion and retirement security in Malaysia, especially among vulnerable groups.

### *3.1 The Study's VAM Framework*

This study utilizes the Value-Based Adoption Model (VAM) developed by Kim, Chan and Gupta (2007), a widely adopted framework for understanding technology and service adoption based on individuals' evaluations of perceived benefits and perceived sacrifices. According to VAM, users assess whether the advantages of a system outweigh its costs, forming an overall perception of perceived value, which subsequently drives adoption intention. Applied to the context of voluntary retirement savings, this study investigates the determinants of participation in Malaysia's i-Saraan scheme, particularly among informal and low-income workers.

Within the VAM framework, perceived benefits are composed of perceived usefulness and perceived enjoyment. Perceived usefulness refers to individuals' beliefs about the functional and financial advantages of i-Saraan, such as enhanced retirement security, long-term savings accumulation, eligibility for government matching contributions and access to tax incentives. Previous studies consistently show that perceived usefulness plays a significant role in shaping retirement saving behavior, with findings supporting its positive impact on individuals' participation in retirement plans (Hershey, Jacobs-Lawson, & Austin, 2013; Lusardi & Mitchell, 2014; Bateman & Thorp, 2019). On the other hand, perceived enjoyment reflects the intrinsic satisfaction or emotional comfort individuals derive from engaging in proactive


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financial planning. This emotional fulfillment fosters long-term commitment to saving for the future (Hershfield et al., 2011; Venkatesh et al., 2012). As such, both perceived usefulness and perceived enjoyment significantly contribute to the perceived value of i-Saraan, ultimately enhancing participation.

Perceived sacrifices, which include perceived technicality and perceived fee, represent the costs associated with adopting i-Saraan. Perceived technicality refers to the complexity involved in navigating, registering, or contributing to i-Saraan, which may be a deterrent for informal workers with lower financial or digital literacy (Agarwal et al., 2009; OECD, 2020). For many low-income individuals, the perceived technicality can create significant barriers, making participation seem challenging or intimidating. Perceived fee, on the other hand, concerns the affordability of i-Saraan. Even small contributions can present significant financial burdens for vulnerable groups, leading to reduced participation (Duflo & Saez, 2003; Chetty, Friedman, & Leth-Petersen, 2014). These sacrifices diminish the overall value of the scheme and hinder adoption.

At the heart of VAM lies perceived value, which represents the overall judgment individuals form by weighing benefits (usefulness and enjoyment) against sacrifices (technicality and fees). Perceived value aligns with Zeithaml's (1988) definition of value as a cognitive trade-off between costs and gains. Evidence consistently shows that perceived value mediates the relationship between benefits, sacrifices and adoption behavior, making it a key predictor of participation (Brown & Previtero, 2014; Nienhüser & Warwas, 2016). As such, the perceived value of i-Saraan significantly influences whether individuals decide to engage with the scheme.

Adoption intention refers to an individual's willingness to join or continue contributing to i-Saraan. This intention is a crucial predictor of actual retirement behavior, reflecting an individual's confidence and commitment to voluntary savings. Strong adoption intention translates into greater participation in retirement schemes like i-Saraan (Ajzen, 1991; Hershey & Mowen, 2000; Venkatesh et al., 2012). By examining the factors that drive adoption intention, this study links technology adoption theory with financial behavior and financial inclusion, offering important theoretical insights into how individuals from vulnerable populations perceive and engage with retirement savings schemes.

The relationships between these study variables are illustrated in Figure 1. Based on the proposed framework, five hypotheses were developed to test how the VAM constructs influence voluntary retirement savings adoption. Specifically, perceived usefulness and perceived enjoyment are expected to positively affect perceived value, while perceived technicality and perceived fee are hypothesized to negatively impact perceived value. In turn, perceived value is predicted to positively influence adoption intention toward i-Saraan. These hypotheses reflect VAM's central premise: that adoption decisions are shaped by individuals' overall evaluation of the benefits and costs of a system.


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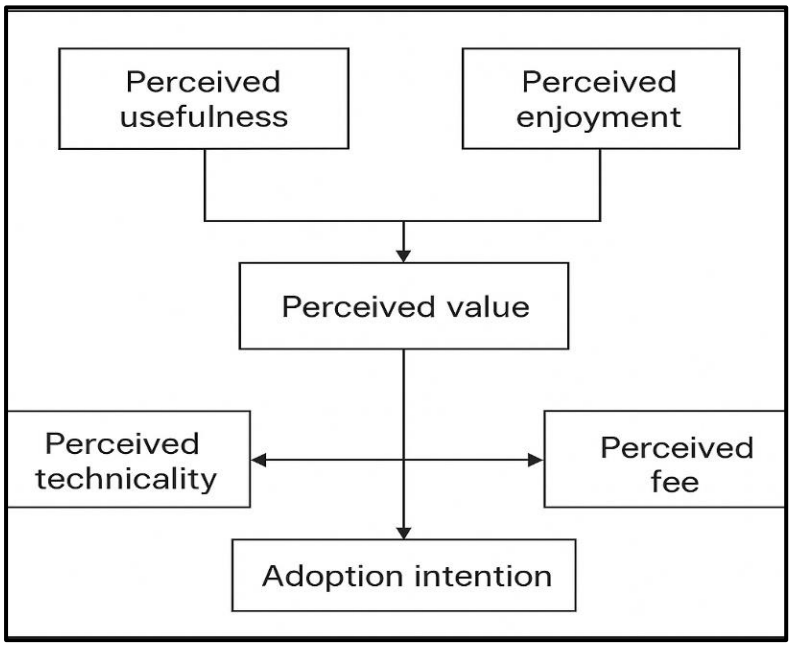



**Figure 1: Research Framework Based on VAM**

## 4. Research Methodology

### *4.1 Research Design*

This study employs a quantitative, cross-sectional survey to explore the factors influencing i-Saraan adoption intention among domestic and part-time student workers at Universiti Utara Malaysia (UUM), Sintok, Kedah. The quantitative approach enables systematic analysis of the relationships between the VAM constructs, providing measurable data on perceptions and behaviors. The cross-sectional design collects data at a single point in time under a consistent policy environment, making it ideal for capturing stable perceptions regarding voluntary retirement savings behavior. This methodology is well-suited for testing the hypothesized relationships within the Value-Based Adoption Model.

### *4.2 Population and Sampling*

The study targets two underrepresented worker groups at UUM: campus domestic workers (cleaners/janitors), representing informal workers with irregular income and part-time student workers, who hold temporary employment during academic terms. These groups are particularly relevant for examining voluntary retirement savings, as they are typically excluded from formal pension schemes and may lack the means for consistent long-term financial planning. Due to the absence of a complete sampling frame, non-probability purposive sampling was employed. Respondents were included if they were currently employed as a domestic or part-time student worker at UUM, aged 18 or above and aware of the voluntary nature of i-Saraan. After screening for completeness and consistency, 338 valid responses were retained for analysis.

### *4.3 Sample Size Justification*


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The final sample of 338 respondents exceeds the minimum recommended for multivariate analysis. According to Hair, Black, Babin and Anderson (2010), it is advisable to have at least 15 to 20 observations per independent variable. With four independent variables and one mediating construct in this study, the sample provides sufficient statistical power for hypothesis testing, reducing the risk of Type II errors. This ensures the robustness and reliability of the findings, supporting valid conclusions based on the collected data.

### *4.4 Instrument*
### *4.5*

A structured questionnaire was developed by adapting validated scales from Kim, Chan and Gupta (2007) to measure the VAM constructs. The questionnaire consisted of seven sections: (A) Demographics, (B) Adoption Intention, (C) Perceived Value, (D) Perceived Usefulness, (E) Perceived Enjoyment, (F) Perceived Fee and (G) Perceived Technicality. All items used 5-point Likert scales, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument was initially prepared in English and pre-tested to ensure clarity, content relevance and face validity before the full-scale distribution. The pre-testing phase ensured that the instrument was comprehensible and adequately reflected the key constructs being studied.

### *4.5 Pilot Study and Reliability Assessment*

A pilot study involving 30 respondents was conducted to evaluate the clarity, readability and overall reliability of the measurement instrument. Internal consistency reliability was assessed using Cronbach's Alpha (CA), with values above 0.60 considered acceptable for exploratory research (Hair et al., 2010). All constructs recorded alpha values exceeding this threshold, indicating satisfactory internal consistency. Based on feedback from the pilot respondents, minor revisions were made to the wording of several items to enhance clarity and precision before administering the questionnaire during the full data collection phase.

### *4.6 Data Analysis Techniques*

The collected data were analyzed using SPSS to ensure methodological rigor. Descriptive statistics were first employed to summarize respondents' demographics, providing a clear picture of the sample characteristics. Reliability analysis (Cronbach's Alpha) was conducted to assess the internal consistency of the constructs. Factor analysis followed, confirming the construct validity and dimensionality of the scales used. Correlation analysis was then performed to examine the strength and direction of relationships among the variables. To test the direct effects within the VAM framework, multiple regression analysis was used, with a particular focus on the mediating role of perceived value. ANOVA was also conducted to evaluate the overall significance of the regression models and to compare group differences where relevant. These analyses provided a comprehensive and robust assessment of the hypothesized relationships, ensuring that the study's results were both reliable and valid.

## *5. Results*

A total of 338 valid responses were collected for analysis. The gender distribution was balanced, with 52.7% female and 47.3% male respondents. In terms of employment categories,


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53.0% were campus cleaners, 26.9% were part-time student workers, 9.5% were cafeteria workers, 5.0% were part-time student operators and 5.6% were small traders. Most respondents fell within the low to middle income bracket, with 38.5% earning below RM1,000 per month and 38.2% earning RM1,500 to RM1,999. This demographic profile aligns with the study's focus on informal and low-income groups, supporting the relevance of the dataset for examining adoption intention toward i-Saraan.

### *5.1 Reliability Analysis*
### *5.2*

Internal consistency reliability was assessed using Cronbach's Alpha, with values above 0.60 deemed acceptable for exploratory research (Hair et al., 2010). As shown in Table 3, all constructs exceeded this recommended threshold, demonstrating satisfactory internal consistency across the measurement scales.

All constructs met the acceptable reliability benchmark, indicating solid internal consistency across the pilot items. Minor wording adjustments were made based on pilot feedback prior to the full-scale data collection.

**Table 3. Reliability Analysis**

| No | Construct | Cronbach's Alpha |
|---|---|---|
| 1 | Adoption Intention | 0.751 |
| 2 | Perceived Value | 0.714 |
| 3 | Perceived Usefulness | 0.608 |
| 4 | Perceived Enjoyment | 0.709 |
| 5 | Perceived Fee | 0.712 |
| 6 | Perceived Technicality | 0.682 |

### *5.2 Validity Analysis*

Construct validity was evaluated using Pearson's inter-item correlation analysis, ensuring that all items within each construct measured the same underlying concept. According to Hair, Black, Babin and Anderson (2010), item-total correlation values above 0.30, with statistical significance at $p < 0.05$, indicate acceptable construct validity. In this study, all six constructs; Adoption Intention, Perceived Value, Perceived Usefulness, Perceived Enjoyment, Perceived Fee and Perceived Technicality that showed inter-item correlations well above the recommended threshold, with all correlations significant at the 0.01 level (See Table 4). These results confirm that all items demonstrate strong internal alignment with their respective constructs, supporting the validity and robustness of the measurement instrument for subsequent hypothesis testing.

**Table 4. Item Total Correlation for Construct Validity**

| Construct | Inter Item Correlation Range | Significance |
|---|---|---|
| Adoption Intention | 0.386 – 0.532 | $p < 0.01$ |
| Perceived Usefulness | 0.309 – 0.522 | $p < 0.01$ |
| Perceived Enjoyment | 0.333 – 0.524 | $p < 0.01$ |
| Perceived Fee | 0.628 | $p < 0.01$ |


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| | | |
|---|---|---|
| Perceived Technicality | 0.340 – 0.452 | $p < 0.01$ |
| Perceived Value (Mediator) | 0.503 – 0.577 | $p < 0.01$ |

### 5.3 Correlation Analysis

A Pearson correlation analysis was performed to examine relationships among the key variables. As presented in Table 5, all constructs were significantly correlated in the hypothesized directions, with all correlations being statistically significant at the 0.01 level. This provides strong initial support for the proposed model.

**Table 5: Pearson Correlation Coefficients Between Constructs (N = 338)**

| Variable Pair | Correlation (r) | Significance |
|---|---|---|
| Perceived Usefulness → Perceived Value | 0.641 | $p < 0.001$ |
| Perceived Enjoyment → Perceived Value | 0.584 | $p < 0.001$ |
| Perceived Technicality → Perceived Value | 0.496 | $p < 0.001$ |
| Perceived Fee → Perceived Value | 0.386 | $p < 0.001$ |
| Perceived Value → Adoption Intention | 0.567 | $p < 0.001$ |
| Perceived Usefulness → Adoption Intention | 0.621 | $p < 0.001$ |
| Perceived Enjoyment → Adoption Intention | 0.697 | $p < 0.001$ |
| Perceived Technicality → Adoption Intention | 0.650 | $p < 0.001$ |
| Perceived Fee → Adoption Intention | 0.642 | $p < 0.001$ |

The analysis revealed that Perceived Usefulness had a strong positive correlation with Perceived Value ($r = 0.641$, $p < 0.001$), suggesting that respondents who perceived i-Saraan as useful tended to assign higher overall value to the scheme. Perceived Enjoyment also demonstrated a significant positive correlation with Perceived Value ($r = 0.584$, $p < 0.001$), highlighting the role of intrinsic motivation in value assessment. Interestingly, Perceived Technicality showed a moderate positive correlation with Perceived Value ($r = 0.496$, $p < 0.001$), indicating that respondents who perceived the system as more complex still tended to assign higher value, possibly reflecting an appreciation of advanced features. In contrast, Perceived Fee had a weaker positive correlation with Perceived Value ($r = 0.386$, $p < 0.001$), suggesting that while costs were considered, they had a limited effect on the overall perception of value.

Regarding Adoption Intention, the correlation analysis showed that Perceived Value was positively associated with Adoption Intention ($r = 0.567$, $p < 0.001$), indicating that respondents who perceived higher value in i-Saraan were more likely to intend to adopt it. Both Perceived Usefulness ($r = 0.621$, $p < 0.001$) and Perceived Enjoyment ($r = 0.697$, $p < 0.001$) had strong positive correlations with Adoption Intention, emphasizing that both practical benefits and enjoyment were strong motivators for adoption. Similarly, Perceived Technicality ($r = 0.650$, $p < 0.001$) and Perceived Fee ($r = 0.642$, $p < 0.001$) also showed strong positive correlations with Adoption Intention, which suggests that respondents might view these factors as manageable trade-offs for the benefits received.

The correlation results support the theoretical premise of the Value-Based Adoption Model (VAM), where both perceived benefits (usefulness, enjoyment) and costs/complexity


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(technicality, fees) are meaningfully associated with perceived value and adoption intention. It appears that benefits, particularly usefulness and enjoyment, are more influential in shaping respondents' behavioral intentions than cost-related factors.

### *5.4 Regression Analysis*

#### *5.4.1 Direct Effects of Independent Variables on Adoption Intention*

Multiple regression analysis was conducted to assess the direct influence of the independent variables on adoption intention. As shown in Table 6, the model explained 64.2% of the variance in adoption intention ($R^2 = 0.642$), indicating strong predictive power.

**Table 6: Regression Results for Perceived Value (DV: Perceived Value)**

| Independent Variable | Beta (β) | p-value | Result |
|---|---|---|---|
| Perceived Fee | 0.290 | < 0.001 | Supported |
| Perceived Enjoyment | 0.276 | < 0.001 | Supported |
| Perceived Technicality | 0.227 | < 0.001 | Supported |
| Perceived Usefulness | 0.191 | < 0.001 | Supported |

#### *5.4.2 Effects of Independent Variables on Perceived Value (Mediator)*

A second regression analysis tested the effects of the independent variables on the mediating variable, perceived value. The model explained 47.1% of the variance in perceived value ($R^2 = 0.471$), as shown in Table 7.

**Table 7: Regression Results for Perceived Value (Mediator)**

| Independent Variable | Beta (β) | p-value | Result |
|---|---|---|---|
| Perceived Usefulness | 0.425 | < 0.001 | Supported |
| Perceived Enjoyment | 0.269 | < 0.001 | Supported |
| Perceived Fee | 0.015 | 0.759 | Not Supported |
| Perceived Technicality | 0.072 | 0.191 | Not Supported |

The results reveal that perceived usefulness ($\beta = 0.425$, $p < 0.001$) and perceived enjoyment ($\beta = 0.269$, $p < 0.001$) significantly positively influenced perceived value. Perceived fee and perceived technicality did not significantly affect perceived value, indicating that benefit-driven factors are more critical than cost or complexity in shaping value perceptions.

#### *5.4.3 Full Model: Effects of Independent Variables and Mediator on Adoption Intention*

The full regression model was tested, incorporating both the independent variables and the mediator (perceived value) to predict adoption intention. The model explained 65.1% of the variance in adoption intention ($R^2 = 0.651$), as shown in Table 8. The significant contribution of perceived value in the full model confirms the presence of partial mediation, highlighting the benefit-driven nature of adoption intention.


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**Table 8: Full Regression Results Including Perceived Value (Mediator)**

| Predictor | Beta (β) | p-value | Result |
|---|---|---|---|
| Perceived Fee | 0.288 | < 0.001 | Supported |
| Perceived Enjoyment | 0.246 | < 0.001 | Supported |
| Perceived Technicality | 0.219 | < 0.001 | Supported |
| Perceived Usefulness | 0.113 | < 0.001 | Supported |
| Perceived Value (Mediator) | 0.113 | 0.012 | Supported |

### *5.4.4 Hypothesis Testing Summary*

A summary of the hypothesis testing results is presented in Table 9. All proposed hypotheses (H1 to H5) were tested and supported, with the exception of those related to the effects of perceived technicality and perceived fee on perceived value.

**Tabl 9: Hypothesis Testing Summary**

| Hypothesis | Statement | Result |
|---|---|---|
| H1 | Perceived Usefulness → Perceived Value | Supported |
| H2 | Perceived Enjoyment → Perceived Value | Supported |
| H3 | Perceived Technicality → Perceived Value | Not Supported |
| H4 | Perceived Fee → Perceived Value | Not Supported |
| H5 | Perceived Value → Adoption Intention | Supported |

## 6. Discussion

This study provides empirical support for the Value-Based Adoption Model (VAM) in explaining behavioral intention to adopt Malaysia's i-Saraan voluntary retirement savings scheme among financially vulnerable informal sector workers and part-time student employees. The findings contribute to extending the application of VAM into the underexplored domain of voluntary retirement savings, a field that has primarily been studied in the context of technology and financial service adoption (Kim, Chan, & Gupta, 2007). By applying the VAM to financial inclusion contexts, this study offers significant insights into how perceived benefits and costs influence adoption intention in a setting where financial accessibility is a critical issue.

Consistent with prior VAM research (Kim et al., 2007; Davis, 1989; Venkatesh & Davis, 2000), perceived usefulness emerged as a significant positive predictor of perceived value. Participants who believed that i-Saraan would enhance their long-term retirement security demonstrated higher evaluations of the program's overall value. This finding aligns with the fundamental VAM assumption that functional benefits are core drivers of perceived value and subsequent adoption intention (Venkatesh et al., 2012). The results underscore that individuals' perceptions of practical and financial advantages directly influence their decision to engage in voluntary retirement savings.

Similarly, perceived enjoyment was found to significantly influence perceived value, suggesting that emotional satisfaction plays an important role even in financially oriented decisions. This reinforces the growing recognition of intrinsic psychological engagement in


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adoption behavior, as previously observed in technology adoption research (Venkatesh et al., 2012). In the context of i-Saraan, enjoyment may reflect respondents' sense of personal empowerment and proactive financial planning, which contributes positively to their perception of the program. This highlights the importance of integrating emotional and intrinsic motivations into the adoption process, even within financial decision-making.

Interestingly, perceived technicality and perceived fee did not significantly influence perceived value, but they remained significant direct predictors of adoption intention. This partial mediation suggests that, while individuals may recognize the benefits of i-Saraan, practical barriers related to system complexity and affordability continue to exert substantial influence on behavioral intention. These findings are aligned with earlier studies that indicate complexity and cost concerns often act as direct inhibitors to adoption in financial services (Zeithaml, 1988; Venkatesh & Davis, 2000). This highlights the need for simplification and affordability to increase participation, particularly among vulnerable groups.

Among all predictors, perceived fee emerged as the strongest direct predictor of adoption intention, underscoring the financial sensitivity of informal sector workers. Although i-Saraan allows for flexible contributions, the cost burden still appears significant for low-income participants. This finding confirms the continued relevance of perceived price sacrifice in shaping adoption decisions within voluntary financial programs (Zeithaml, 1988). Affordability concerns, particularly among low-income groups, remain a critical factor in driving participation in such schemes.

The observed partial mediation of perceived value offers important theoretical insight into VAM's application in financial inclusion contexts. While VAM has been widely validated in technology adoption, this study suggests that, in financial programs targeting lower-income populations, direct cost and complexity barriers may bypass or partially override value assessments. This finding refines the explanatory power of VAM in domains where affordability constraints are especially prominent, offering a more nuanced understanding of adoption behavior in financial services for marginalized populations.

Overall, these results highlight the multidimensional nature of adoption behavior in voluntary retirement savings. Both cognitive evaluations (usefulness, enjoyment, value) and practical considerations (technical complexity, financial affordability) jointly determine behavioral intentions. The findings underscore the need for comprehensive interventions that address both psychological motivation and structural accessibility to enhance voluntary participation in retirement savings schemes.

### *6.1 Policy implications and Recommendation*

The findings of this study provide actionable insights for policymakers, program administrators and institutional stakeholders seeking to increase participation in voluntary retirement savings schemes, such as i-Saraan, particularly among financially vulnerable groups within Malaysia's informal sector. These insights offer specific directions for improving financial inclusion and retirement security for marginalized workers.


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First, the significant influence of perceived usefulness and perceived enjoyment on perceived value highlights the need for targeted financial education programs. These initiatives should emphasize not only the long-term financial benefits of retirement savings but also the psychological satisfaction derived from proactive financial planning. Tailored financial literacy programs, particularly for part-time student workers, cleaners and small traders, could foster both cognitive understanding and emotional motivation to engage in voluntary savings.

Second, although perceived technicality did not directly affect perceived value, its significant direct effect on adoption intention suggests that system complexity remains a substantial barrier. Program administrators, particularly the EPF, should focus on simplifying digital platforms, streamlining enrollment procedures and offering personalized assistance to users with limited digital literacy. Initiatives such as mobile-based enrollment tutorials, in-person support centers, or community outreach programs targeting vulnerable groups could significantly reduce these barriers.

Third, the strong influence of perceived fee confirms that affordability remains a primary concern for informal sector workers. While i-Saraan offers flexible contributions, policymakers should consider enhancing financial incentives, such as expanded government matching contributions, income-based contribution tiers, or temporary subsidies during economic downturns. These measures could significantly alleviate the perceived financial burden and enhance adoption rates.

Fourth, a multi-stakeholder approach involving universities, employers, labor organizations and community leaders could amplify outreach efforts. Universities could incorporate retirement planning education into student financial literacy curricula, while employers and community groups can serve as trusted intermediaries to promote awareness, assist with enrollment and sustain participation among informal workers.

Finally, these policy recommendations align with Malaysia's broader national agenda to strengthen financial inclusion, expand social protection coverage and address the country's transition into an aged nation by 2040 (Malay Mail, 2024; Yunus, 2024). Proactive, integrated strategies addressing both behavioral and structural adoption barriers are essential to ensuring long-term financial security for Malaysia's growing population of informal workers.

## 7. Conclusion

This study investigated the behavioral factors influencing adoption intention toward Malaysia's i-Saraan voluntary retirement savings scheme among informal sector workers and part-time student employees. Grounded in the Value-Based Adoption Model (VAM), the study extends existing theoretical frameworks by applying VAM to the underexplored domain of voluntary pension program adoption, particularly among financially vulnerable populations. This is a significant contribution to the literature, as it brings VAM into the context of financial inclusion and voluntary retirement savings, areas that have largely been studied within the technology and formal financial service sectors (Kim, Chan, & Gupta, 2007).


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The findings confirmed that both perceived usefulness and perceived enjoyment significantly enhance perceived value, reinforcing VAM's core proposition that cognitive and emotional benefits jointly influence value perceptions (Kim, Chan, & Gupta, 2007; Venkatesh et al., 2012). This indicates that for i-Saraan participants, practical benefits (such as improved retirement security) and emotional rewards (such as the satisfaction of proactive financial planning) are both crucial in shaping their overall evaluation of the program. While perceived technicality and perceived fee did not significantly affect perceived value, they demonstrated strong direct effects on adoption intention. This highlights the critical role of practical barriers such as system complexity and affordability concerns in shaping financial decision-making among informal workers. These barriers often deter participation, even when the long-term benefits of the program are recognized.

Importantly, perceived fee emerged as the strongest predictor of adoption intention, underscoring the centrality of affordability in influencing voluntary program participation. Despite the flexibility of contributions in i-Saraan, cost considerations remain decisive, especially for low-income groups. This finding confirms that financial sensitivity plays a pivotal role in the adoption of voluntary savings programs, where even small contributions can become significant barriers for vulnerable populations.

The observation of partial mediation offers a nuanced understanding of VAM's application, particularly in financially sensitive domains like voluntary retirement savings. In these contexts, structural constraints such as cost and complexity can bypass or dilute value assessments, highlighting that practical considerations often outweigh cognitive evaluations of program benefits. This insight refines VAM's applicability, extending it beyond technology adoption to include financial inclusion contexts, where cost and complexity may be more impactful than perceived value.

From a practical perspective, the study provides concrete policy recommendations aimed at enhancing i-Saraan participation. These include simplifying enrollment systems, developing targeted financial literacy programs, expanding government incentives and fostering coordinated stakeholder collaboration. Such interventions are crucial to advancing Malaysia's social protection agenda, particularly considering the rapid demographic shifts toward an aging population. By addressing both behavioral motivations and structural barriers, these strategies can help increase voluntary participation in retirement savings, ensuring long-term financial security for informal workers.

Overall, this study contributes theoretically by validating the Value-Based Adoption Model within the context of voluntary retirement savings and practically by providing evidence-based policy insights that support financial inclusion for Malaysia's informal workforce. By demonstrating the importance of both cognitive evaluations and practical barriers, this research offers valuable implications for improving the design and implementation of voluntary retirement savings schemes, not only in Malaysia but also in other developing economies facing similar demographic challenges.


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