



PROCEEDING:

5TH INTERNATIONAL VIRTUAL CONFERENCE ON SOCIAL SCIENCES, EDUCATION AND INNOVATION 2026 (5TH IVCosei 2026)



GLOBAL
ACADEMIC
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**5TH INTERNATIONAL VIRTUAL CONFERENCE ON SOCIAL
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PREFACE

The 5th International Virtual Conference on Social Sciences, Education and Innovation 2026 (5th IVCoSEI 2026) represents a significant scholarly platform that brings together academicians, researchers, professionals, intellectuals, and practitioners from diverse disciplines across the globe. The conference was successfully conducted on 7th – 8th February 2026 through virtual platforms, enabling participants to share knowledge and exchange research findings in an inclusive and dynamic academic environment.

Organized by Global Academic Excellence (M) Sdn Bhd (GAE), this conference aims to foster multidisciplinary dialogue and promote collaborative research across the domains of social sciences, education, business, and innovation. The conference serves as an essential forum for discussing current global issues, presenting innovative ideas, and proposing practical solutions to emerging challenges faced by society, industries, and educational institutions worldwide.

The proceedings of IVCoSEI 2026 compile selected papers presented during the conference, reflecting a wide range of sub-themes including social policy, economic and management studies, educational leadership and pedagogy, technological advancement, innovation systems, sustainability, and creative industries. These contributions demonstrate the commitment of researchers and scholars in advancing knowledge and producing impactful research aligned with global development and transformation agendas. This proceeding is published annually

The organizing committee extends its heartfelt appreciation to all authors, reviewers, keynote speakers, session chairs, and participants whose dedication and valuable contributions ensured the success of this conference. Special acknowledgment is also given to the editorial and publication teams for their meticulous efforts in reviewing and preparing these proceedings for dissemination to the academic and professional communities.

It is our sincere hope that this collection of scholarly works will provide meaningful insights, stimulate further research collaborations, and contribute significantly to academic development, policy formulation, and innovative practices in various disciplines.

Thank you to all contributors and stakeholders for supporting IVCoSEI 2026. We look forward to continuing this academic journey together in future conferences and collaborative initiatives.

Assoc. Prof. Dr. Adi Anuar Azmin
Conference Chairman
5th IVCoSEI 2026



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GEN Y AND GEN Z'S COMMITMENT TO BNPL SERVICES IN MALAYSIA: A STUDY OF ATTITUDE-MEDIATED CONTINUANCE INTENTION

Wan Rasyidah Wan Nawang¹, Syakirah Jasazami², Intan Fatimah Anwar³, Siti Nurulhuda Nordin⁴

¹Faculty Economics and Muamalat, Universiti Sains Islam Malaysia (USIM), Malaysia, (wrasyidah@usim.edu.my)

²Faculty Economics and Muamalat, Universiti Sains Islam Malaysia (USIM), Malaysia, (syakirahjasazami@raudah.usim.edu.my)

³Faculty Economics and Muamalat, Universiti Sains Islam Malaysia (USIM), Malaysia, (intan.anwar@usim.edu.my)

⁴Faculty Economics and Muamalat, Universiti Sains Islam Malaysia (USIM), Malaysia, (nurulhuda@usim.edu.my)

Abstract: Buy Now Pay Later (BNPL) has rapidly gained popularity among Malaysian Gen Y and Gen Z consumers due to its convenience, despite concerns from fintech and consumer finance experts that it may encourage overspending, debt accumulation, and poor financial habits. This study examines the factors influencing young Malaysians' continuance intention to use BNPL, focusing on perceived ease of use, perceived usefulness, social influence, financial literacy, and attitude, with attitude as a mediator. Using purposive sampling, data were collected from 219 Gen Y and Gen Z respondents via an online survey and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). Results indicate that perceived ease of use, perceived usefulness, social influence, and attitude significantly influence continuance intention, while financial literacy does not. Attitude mediates the effects of ease of use, usefulness, and social influence, but not financial literacy. Findings highlight the importance of promoting responsible BNPL usage through financial literacy initiatives and improving platform usability, offering insights for policymakers, educators, and industry players.

Keywords: Buy Now Pay Later, Gen Y, Gen Z, Young Adults, Continuance Intention

Introduction

The digitalisation of financial services has significantly transformed consumer payment and credit behaviours. Among these innovations, Buy Now Pay Later (BNPL) has emerged as one of the fastest-growing alternative credit solutions globally and in Malaysia. Offered as an interest-free instalment feature embedded within e-commerce platforms and mobile applications (Mallekoote & Balraadsing, 2025), BNPL is particularly attractive to Gen Y and Gen Z consumers (Behera & Dadra, 2024; Kumar et al., 2025b). These cohorts, Malaysia's most active digital adopters, favour seamless, flexible, and low-commitment payment options, making them an important market segment for fintech services (Israfilzade & Guliyeva, 2023; Pandey et al., 2020; Tjiptono et al., 2020).

Notwithstanding its rapid uptake, BNPL raises considerable consumer-finance and regulatory concerns. Fintech and consumer finance experts warn that its ease of access, minimal eligibility



checks, and deferred payment structure may encourage overspending, impulse purchases, and weak financial discipline (Hassan et al., 2025; Qi, 2025). Fragmented commitments across multiple platforms can further accumulate into unmonitored debt, heightening risks for young adults. These concerns are reflected in Malaysia's RM4.2 billion BNPL loan exposure across seven million accounts, with RM147.7 million (3.5%) overdue from 185,465 users (San & Vethasalam, 2025). In response, Bank Negara Malaysia (BNM) has issued cautions regarding digital credit risks and introduced the Consumer Credit Act (CCA), expected to take effect by the end of 2025, to strengthen regulatory oversight of BNPL providers (Hishamudin, 2025). Nonetheless, young Malaysians remain active BNPL users, suggesting that psychological and behavioural factors may outweigh financial concerns. This is evident in the 5.1 million active BNPL accounts in Malaysia, the majority held by working adults aged 21 to 45 (San & Vethasalam, 2025).

Despite BNPL's relatively recent introduction, it has experienced swift and widespread adoption in Malaysia, making it a fast-growing yet underexplored area of research (Kumar & Nayak, 2025). Its ease of adoption, combined with moderate financial literacy and high household indebtedness, raises concerns about prolonged engagement. Accordingly, this study focuses on continuance intention, as sustained use has stronger implications than initial adoption. To explain the drivers of continuance intention, this study examines perceived ease of use, perceived usefulness, and financial literacy, with attitude incorporated as both an independent predictor and a mediating mechanism linking these factors to continuance intention. These variables extend the Technology Acceptance Model (TAM), providing a comprehensive framework for explaining ongoing engagement with BNPL services, especially among Gen Y and Gen Z users, who constitute the largest BNPL user base and whose behavioural tendencies may perpetuate continued use despite potential financial pitfalls.

Literature Review

Theory of Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis (1989), explains how individuals come to accept and use technological systems. It proposes that behavioural intention is primarily influenced by perceived ease of use and perceived usefulness, which shape attitudes and adoption decisions. In the domain of BNPL adoption, TAM is particularly appropriate because young consumers evaluate BNPL as a digital purchasing tool integrated into their daily lifestyle, making these cognitive evaluations highly relevant to their intention to adopt and continue using the service. Over time, the Technology Acceptance Model has been extended to incorporate additional factors, allowing for a more comprehensive understanding of individual and contextual influences on technology adoption.

This study further extends TAM by incorporating social influence, financial literacy, and attitude to examine the continuance intention of BNPL usage. By integrating these constructs, the model provides a robust framework that accounts for both technological perceptions and personal capabilities in shaping ongoing usage decisions among Gens Y and Z.

Hypothesis Development

Continuance intention refers to a user's deliberate and ongoing commitment to use a technology beyond the initial adoption stage, reflecting their long-term evaluation of the system (Bhattacharjee, 2001). BNPL has rapidly become an integral part of many young adults'



financial behaviour, with repeated usage becoming increasingly common (Maesen & Ang, 2025). Therefore, investigating the behavioural factors that drive continuance intention provides more meaningful insights than focusing solely on initial adoption. To capture these influences comprehensively, this study examines continuance intention using five key determinants derived from the extended TAM, specifically perceived ease of use, perceived usefulness, social influence, financial literacy, and attitude. These factors offer a holistic view that integrates both technological perceptions and individual financial capabilities in shaping sustained engagement with BNPL services.

Perceived ease of use refers to the degree to which users believe that interacting with a technology requires minimal effort (Davis, 1989). Prior studies indicate that ease of use significantly predicts attitude, as technologies perceived as simple and straightforward reduce cognitive burden, enhance user comfort, and foster more favourable evaluations of the system (Nguyen et al., 2024; Shahzad et al., 2022; Van Tuan et al., 2024). In the BNPL context, it reflects how effortlessly users can register, navigate, and complete purchases, with platforms designed for seamless experiences through instant approvals, automated limits, and e-commerce integration.

Perceived usefulness refers to the extent to which individuals believe a technology will provide meaningful benefits (Venkatesh & Davis, 2000). Prior studies indicate that perceived usefulness is a strong predictor of attitude, as users who recognize clear functional and practical benefits are more likely to form positive evaluations and develop favourable beliefs toward the use of technology (Behera & Dadra, 2024; Kumar et al., 2025b). Within the realm of BNPL, it reflects users' perceptions that the service facilitates financial management, enhances purchasing power, and allows access to goods without immediate payment.

Social influence refers to the extent to which individuals perceive that important people in their social environment, such as peers, family, or online communities, believe they should use a particular technology (Venkatesh et al., 2024). Empirical studies show that social influence significantly predicts attitude by shaping individuals' evaluations through peer endorsement, social approval, and perceived norms, which encourage more favourable perceptions of using the technology (Al Mamun et al., 2025; Van Tuan et al., 2024). Social influence manifests through peer recommendations, social media trends, and normative pressures that shape young consumers' decisions and reinforce continued use.

Financial literacy refers to the knowledge, skills, attitudes, and confidence required to understand financial information and make effective financial decisions (Lusardi & Messy, 2023; OECD, 2023). It encompasses capabilities such as budgeting, saving, responsible credit use, and long-term planning (Oberrauch et al., 2024). Prior studies indicate that higher financial literacy is linked to more informed and critical attitudes toward financial products (Azizah et al., 2025; Loza et al., 2024; Yew et al., 2017). In digital payments like BNPL, limited financial literacy hinders users' assessment of repayment obligations and risks, promoting permissive attitudes, making financial literacy essential for responsible use.

Attitude is conceptualized as a psychological tendency to evaluate a specific entity along a positive-to-negative continuum, encompassing cognitive beliefs, affective responses, and behavioural inclinations (Bagozzi, 2022; Eagly & Chaiken, 2023). Empirical studies show that positive attitudes significantly influence adoption and continuance intention (Alhassan et al.,

2020; Kumar et al., 2025b; Tang et al., 2025). For BNPL services, attitude reflects consumers' overall evaluation of the platform, including perceived convenience, flexibility, and financial relevance.

In quantitative research, a mediator is a variable that explains the mechanism through which an independent variable influences a dependent variable, clarifying how or why a relationship occurs (Hayes, 2022; Preacher & Hayes, 2021). In this study, attitude serves as a mediator by guiding perceived ease of use, perceived usefulness, social influence, and financial literacy, into continuance intention to use BNPL. Grounded in TAM, attitude transforms functional benefits and social pressures into affective evaluations that drive sustained use. Empirical evidence shows that attitude mediates the effects of ease of use and usefulness by reinforcing positive evaluations of system advantages (Hui et al., 2025; Prasetyani et al., 2024), channels social influence into internalized motivations for habitual use (Aisjah, 2024; Hoo, 2025), and enhances responsible decision-making through financial literacy, promoting sustained rather than impulsive engagement (Podin et al., 2024; Yulianto et al., 2024).

Guided by the literature review, the following hypotheses are developed:

- H1: Perceived ease of use positively influences attitude toward BNPL.
- H2: Perceived usefulness positively influences attitude toward BNPL.
- H3: Social influence positively influences attitude toward BNPL.
- H4: Financial literacy positively influences attitude toward BNPL.
- H5: Attitude positively influences continuance intention toward BNPL.
- H6: Attitude mediates the relationship between perceived ease of use and continuance intention to use BNPL.
- H7: Attitude mediates the relationship between perceived usefulness and continuance intention to use BNPL.
- H8: Attitude mediates the relationship between social influence and continuance intention to use BNPL.
- H9: Attitude mediates the relationship between financial literacy and continuance intention to use BNPL.

Conceptual Framework

Figure 1 illustrates the conceptual framework derived from the literature review and depicts the proposed relationships.

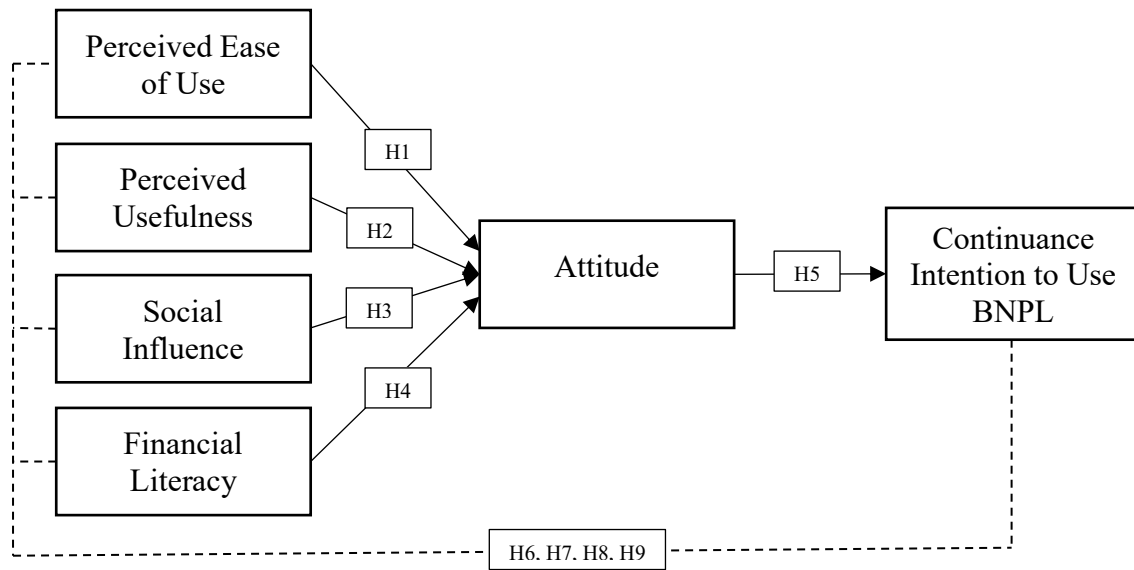


Figure 1: Conceptual Framework

Source: (Authors' Own)

Methodology

This study employed a quantitative, cross-sectional design to examine factors influencing young adults' continuance intention to use BNPL services in Malaysia. Data were collected via a self-administered online survey, targeting digitally active Gen Y and Gen Z consumers using purposive sampling, yielding 219 valid responses. The research framework comprised five independent variables, perceived ease of use, perceived usefulness, social influence, financial literacy, and attitude, with attitude also examined as a mediating variable. Constructs were measured using established multi-item scales adapted from prior studies: perceived ease of use (Kumar et al., 2025a), perceived usefulness (Ramayah & Ignatius, 2005), social influence (Demir et al., 2024), financial literacy (Pertiwi et al., 2025), attitude (Alam et al., 2017), and continuance intention (Abed & Alkadi, 2024), rated on a five-point Likert scale.

Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with a two-stage procedure for measurement and structural model assessment (Hair et al., 2020). Mediation analysis evaluated the indirect effects of system-related and personal factors on continuance intention through attitude. PLS-SEM was chosen for its suitability with complex models, predictive capability, and robustness with non-normal data. The sample size exceeded minimum requirements for detecting medium effect sizes. The survey instrument underwent expert review and a pilot test ($n = 30$), with all constructs showing Cronbach's alpha values above 0.70, confirming satisfactory reliability.

Result

Demographic Profile

Of the 219 respondents, 39.3% were men and 60.7% were women, representing young adults from Gens Y and Z. The largest age group was 21–24 years (26.0 percent), followed by those

aged 33–36 (15.5 percent), 37–40 (13.2 percent), and 41–44 (12.3 percent), while 10.5 percent were aged 18–20. Marital status was nearly evenly split between single (48.4 percent) and married (51.6 percent) individuals. In terms of education, over half held a bachelor's degree (51.1 percent), followed by diploma holders (26.9 percent) and those with a master's degree (8.2 percent), with smaller proportions reporting high school, pre-university, or professional qualifications. Employment patterns showed that 44.7 percent were employed in the private sector and 32.4 percent were students, while others worked in government or semi-government roles (13.7 percent) or were self-employed, business owners, or unemployed. Monthly income levels reflected this composition, with 39.7 percent earning RM2,000 and below and 21.9 percent earning RM2,001–RM4,000, while the remainder were distributed across higher income brackets. Geographically, respondents were primarily concentrated in the central region (47.0 percent), with additional representation from the northern, southern, and eastern regions, as well as Sabah and Sarawak, providing a broad national coverage aligned with areas where BNPL usage is more concentrated.

Measurement Model Assessment

Table 1 presents the results of the measurement model assessment, including factor loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). All constructs demonstrated high internal consistency and reliability, with Cronbach's alpha and CR values exceeding the recommended threshold of 0.708 (Henseler et al., 2015). Factor loadings were all above 0.70, and AVE values surpassed the 0.50 cut-off, supporting convergent validity. Overall, the measurement model meets the recommended criteria for reliability and validity, confirming its suitability for structural analysis (Hair et al., 2020).

Table 1: Factor Loadings, Reliability, and Convergent Validity

Variable and	Item Code	Factor Loadings Range	Cronbach's Alpha	CR	AVE
Perceived Ease of Use	PEOU1 – PEOU6	0.816 – 0.923	0.934	0.950	0.793
Perceived Usefulness	PU1 – PU4	0.870 – 0.938	0.926	0.947	0.818
Social Influence	SI1 – SI4	0.748 – 0.922	0.897	0.929	0.768
Financial Literacy	FL1 – FL6	0.716 – 0.917	0.91	0.927	0.681
Attitude	ATT1 – ATT5	0.870 – 0.903	0.931	0.948	0.785
Continuance Intention	CI1 – CI3	0.922 – 0.956	0.936	0.959	0.887

Table 2 presents the Pearson correlation coefficients among the study variables. All correlations fall below the threshold of 0.85, suggesting no multicollinearity concerns for subsequent regression analysis.

Table 2: Discriminant Validity: HTMT

	1	2	3	4	5	6
1. Attitude						
2. Continuance Intention	0.725					
3. Financial Literacy	0.194	0.069				
4. Perceived Ease of Use	0.642	0.534	0.285			
5. Perceived Usefulness	0.719	0.757	0.221	0.722		
6. Social Influence	0.594	0.700	0.127	0.478	0.612	

Structural Model Assessment

Table 3 summarizes the hypotheses testing results of the study. The structural model analysis revealed that perceived ease of use positively influenced attitude toward BNPL services ($\beta = 0.243$, $t = 2.788$, $p = 0.005$), as did perceived usefulness ($\beta = 0.379$, $t = 4.281$, $p < 0.001$) and social influence ($\beta = 0.222$, $t = 2.792$, $p = 0.005$). Financial literacy did not significantly predict attitude ($\beta = 0.027$, $t = 0.542$, $p = 0.588$). Attitude strongly predicted continuance intention ($\beta = 0.682$, $t = 18.595$, $p < 0.001$). Mediation analysis showed that attitude partially mediated the effects of perceived ease of use ($\beta = 0.166$, $t = 2.840$, $p = 0.005$), perceived usefulness ($\beta = 0.258$, $t = 3.987$, $p < 0.001$), and social influence ($\beta = 0.151$, $t = 2.689$, $p = 0.007$) on continuance intention, while financial literacy remained non-significant ($\beta = 0.018$, $t = 0.544$, $p = 0.586$). These results highlight attitude as a key mechanism through which ease of use, usefulness, and social influence shape continuance intention among young adults.

Table 3: Summary of Hypotheses Testing

Path	Std. Beta	Std. Error	t-value	p-value	LLCI	ULCI
<i>Direct Path</i>						
H1: PEOU -> ATT	0.243	0.087	2.788	0.005	0.078	0.418
H2: PU -> ATT	0.379	0.088	4.281	0.000	0.203	0.544
H3: SI -> ATT	0.222	0.079	2.792	0.005	0.062	0.371
H4: FL -> ATT	0.027	0.050	0.542	0.588	-0.106	0.110
H5: ATT -> CI	0.682	0.037	18.595	0.000	0.601	0.745
<i>Indirect Path</i>						
H6: PEOU -> ATT -> CI	0.166	0.058	2.840	0.005	0.053	0.282
H7: PU -> ATT -> CI	0.258	0.065	3.987	0.000	0.133	0.381
H8: SI -> ATT -> CI	0.151	0.056	2.689	0.007	0.042	0.261
H9: FL -> ATT -> CI	0.018	0.034	0.544	0.586	-0.074	0.074

Table 4 presents the coefficient of determination (R^2) and effect size (f^2) results. The structural model demonstrates satisfactory explanatory power for the endogenous constructs. The R^2 value for attitude is 0.527, indicating that perceived ease of use, perceived usefulness, social influence, and financial literacy jointly explain 52.7% of the variance in attitude. Continuance intention records an R^2 of 0.466, showing that 46.6% of its variance is explained by attitude. According to Cohen's (1988) guidelines, these R^2 values indicate moderate explanatory power in behavioural research. The f^2 values range from 0.001 to 0.872, representing trivial to large effects (Cohen, 1988), with attitude exhibiting the strongest effect on continuance intention ($f^2 = 0.872$). Overall, the f^2 results are consistent with the path coefficient findings, underscoring attitude as the most influential predictor of continuance intention, while financial literacy contributes minimally to attitude formation.

Table 4: Coefficient of Determination and Effect Size

	R^2	R^2 adjusted	f^2
PEOU -> ATT	0.527	0.519	0.066
PU -> ATT			0.139
SI -> ATT			0.070

FL -> ATT			0.001
ATT -> CI	0.466	0.463	0.872

Discussion

This study examined the relationships between perceived ease of use, perceived usefulness, social influence, and financial literacy on continuance intention to use BNPL services, with attitude tested as a mediating variable. Overall, continuance intention was primarily driven by perceived ease of use, perceived usefulness, social influence, and attitude, with attitude mediating all relationships except financial literacy. Interestingly, financial literacy was not a significant factor in influencing ongoing engagement with BNPL among young adults.

Perceived ease of use significantly influenced attitude, indicating that simple and intuitive platforms enhance users' evaluations, consistent with Nguyen et al. (2024), Shahzad et al. (2022), and Van Tuan et al. (2024). Perceived usefulness also positively affected attitude, suggesting that young Malaysians value BNPL for easing short-term financial pressure, increasing purchasing flexibility, and providing convenience, in line with Behera and Dadra (2024) and Kumar et al. (2025b). Social influence further shaped attitude, highlighting the role of peers, family, and online communities in normalizing BNPL use, particularly among digitally connected Gen Y and Gen Z consumers, consistent with prior studies by Al Mamun et al. (2025) and Van Tuan et al. (2024).

Attitude itself strongly predicted continuance intention, reinforcing that positive evaluations translate into ongoing behavioural commitment, in agreement with Al Mamun et al. (2025) and Van Tuan et al. (2024). In contrast, financial literacy did not significantly influence attitude or continuance intention, suggesting that even financially knowledgeable users may prioritize convenience and immediate affordability over long-term financial considerations, perceiving BNPL as a low-risk, low-commitment tool. This finding diverges from previous studies by Azizah et al. (2025), Loza et al. (2024), and Yew et al. (2017).

Mediation analysis confirmed the central role of attitude in shaping continuance intention. Attitude significantly mediated the effects of perceived ease of use, perceived usefulness, and social influence on continuance intention, indicating that these factors primarily influence sustained BNPL use by fostering favourable evaluations. These findings align with prior studies by Hui et al. (2025) and Prasetyani et al. (2024) for perceived ease of use and perceived usefulness and Aisjah (2024) and Hoo (2025) for social influence. In contrast, financial literacy exhibited no significant indirect effect, consistent with its non-significant direct impact, highlighting its limited influence on young adults' BNPL behaviour in the studied sample. This result diverges from previous findings reported by Podin et al. (2024) and Yulianto et al. (2024).

Conclusion

This study extends the TAM by examining perceived ease of use, perceived usefulness, social influence, and financial literacy on BNPL continuance intention among Malaysian Gen Y and Z, with attitude as both predictor and mediator. The findings confirm that BNPL's simplicity, perceived utility, and peer influence strongly drive continued engagement, explaining its widespread popularity and hype among younger consumers. Attitude significantly mediates



these relationships, highlighting the central role of affective evaluation in shaping ongoing usage. Critically, financial literacy was found to be insignificant, indicating that young adults prioritise convenience, immediate affordability, and social influence over rational financial considerations. This highlights why BNPL-related debt is disproportionately high among Gen Y and Z. The results strongly support the need for regulatory interventions, such as BNM's CCA and the introduction of credit reporting requirements, to protect financially vulnerable young consumers and mitigate over-indebtedness.

The study contributes theoretically by validating TAM in the context of emerging fintech products and highlights the role of cognitive, social, and affective factors in sustained digital financial behaviour. Practically, the findings call for BNPL providers to enhance platform usability responsibly, while policymakers and financial educators must prioritise financial literacy programmes targeting young adults to foster prudent credit behaviours.

Despite its contributions, the study has limitations. The sample is confined to urban Gen Y and Z, mostly low-income, limiting generalisability to older, higher-income, or rural populations. Self-reported data may introduce bias, and other relevant factors, such as impulsive buying, financial stress, religiosity, trust, and perceived risk, were not examined. The cross-sectional design precludes causal inference. Future research should expand demographic coverage, integrate additional socio-psychological and cultural variables, and adopt longitudinal approaches to track changes in BNPL continuance intention, particularly under evolving regulatory frameworks. Examining digital vulnerability, cybersecurity awareness, and credit behaviour would further support effective consumer protection and financial education strategies.

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GRADUATE EMPLOYABILITY IN THE AGE OF AI: A CONCEPTUAL EXAMINATION OF GENDER DYNAMICS AND JOB PERFORMANCE IN INDUSTRY 4.0

**Nur Syazwani Zulaikha Safwan¹, Mohamad Firdaus Ahmad^{2*}, Ellail Ain Mohd Aznan³,
Siti Sara Ibrahim⁴**

¹Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

²Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Cawangan Negeri Sembilan, Kampus Seremban

³Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau

⁴Business and Management Faculty UiTM Cawangan Negeri Sembilan, Kampus Rembau

Abstract: *The rapid advancement of artificial intelligence (AI) within Industry 4.0 has reshaped the competencies required for employability and job performance, particularly among new graduates entering the workforce. Despite increased demand for technologically skilled graduates, gender differences in AI adoption, skill acquisition, and career progression remain persistent. This conceptual paper examines how AI adoption shape graduate employability and job performance, with graduate employability acting as a mediating mechanism. Drawing upon Human Capital Theory, Social Cognitive Career Theory, and Gender Role Theory, the study proposes a conceptual model positioning employability as a key pathway linking AI adoption to job performance outcomes. Gender dynamics are integrated to explain disparities in access, confidence, and skill readiness in AI fields. The proposed conceptual framework provides theoretical insights and practical implications for universities, employers, and policymakers seeking to enhance employability strategies and reduce gender-based gaps in today's workforce. Future research directions are also discussed.*

Keywords: *Artificial Intelligence, Employability, Job Performance, Graduates, IR 4.0*

Introduction

Artificial Intelligence (AI) adoption is rapidly increasing across various sectors due to its potential benefits, such as enhanced efficiency, cost savings, and improved decision-making. Organizations are leveraging AI technologies for applications like fraud detection, personalized customer experiences, and operational efficiency (Harmon et al., 2025). AI is transforming sectors like public governance, agriculture, and foodservice by optimizing services and providing valuable insights (Yigitcanlar et al., 2024). Similarly, AI is revolutionizing medical and nursing fields by improving patient care and decision-making processes in healthcare (Senthilkumar et al., 2023). The adoption of artificial intelligence in the workplace has a multifaceted impact on employability, reshaping job roles and organizational structures. According to Hölzle et al. (2024), the integration of AI necessitates a shift in talent management practices, with a focus on upskilling and reskilling employees to align with emerging skill requirements. However, AI technologies automate repetitive tasks, leading to significant job losses in sectors like manufacturing and retail, where displacement rates are as high as 45% and 35%, respectively (Maria et al., 2025). Maria et al. (2025) also signifies that AI also creates new job opportunities, particularly in healthcare and education, with job creation rates of 50% and 60%. The transition from traditional roles to this



technological based necessitates reskilling and upskilling due to many employees are unprepared for these new roles. This highlights AI adoption has a profound impact on the employability of employees to collaborate effectively with intelligent technologies.

Employability refers to the set of skills, knowledge, and attributes that enable an individual to gain and maintain employment, as well as to adapt to career-related changes in the labor market (Gerçek, 2024). It encompasses both technical and soft skills, which are increasingly critical in today's dynamic job environment. The concept of employability has gained significant attention due to its impact on organizational performance and individual career success. Studies have shown that employability skills are essential for enhancing employee performance, which in turn positively affects organizational outcomes (Gyanwali et al., 2023; Karmacharya et al., 2025). According to Naderiadib Alpler et al., (2021), employability is not only about securing a job but also about the ability to move autonomously and effectively manage career transitions. Organizations benefit from a workforce with high employability skills as it leads to improved employee performance, adaptability, and overall organizational growth. For individuals, employability enhances job performance and career success, both objectively and subjectively. As the job market evolves, the ability to adapt and acquire new skills becomes increasingly important, making employability a critical focus for both educational institutions and employers in enhancing job performance (Rakowska & de Juana-Espinosa, 2021).

Job performance is an essential indicator to evaluate the effectiveness of an individual in performing responsibilities, especially in the complex era of technological environment. In today's Industrial Revolution (IR) 4.0, the job performance is not depending on the technical competencies only, but it involves the capabilities of an individual to adapt with the current technology, organize the digital work, and portray supportive attitude within organization (Abdul Hamid, 2022). The concept of job performance is also undergoing change as employees are required to master digital skills, interact with smart systems, and demonstrate flexibility in performing tasks. A work environment driven by digital technology and artificial intelligence (AI) demands that employees constantly upgrade their skills, practice continuous learning, and adapt to rapid changes. For recent graduates entering the job market, the challenge of achieving high job performance becomes more pronounced due to the gap between academic skills and industry needs (Nazarzadeh Zare & Parvin, 2024). Failure to adapt to these demands can not only affect individual work performance but also have implications for overall organizational productivity. This highlights that sustaining job performance become more challenging for employees, especially in this rapid advancement of technology.

Previous scholars indicate female employees report higher AI anxiety and lower positive attitudes towards AI, which can hinder their adoption and use of AI technologies (Barqawi & Al-Rashdan, 2025). They also face higher risks of job displacement due to automation, particularly in roles where they are overrepresented, such as administrative positions compared to male employees (Russo et al., 2025). This situation may reflect to the pressure of employees to adapt to the culture of AI work environment. Therefore, the purpose of this paper is to conceptually examine the relationships between artificial intelligence adoption, employability, and job performance moderated by gender. By developing a theoretically grounded conceptual framework, this paper contributes to the literature by advancing a gender as a moderator that may influence workforce readiness in the age of AI.

Literature Review



Artificial Intelligence Adoption

The adoption of artificial intelligence (AI) among graduates is influenced by various factors, including readiness, interactivity, and ethical awareness. Studies have shown that graduates who utilize AI-based career services report higher employment rates and improved job readiness due to the development of industry-relevant skills (Alzubaidi & Khalid, 2025). For instance, institutions like the University of Nottingham Malaysia and RMIT University Vietnam have observed significant improvements in employment rates among graduates who used AI tools compared to those who did not (Alzubaidi & Khalid, 2025). Additionally, AI-driven platforms have enhanced student satisfaction, with a substantial percentage of students acknowledging the role of AI in aligning curricula with industry needs, thereby increasing their employability.

Moreover, the willingness of graduates to adopt AI applications is shaped by factors such as technical preparedness, trust, and ethical considerations (Alshammari et al., 2025). Research conducted at the University of Ha'il revealed that readiness and ethical awareness significantly affect students' adoption of AI, while trust and performance did not have a significant impact (Alshammari et al., 2025). This suggests that fostering AI adoption among graduates requires a holistic approach that addresses technical preparedness and ethical usage. Furthermore, studies in Malaysia have identified hedonistic and habitual factors as significant influencers of AI adoption among postgraduate students, indicating that enjoyment and routine use play crucial roles in their willingness to engage with AI technologies (Razak et al., 2025). These insights highlight the importance of developing necessary infrastructure, providing training, and addressing ethical concerns to effectively integrate AI into graduates' learning and professional environments.

Employability

Employability is a multifaceted concept that encompasses a range of skills, attributes, and competencies necessary for individuals to gain, maintain, and transition between jobs. It is often defined as a set of achievements, including skills, understandings, and personal attributes, that make graduates more likely to secure employment and succeed in their chosen occupations, benefiting themselves, the workforce, the community, and the economy (Nguyen & Hartz, 2020). The concept of employability has evolved over time, influenced by changing labor market conditions and government policies. It is characterized by the ability to gain and maintain work within and across organizations, and it requires adaptability and capabilities such as knowledge, skills, and attributes to obtain sustainable employment and resolve work ambiguities in challenging globalized contexts (Van der Heijde, 2014). Higher education institutions play a crucial role in developing employability by integrating discipline-specific and transferable skills into their curricula, promoting experiential learning models such as internships and work-integrated learning, and fostering career development competencies (Choi-Lundberg et al., 2024).

The development of employability skills is influenced by various factors, including educational background, vocational skills, and social resources (Chen et al., 2025). Studies have highlighted the importance of aligning educational curricula with market demands, providing adequate vocational training, and leveraging social networks to enhance employability (Chen et al., 2025; Jiang et al., 2023). Additionally, employability is seen as both a product and a



process, involving the acquisition and improvement of marketable knowledge and skills through purposeful learning and diverse experiences. Employers value soft skills, such as communication and problem-solving abilities, as they are essential for maintaining harmonious relationships in the workplace (Bodey & Witkemper, 2024). Employability is also linked to career success, with factors such as career competencies, job crafting, and career development support playing significant roles in enhancing perceived employability and career outcomes. This highlights the integration of employability skills into higher education and the continuous adaptation to labor market needs are essential for preparing graduates to navigate the complexities of contemporary careers.

Job Performance

Job performance is conceptualized as a multi-dimensional construct comprising behaviors and actions that contribute to the achievement of organizational goals (Koopmans et al., 2011). The performance would be more significance when we recognized individual contributions, as it may impact the organizational resilience, innovation, and overall productivity (Lv et al., 2022). Given its critical role in sustained organizational success, identifying the individual, organizational, and environmental determinants of job performance has become a central area of inquiry in management and social sciences (Joseph et al., 2023). The literature generally categorizes performance into three primary domains: task performance, which involves the technical requirements and core duties of the job; contextual performance, or organizational citizenship behavior (OCB), which supports the social and psychological environment of the workplace; and counterproductive work behavior (CWB), encompassing voluntary actions that harm the organization (Viswesvaran & Ones, 2000; Koopmans et al., 2011).

A nuanced understanding of job performance further involves considering both its adaptive and counterproductive dimensions, acknowledging that individual actions can either enhance or detract from organizational efficacy (Jundt et al., 2015). Some scholars emphasize task performance, contextual performance, and counterproductive work behaviors as key components, while others highlight the dynamic nature of performance, acknowledging its variability across time and situations (Devonish & Greenidge, 2010). This highlights that job performance is frequently conceptualized as actions and behaviors under an individual's control that contribute to the organizational goals. Consequently, investigating job performance theories helps clarify how and why specific employee behaviors translate into measurable work outcomes.

Gender Dynamic in the Workplace

The dynamics of gender roles in the workplace are shaped by a complex interplay of societal norms, organizational culture, and individual behaviors, significantly influencing career trajectories and job performance (Hundera & Mudde, 2024). Gender role theory posits that traditional expectations regarding masculinity and femininity can dictate the behaviors deemed acceptable or desirable in professional settings, often leading to disparities in leadership opportunities and workplace interactions. The presence of gender stereotypes can affect performance evaluations, with women often receiving less favorable assessments compared to their male counterparts, even when their performance is equivalent (Heilman et al., 2024). The rise of remote work and flexible arrangements has also introduced new dimensions to gender role dynamics, as traditional expectations around caregiving and domestic responsibilities



continue to disproportionately affect women, impacting their career progression and work-life balance (Dordoni, 2025). Additionally, organizations that actively promote gender diversity and inclusivity tend to benefit from enhanced creativity and innovation. This suggests that challenging traditional gender roles can lead to more equitable and productive work environments. Overall, understanding and addressing gender role dynamics in the workplace is crucial for fostering an inclusive culture that supports the advancement of all employees, regardless of gender.

Theoretical Foundations

Human Capital Theory

Human capital theory posits that investments in education and training enhance worker productivity, which in turn improves employability and job performance (Maitah & Urbankova, 2015). The integration of AI into Human Resource Management (HRM) and job performance evaluation has significantly reshaped these dynamics. AI-driven innovations in corporate settings have been shown to optimize human capital structures by promoting technological advancements and reducing the proportion of low-educated labor, thereby enhancing employability (Fan et al., 2025; Qi & Yu, 2025). Furthermore, AI applications in HRM, such as adaptive training programs, recruitment, and performance management, have demonstrated potential in improving employee performance and engagement (Nie, 2024). However, the effectiveness of AI in directly enhancing job performance is moderated by human-centered factors like motivation and training effectiveness. AI's role in enhancing employability is also evident in its ability to facilitate skill development and decision-making processes, which are crucial for job performance. In conclusion, AI may serve as a powerful enabler in strengthening human capital, enhancing employability, and improving job performance through responsible and well-governed implementation.

Social Cognitive Career Theory

Social Cognitive Theory (SCT) provides a valuable framework for understanding the interplay between artificial intelligence (AI), employability, and job performance. SCT emphasizes the role of self-efficacy, which is crucial in mediating the effects of AI on employees' career behaviors and job performance. AI tools like ChatGPT have been shown to enhance employee productivity by boosting self-efficacy and facilitating self-learning, although this relationship is moderated by job anxiety (Patil & Pramod, 2024). AI's role in knowledge creation within firms significantly affects employee creativity and engagement, suggesting that AI's impact is mediated through cognitive processes rather than being direct (Khan et al., 2026). This aligns with findings that AI assistance can enhance job performance by fostering innovative work behavior, especially in complex tasks. Therefore, understanding the socio-cognitive mechanisms is essential for leveraging AI to improve employability and job performance effectively. This comprehensive view underscores the importance of tailored AI strategies that consider individual and contextual factors to maximize positive outcomes in the workplace.

Gender Role Theory

The intersection of gender role theory, artificial intelligence, employability, and job performance reveals complex dynamics influenced by societal norms and technological advancements. Gender role theory suggests that masculinity correlates positively with job



performance, while femininity is linked to contextual performance, indicating that traditional gender roles still influence workplace outcomes (Fang, 2011). AI's integration into teams shows that gendered perceptions of AI. Researchers also stated that male are more likely to perceive AI as more competent but less warm. This lead to affect the cooperation and performance of employees, reflecting societal biases (Tu et al., 2025). The gender gap in AI-related careers is further exacerbated by implicit biases and societal discrimination, hindering women's participation and advancement in tech fields (Idemudia & Onoshakpor, 2023). Overall, while AI offers tools to enhance job performance and employability, it also risks perpetuating existing gender inequalities unless carefully managed and designed with gender inclusivity in mind.

Conclusion

In summary, this conceptual paper deepens understanding of graduate employability and job performance in the era of Industry 4.0 by integrating artificial intelligence adoption and gender dynamics through Human Capital Theory, Social Cognitive Career Theory, and Gender Role Theory. It proposes graduate employability as a key mediating mechanism through which AI influence job performance, highlighting that technical AI skills alone are insufficient without broader employability attributes such as adaptability, self-efficacy, and continuous learning. By incorporating gender dynamics, the framework explains how differences in access to AI resources, confidence, and socially constructed roles may shape graduates' employability and performance outcomes in AI-driven workplaces. The paper offers valuable theoretical insights while emphasizing practical implications for universities, employers, and policymakers to implement inclusive, gender-sensitive employability and AI training strategies. As a conceptual contribution, it lays a foundation for future empirical research to validate the proposed relationships and further explore inclusive workforce development in the age of artificial intelligence.

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SAFETY AND HEALTH IN THE ENTERTAINMENT INDUSTRIES: A BIBLIOMETRIC AND NARRATIVE REVIEW

Khairul Hafezad Abdullah¹, Luqman Mahmud²

¹Occupational Safety and Health Program, School of Business Management, Universiti Utara Malaysia (UUM), Malaysia, (hafezad@uum.edu.my)

²Human Resource Management Program, School of Business Management, Universiti Utara Malaysia (UUM), Malaysia, (luqman.mahmud@uum.edu.my)

Abstract: *The entertainment industries are known for their creativity, colour, and economic strength, but safety and health are often disregarded. This study aims to map and critically interpret the evolution of safety and health publications within the entertainment industries. Drawing on 44 publications indexed in Scopus and Web of Science (WoS). The analysis spans three decades of research, with an initial emphasis on performance-related hazards, particularly dance, music, and musical theatre. However, the landscape has evolved, and from 2023 onwards, the increasing prominence of terms such as mental health and stigma indicates a broadening of academic focus. Visualisation with VOSviewer revealed four clusters encompassing physical, psychosocial, and organisational domains. The interpretation of these patterns, when considered in conjunction with the narrative review, yields a more comprehensive understanding. Early research focused on the potential of the performing arts for development and health promotion. There was a subsequent increase in indications of psychological stress, emotional tensions, and mental health vulnerabilities among creative workers. More recent works move a step further by calling for broader structural interventions, including stigma reduction, institutional safeguards and stronger mental health governance. These strands lead to a crucial conclusion. Suppose the entertainment industry is to support the well-being of its workers. In that case, safety frameworks must evolve beyond narrow definitions of physical harm and instead recognise the full continuum of risks shaping creative labour today.*

Keywords: *Entertainment Industries, Performing Arts, Mental Health, Stigma, Creative Workers*

Introduction

The entertainment industries have long been celebrated as a vibrant arena of creativity, cultural expression, and economic contribution (Mammadova & Abdullayev, 2025). Nonetheless, behind the visible charm of performance and production lies a more intricate world of safety and health risks (Santos & de Oliveira, 2019), many of which unfold quietly but carry significant consequences to the workers. Over the years, discussions regarding safety and health within the entertainment industries have expanded (Lai, 2025). What was previously focused on physical injury, performance-related hazards, and biomechanical stress, particularly in cheerleading performances (Deng & Yu, 2025). Not only are these issues concerning, but entertainment workers also experience psychosocial pressures, which affect their emotional well-being, and are influenced by organisational dynamics (Geetha & Chitranshi, 2024). This shift mirrors a wider global rethinking of safety and health, particularly in sectors characterised by precarious contracts, intense performance demands and constant public visibility. One may



even enquire to what extent we have genuinely recognised humans associated with artistic excellence.

Despite this increasing awareness, scholarly research on safety and health within entertainment industries remains inconsistent. Much of the early scholarly literature was discipline-specific, examining areas such as dance science, musicians' health performance, or ergonomics within theatre production (Daykin et al., 2008; Lai et al., 2021), which led to isolated knowledge domains that seldom transcended disciplinary boundaries. In recent years, however, we have observed a greater diversity of scholarly perspectives emerging. Research currently investigates mental health vulnerabilities among performers, the stigma that inhibits help-seeking within artistic communities, and the institutional support systems necessary to protect creative workers (Li et al., 2025; Newman et al., 2022). These advancements, while encouraging, prompt a critical inquiry about how discipline has progressed, and which conceptual voids continue to require investigation.

Bibliometric analysis offers a pathway for tracing this evolution by observing trends, keyword shifts, and the intellectual framework of the field (Nora et al., 2025). When paired with a narrative review, it becomes even more insightful, allowing numerical patterns to be interpreted alongside the lived realities reflected in qualitative scholarship (Abdullah et al., 2023; Marzi et al., 2024). This proves especially valuable in safety and health research, where conceptual transformations frequently develop incrementally and are closely tied to broader industry developments (Abdullah et al., 2024). The COVID-19 pandemic, for example, revealed vulnerabilities related to job insecurity, emotional fatigue, and the fragility of live performance ecosystems (Hancock & Tyler, 2024). These issues have transformed the ongoing discourse regarding risk in creative settings. Gaining insight into how these changes manifest in literature provides a significant perspective on emergent priorities and issues.

Against this backdrop, this study aims to map and critically interpret the evolution of safety and health publications within the entertainment industries by examining shifts in keyword prominence, thematic clustering and conceptual trends. In order to attain this aim, the study addresses the following research questions:

1. How have key safety and health concepts within the entertainment industry evolved?
2. What thematic structures and conceptual clusters emerge from the co-occurrence of author keywords, and how do these clusters reflect the shifting priorities of safety and health research in entertainment industries?
3. To what extent do recent publications highlight emerging themes?
4. How do the findings from the narrative review deepen our understanding of the ideas, debates and knowledge gaps underlying the thematic evolution identified in the bibliometric analysis?
5. What implications do these evolving patterns hold for future safety and health research, policy and practice in the entertainment industries?

Methodology

Study Design

This study uses a combination of bibliometric analysis and narrative review. Bibliometric analysis is a methodological examination of scientific literature that aims to identify research patterns and trends (Nora et al., 2025; Passas, 2024). Bibliometric analysis facilitates the



compilation of publications in a field, making it easier for researchers to identify trends and research gaps (Abdullah et al., 2023). Narrative review refers to an effort to compile and describe existing knowledge from past studies. However, because it does not employ a systematic method, narrative reviews are often regarded as having a lower level of evidence than other types of reviews (Sukhera, 2022). Nonetheless, a narrative review can provide the depth of interpretation that researchers need (Paparini et al., 2021). Therefore, in this study, the combination of bibliometric analysis and narrative review enables us to produce a description that is not only based on numbers but also provides more profound meaning and conceptual development (Marzi et al., 2024).

Data Source and Search Strategy

This study utilised Scopus and Web of Science (WoS) databases. These databases are recognised for their rigorous indexing standards and the accuracy of their scholarly metadata (Kumpulainen & Seppänen, 2022). This selection was not simply a matter of routine procedure, but rather a deliberate choice made to enhance the methodological rigour of this study. In an effort to map the development of research related to safety and health in the entertainment industries, this study used the following search terms: (“safety and health” OR “safety” OR “health”) AND (“entertainment industry” OR “film industry” OR “movie industry” OR “television industry” OR “music industry” OR “radio industry” OR “performing arts” OR “theatre industry” OR “live entertainment” OR “event production” OR “broadcasting industry”). These terminologies were selected to align with the codes, standards, and recommended practices in the field, where prioritising safety and health has become a fundamental principle (Greenfield, 2022).

To improve the accuracy of the search for publications related to this study, the search was limited to the article title field. This selection was made because studies that truly focus on safety and health issues usually show a clear focus in the title. The publication search was conducted in October 2025, without restriction to a specific year. This decision was made because filtering out any studies may result in the omission of relevant works. It is essential to acknowledge that they remain important for their ideas and conceptual contributions. As a result, a total of 102 records were retrieved from both databases. The list of publications obtained was exported in CSV and TXT formats and saved in a folder. This dataset was then processed using ScientoPy for duplicate removal during the pre-processing stage.

Pre-processing analysis serves as a quality control measure on the collected dataset. This step is crucial before the data is used in bibliometric analysis and narrative review. During this stage, the dataset was refined to ensure that only materials suitable for bibliometric assessment and narrative review were retained. As a result, 32 publications (31.40%) were excluded because they did not meet the required document type criteria. Only three document types were selected, consisting of conference papers, review articles, and proceedings. Review articles offer a more in-depth theoretical overview and conceptual development. In contrast, conference papers and proceedings typically present the latest research findings that have not yet been published as full journal articles. The selection of these documents ensures that the data used are more stable and uniform, thus making them suitable for analysis in both the bibliometric and narrative review approaches.



After selecting the document types, this study identified 70 publications for subsequent analysis. These 70 publications comprised 35 papers in WoS and 35 papers in Scopus. Next, the duplicate removal process was carried out. The duplicate removal process identified 26 duplicate items, which account for 37.10%. None of these duplicates were found in WoS. After removing all duplicate items, the final dataset consisted of 44 papers. In this study, WoS contributed the majority (35 papers, 79.50%), while Scopus contributed nine papers (20.50%). The cleaned dataset remains robust, coherent, and adequate for tracing developments through an integrated bibliometric analysis and narrative review.

Bibliometric Keyword Examination

The first analytical stage of this study involved a bibliometric examination. This phase employed ScientoPy and VOSviewer, two widely recognised tools in contemporary scholarly mapping (Abdullah & Sofyan, 2023). ScientoPy, a Python-based bibliometric platform, was used to generate insights into publication performance and the broader trajectory of research developments (Ruiz-Rosero et al., 2019). VOSviewer, in contrast, offered strong capabilities for scientific visualisation, particularly in testing and illustrating relationships within large datasets (Orduña-Malea and Costas, 2021).

In this study, both tools were used to undertake three interconnected bibliometric functions. Collectively, they enabled a more nuanced understanding of how research on occupational safety and health has unfolded within the entertainment industries. First, keyword frequency analysis helped identify recurrent and dominant terms, signalling the conceptual priorities of the field. Second, by examining thematic evolution over time, the study traced how these keywords emerged, declined, or shifted in meaning. Third, keyword co-occurrence clustering enabled the exploration of how related concepts converge and interact, providing a structured view of the intellectual landscape surrounding safety and health issues in entertainment industries.

Through these analytical procedures, the current study identified the ten most prominent keywords. These keywords play two important roles. They help delineate the thematic boundaries of the field and guide the selection of publications for more detailed qualitative interpretation. This step is crucial in ensuring that the subsequent narrative analysis is grounded in clear conceptual patterns and yields richer, more meaningful insights.

Selection of Publications for the Narrative Review

For the narrative review stage, publications associated with each of the ten most prominent keywords were manually extracted and examined. The narrative review serves as a crucial complement to the bibliometric analysis. While bibliometric indicators are valuable for illustrating numerical patterns, such as rising or declining publication trends, they are limited in explaining the intellectual depth or the evolution of a body of research, particularly in relation to knowledge gaps (Abdullah et al., 2023). This limitation has led contemporary bibliometric work to increasingly integrate qualitative assessment through narrative review (Marzi et al., 2024). Such integration enables richer and more meaningful interpretations of



frequently occurring keywords, helping us to grasp the ideas that have been advanced, debated, and refined across literature.

To complete the narrative review in this study, three approaches were applied. First, the selected publications had to be directly relevant to safety and health within the entertainment industries. Second, each publication was required to offer a substantive conceptual or empirical contribution to understanding safety and health issues in this context. Third, full-text availability was crucial to enable comprehensive reading and interpretation. Applying these criteria enabled the study to create a purposeful and coherent body of literature that captures the key thematic strands shaping contemporary scholarship on occupational safety and health in entertainment industries.

Content Analysis

The selected publications were subsequently examined using content analysis. Each text was read closely, enabling the study to extract several core elements: (i) how safety is defined and conceptualised across various entertainment industries, (ii) the categories of hazards and risks discussed, whether physical, psychological, or ergonomic, and (iii) the management strategies, regulatory frameworks, and industry practices highlighted by the authors. Attention was also given to emerging themes, particularly those indicating shifts in the broader discourse on occupational safety. Through this content analysis, inductive codes were developed and later organised into broader thematic categories aligned with the ten leading keywords. This systematic process enabled the study to construct an integrated thematic map, bringing together the bibliometric patterns identified earlier with richer interpretive insights grounded in narrative analysis.

Synthesis and Reporting

Findings from the bibliometric analysis and narrative review were brought together. This integration enabled the study to develop a more coherent and comprehensive understanding of how safety and health have been examined within the entertainment industries. It also illuminated the themes that consistently shape the literature, as well as the conceptual gaps that warrant deeper scholarly attention. The results are organised thematically, with visual outputs generated through ScientoPy used to support and clarify the interpretations presented. Ultimately, by following the analytical flow illustrated in Figure 1, this study achieves a synthesis that transcends mere cataloguing of patterns. It brings to the surface conceptual gaps, methodological imbalances, and emerging frontiers that merit further academic inquiry. The narrative produced is therefore both empirically grounded and analytically reflective, offering a richer appreciation of the field's historical development and its potential future trajectories.

Study Design	Datasets	Pre-processing	Bibliometric Analysis	Narrative Review	Content Analysis	Synthesis & Reporting
Combine bibliometric analysis	Select Scopus + Web of Science (WoS)	Remove unsuitable document types	Keyword frequency (ScientoPy)	Relevance to safety & health in entertainment	Extract definitions, risks, frameworks	Integrate bibliometric patterns + narrative insights
Combine narrative review	Define search strings	Select allowed types (proceedings, conference papers, reviews)	Keyword co-occurrence clusters (VOSviewer)	Conceptual or empirical contribution	Develop inductive codes	Construct thematic interpretation
	Title-field search	Duplicate removal (ScientoPy)		Full-text availability	Build thematic categories	Report findings with visuals (ScientoPy + VOSviewer)
	Export records (CSV/TXT)	Final cleaned dataset				

Figure 1: Overview of the Study's Integrative Methodological Approach

Results

Keyword Frequency, Conceptual Priorities, and Thematic Evolution

The thematic evolution depicted in Figure 2 illustrates a gradual shift in how safety and health issues are framed within the entertainment industries. Earlier studies were anchored mainly in traditional, discipline-specific terms such as “performing arts”, “dance”, “music”, and “musical theatre”. All these keywords have a percentage of documents published in 2023 and 2024 (PDLY) value of zero, suggesting that much of the early scholarship focused on physical performance settings and the operational risks associated with them. At that stage, the emphasis tended to centre on preventing injuries, managing biomechanical strain and ensuring safe practices in staged or choreographed environments.

A different pattern begins to emerge from 2023 onwards. The rise of keywords such as “mental health” and “stigma”, each with a PDLY value of 50%, points to a noticeable shift towards psychosocial concerns. This development mirrors broader conversations in occupational safety and health, where psychological well-being, emotional resilience and societal attitudes towards mental illness are increasingly recognised as part of the risk landscape. Given the nature of entertainment work, often characterised by insecure contracts, intense performance demands and heightened public scrutiny, such concerns are neither unexpected nor trivial. One could ask whether this marks a redefinition of what “safety” means for creative workers today; the emerging literature suggests that it does.

The gradual resurgence of interest in the “music industry” (PDLY=33%) reinforces this shift, hinting at renewed attention to the organisational and cultural contexts of creative labour in the aftermath of COVID-19. Meanwhile, keywords such as “health”, “depression” and “health care”, though less frequent and without recent growth, show that earlier conceptual strands related to well-being have long existed, albeit in a quieter form. These threads now appear to converge with the more contemporary focus on mental health.

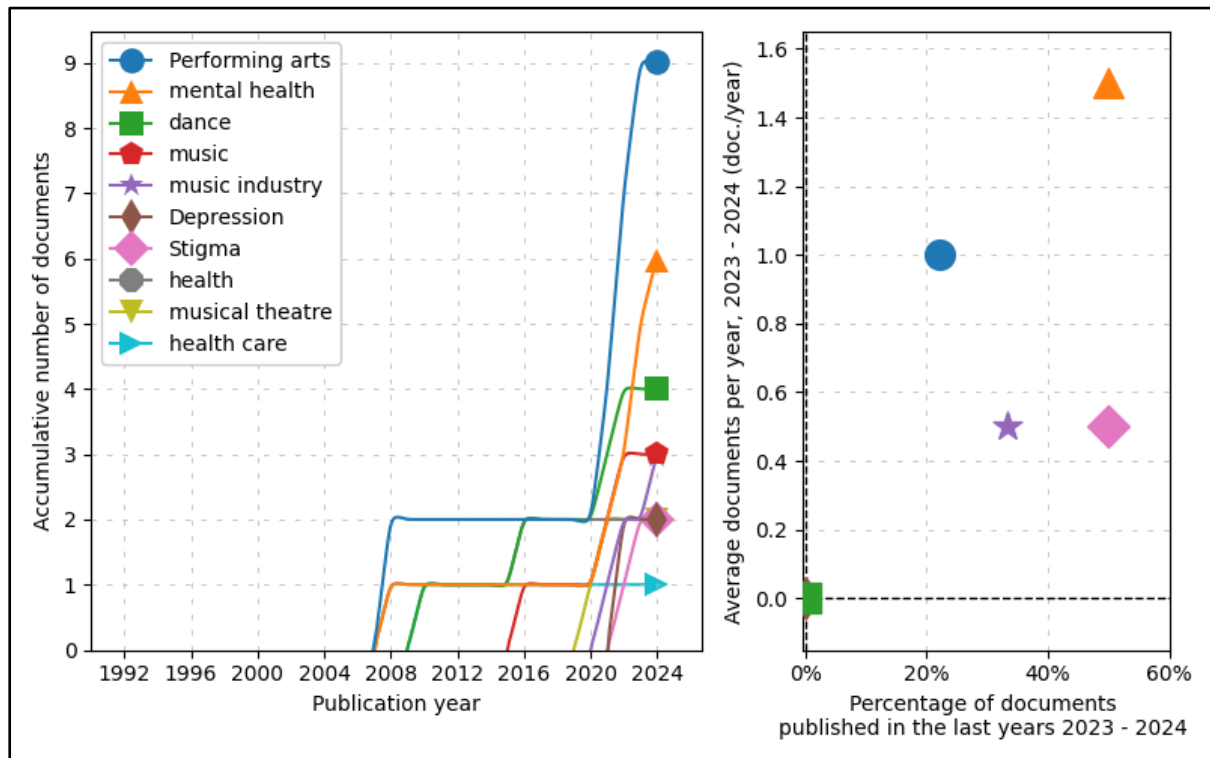


Figure 2: Top Ten Keywords

This thematic evolution signals a sector that is gradually expanding its scope. The field is moving beyond a narrow concern with physical and performance-related hazards towards a more holistic understanding that includes psychological and social dimensions of work. The shift reflects the field's ongoing conceptual maturation, positioning psychosocial risk as a critical frontier for future research in entertainment-related safety and health.

Keyword Co-occurrence Clusters and Thematic Structure

The VOSviewer network visualisation (Figure 3) offers a structural view of how the key concepts in the dataset are connected. Using a minimum occurrence threshold of two, only nine out of the original 73 keywords met the inclusion criteria. These nine terms were then organised into four clusters, each indicating a coherent thematic direction within the literature. The first cluster, shown in red and comprising “music”, “dance” and “musical theatre”, represents the more traditional, performance-oriented segment of the entertainment field. Studies associated with these keywords often focus on choreography, physical movement, injury prevention and the biomechanical or ergonomic demands placed on performers. Their co-occurrence suggests a shared conceptual foundation rooted in bodily engagement, artistic expression and the physical risks inherent in live performance.

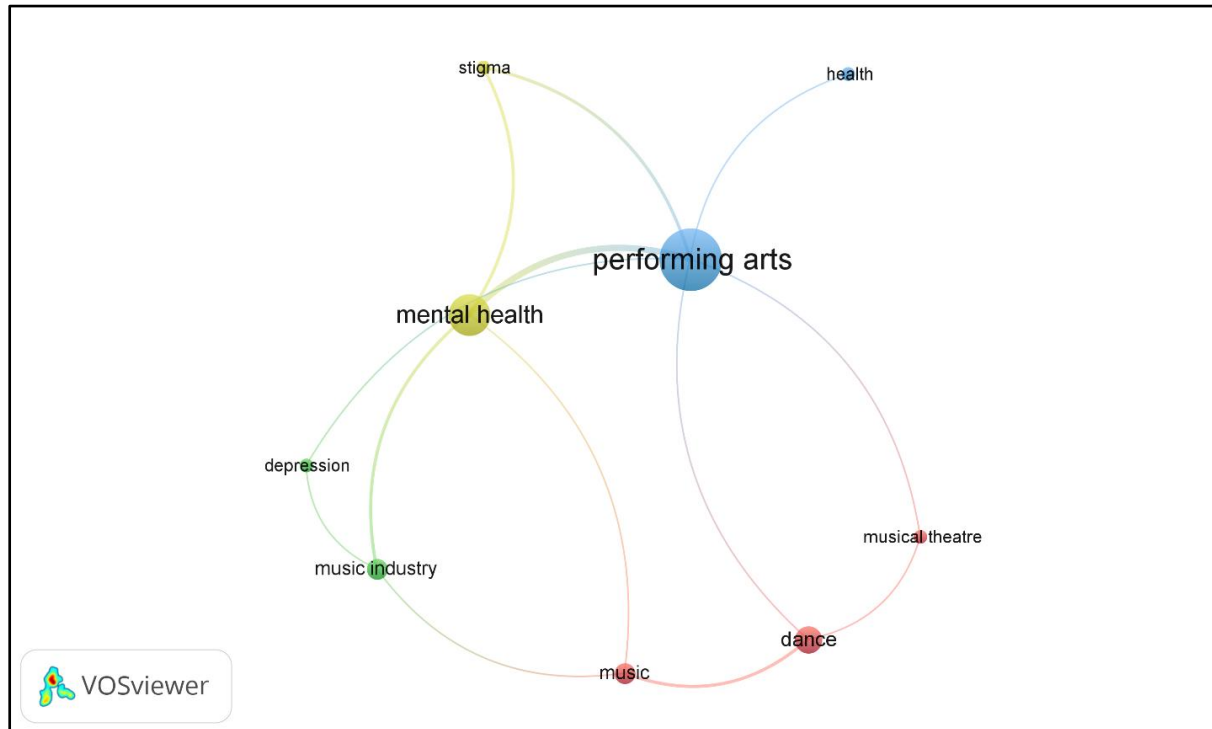


Figure 3: Network Visualisation of the Co-occurrences of Authors' Keywords

The blue cluster, which includes “performing arts” and “health”, reflects a broader thematic strand. Rather than concentrating on a single discipline, this grouping brings together research that addresses health and safety issues across multiple artistic forms. Its central position in the network indicates that it often acts as a connective bridge, linking discipline-specific discussions to broader debates in occupational health.

The green cluster, comprising “depression” and “music industry”, shifts attention to the psychosocial pressures experienced by workers in creative environments. These terms tend to appear in studies exploring emotional strain, precarious employment arrangements and mental health challenges in the commercial music sector. This cluster highlights a growing awareness of psychological risks and the structural vulnerabilities that shape creative labour.

The final cluster, coloured yellow and containing “mental health” and “stigma”, points towards a more recent thematic frontier. The close relationship between these terms suggests that current scholarships are increasingly concerned not only with mental health conditions themselves but also with the social consequences, such as the reluctance to seek help or the fear of being labelled that affect performers and other creative workers.

These four clusters reveal a field that is becoming more diverse in its conceptual concerns. While earlier scholarship centred on physical and performance-related hazards, newer clusters indicate a parallel shift towards understanding psychosocial well-being, mental health and the organisational realities of entertainment work. This evolving structure suggests that occupational safety and health research in the entertainment industries is expanding its scope, from a narrow physical-risk perspective to a more comprehensive view that incorporates emotional, social, and institutional dimensions.

Narrative Review and Content Analysis

Table 1 summarises the publications selected for the narrative review, organised according to the ten most prominent keywords identified in the bibliometric analysis. The publications associated with the “performing arts” keyword reveal a consistent scholarly interest in understanding how arts involvement shapes health and well-being, especially among young populations. The earliest work in the dataset, Daykin et al. (2008), undertook a systematic synthesis of music, dance and drama studies involving adolescents. Although the review concluded that the evidence was promising, it also highlighted methodological inconsistencies and the relatively early stage of the field. This earlier strand of research often emphasised physical, emotional and developmental outcomes.

More recent publications move away from broad reviews toward more focused empirical evidence. Stubbe et al. (2021), for example, followed performing-arts students throughout the COVID-19 lockdown and found rising levels of loneliness and mental-health complaints, despite improvements in perceived stress and sleep quality. Lai et al. (2021) demonstrated, through qualitative narratives from a youth street-dance programme, that group-based participation in performing arts can cultivate happiness, prosocial attitudes, and greater self-efficacy. Ramos Ramos (2023) similarly reported that school-based drama initiatives help strengthen resilience and social connection. Collectively, these studies frame performing arts as a pathway for building psychosocial assets across the life course.

A second stream of literature focuses on mental health risks within the music and performing arts industries. Brunt and Nelligan (2021) analysed how Australian media portrayed the psychological fallout of COVID-19 among musicians, highlighting themes of financial insecurity, job loss and uncertainty about the future of live performance. Newman et al. (2022) added quantitative evidence by documenting high levels of depression, anxiety, suicidality and burnout among international touring professionals, while identifying mindfulness and social, where emotional skills as potential protective factors. Building on these concerns, Jepson et al. (2024) reviewed evidence supporting the development of a mental-health code of practice for the contemporary music industry.

A third thematic direction addresses stigma, care ecosystems and professional responses. Cid-Vega and Brown (2023) proposed the concept of “communities of care” within the performing arts, drawing on global mental health frameworks to argue for a shared responsibility in identifying and supporting distressed colleagues. Agius and Agius (2022) examined how opera and theatre, including Maltese productions such as Ciklu, have been used to destigmatise mental illness and promote help-seeking. At the institutional level, Fancourt and Poon (2016) introduced the Arts Observational Scale (ArtsObs), a mixed-methods tool for evaluating arts-in-health programmes, while Weslin and Silva-Smith (2010) highlighted the emergence of advanced nursing roles tailored to performers’ health needs.

Table 1: Summary of Publications Selected for the Narrative Review

Keyword	Representative Studies	Focus or Contribution	Relation to Safety & Health in the Entertainment Industries
Performing arts	Daykin et al. (2008); Stubbe et al. (2021); Lai et al. (2021); Ramos Ramos (2023)	Health promotion, resilience, youth development, psychosocial well-being	Shows performing arts as a medium for emotional, social and developmental health benefits

Mental health, Depression Stigma	Stubbe et al. (2021); Brunt & Nelligan (2021); Newman et al. (2022) Cid-Vega & Brown (2023); Agius & Agius (2022)	Mental-health complaints, loneliness, depression, burnout Stigma reduction, help-seeking, communities of care	Highlights the psychological vulnerabilities of students and performers Suggests structural and cultural barriers to mental-health support in creative fields
Music industry, Music Dance, Musical theatre	Newman et al. (2022); Jepson et al. (2024) Daykin et al. (2008); Lai et al. (2021)	Occupational stress, suicidality, and working conditions Physical movement, group bonding, expressive arts	Frames the music industry as a high-risk psychological environment Links artistic practice to injury prevention, ergonomics and social well-being
Health, Health care	Fancourt & Poon (2016); Weslin & Silva-Smith (2010); Frishkopf et al. (2016); McCrary et al. (2022)	Tools for arts-in-health evaluation; specialised health roles; Population outcomes, disease-prevention messaging	Shows institutional and clinical approaches to supporting performers and demonstrates how performing arts function as public-health interventions

In northern Ghana, Frishkopf et al. (2016) found that music and dance-drama interventions improved knowledge of malaria and cholera prevention, positioning the performing arts as a form of social technology for grassroots health promotion. At a population level, McCrary et al. (2022) explored performing-arts engagement in 500 American cities and, while not finding consistent protective effects, highlighted the challenges of epidemiological work in arts-participation research.

Taken as a whole, these publications outline a clear developmental pathway. Early work established the health-promoting potential of the performing arts; later studies exposed the substantial mental health risks borne by performers and creative industry workers; and more recent scholarship has turned its attention to systemic responses, such as stigma reduction, codes of practice, and new care-based models within the performing arts ecosystem. This trajectory reinforces the view that the entertainment industries are both a space for health enrichment and a high-risk occupational environment that requires deliberate mental health and psychosocial governance.

Discussion

The findings of this study indicate a quiet yet significant transformation in how safety and health are perceived within the entertainment industries. Earlier scholarships, as evident in the evolution of keywords, concentrated heavily on the physical world of performance, including dance, music, musical theatre, and other movement-based practices. These themes, all of which recorded a PDLY value of zero, reflect a period when safety was primarily equated with bodily strain, injury risks, and the physical demands inherent in choreographed or staged activities. This orientation is unsurprising. For many decades, the most visible hazards in the performing arts were those that could be seen, measured or prevented through established injury-prevention strategies (Cheng & Chen, 2021).

Nevertheless, from 2023 onwards, the landscape appears to have shifted. The appearance and rapid rise of keywords such as “mental health” and “stigma”, each carrying a PDLY value of



50%, signals an expanding understanding of what constitutes risk in the entertainment industries. These developments reflect broader shifts in occupational safety discourse, where psychological well-being and emotional resilience are no longer viewed as supplementary concerns but as central components of workplace safety (Sorensen et al., 2021). When one considers the realities of the entertainment industry, including uncertain contracts, intense public scrutiny, and erratic schedules, it becomes clearer why psychosocial risks have come to the forefront. The widening interest in these themes suggests not merely an academic trend, but a changing lived experience for performers and creative workers. Are we, therefore, witnessing a reframing of “safety” itself? The evidence points in that direction.

The renewed scholarly activity surrounding the “music industry”, reflected in a PDLY value of 33%, reinforces this shift. Following the upheavals of COVID-19, studies in this area have turned their attention to the organisational cultures of creative labour, especially the pressures experienced by touring professionals, production crews and gig-based workers (Armes-Cruz, 2021; Tsui, 2020). Even keywords such as “health”, “depression”, and “health care”, although appearing less frequently and without recent growth, hint at earlier conceptual threads that are now reconnecting with contemporary conversations on mental health and psychosocial well-being. Taken together, thematic progression suggests a field moving from a narrow view of physical hazards towards a more comprehensive, human-centred understanding of safety in creative settings.

The VOSviewer clusters offer further insight into this conceptual broadening. The red cluster, “music”, “dance” and “musical theatre”, captures the long-standing performance-oriented tradition of research. This is the space of choreography, physical movement, and injury prevention, where the body is central (Fotaki et al., 2021). The blue cluster, pairing “performing arts” with “health”, takes on a bridging role. It brings together cross-disciplinary perspectives and serves as a conceptual link between individual artistic disciplines and broader occupational health concerns, suggesting a more integrative approach in literature (Sy et al., 2025).

The shift becomes more pronounced in the green cluster, “depression” and “music industry”, where the focus turns explicitly to emotional strain, precarious employment and the psychological vulnerabilities of creative-sector workers. This cluster reflects an emerging recognition of the deeper social and organisational structures shaping health risks in entertainment industries (Koohang et al., 2023). Finally, the yellow cluster, “mental health” and “stigma”, represents the most recent thematic frontier. Its emphasis on social perceptions, stigma, and help-seeking barriers suggests that the field is beginning to grapple with the invisible burdens carried by performers, where silence, fear of judgment, and reluctance to disclose psychological distress (Hurtaud et al., 2025). These four clusters collectively demonstrate a sector in transition, expanding beyond physical hazards to encompass the social, emotional, and institutional dimensions of safety.

The narrative review reinforces this trajectory. Studies grouped under “performing arts” continue to highlight the health-enhancing potential of artistic participation, particularly among young people. Early works, such as those by Daykin et al. (2008), laid the foundation for this understanding, while more recent studies by Lai et al. (2021) and Ramos (2023) demonstrate how the performing arts can foster resilience, social connectedness, and self-efficacy. These findings remind us that creative engagement is not merely a site of risk, but also a source of strength. At the same time, evidence from the music and performing arts industries paints a



more sobering picture. Research by Brunt and Nelligan (2021) and Newman et al. (2022) reveals substantial mental-health burdens, depression, anxiety, suicidality and burnout, among musicians and touring professionals. Jepson et al. (2024) further underscore the need for formal mental-health governance, proposing codes of practice to safeguard workers in the contemporary music ecosystem.

A third body of work highlights the structural and cultural factors that shape mental health outcomes. Studies by Cid-Vega and Brown (2023) and Agius and Agius (2022) illuminate the persistence of stigma, while institutional contributions by Fancourt and Poon (2016) and Weslin and Silva-Smith (2010) demonstrate how health-support systems in the arts are gradually becoming more specialised and professionalised. Public-health-oriented research, such as that by Frishkopf et al. (2016) and McCrary et al. (2022), adds another layer by illustrating the potential of arts-based interventions to promote health beyond the entertainment workers themselves.

Across these strands, a clear developmental pattern emerges. Early research highlighted the benefits of artistic engagement. Later studies exposed the mental-health risks borne by performers and creative-industry workers. The most recent scholarship focuses on systemic solutions, including stigma reduction, communities of care, codes of practice, and professionalised health-support structures. This progression reflects a maturing field, one that increasingly acknowledges that the entertainment industries can be both a transformative space for well-being and a high-risk occupational environment.

Although this study offers a structured and integrative understanding of safety and health research within the entertainment industries, several limitations should be acknowledged. First, the analysis relies solely on publications indexed in Scopus and Web of Science. While both databases are well-regarded for their quality and coverage, their selection inevitably excludes relevant works published in local journals, industry reports, or practitioner-oriented literature that often provide greater contextual detail on safety and health risks. This may narrow the range of perspectives represented in the final dataset. Second, the study's emphasis on article titles as the primary search field may have filtered out papers where safety and health issues appear prominently in the abstract or keywords but are not explicitly signalled in the title. As a result, specific conceptual threads, especially those embedded in interdisciplinary or applied research, may remain under-represented.

Looking forward, the results strongly suggest that future research must continue to expand beyond physical hazards and attend more deliberately to psychosocial and organisational concerns. There is a pressing need to understand how employment precarity, public scrutiny, performance pressure and cultural expectations interact to shape safety outcomes. Equally important is the development of industry-wide mental-health governance models, initiatives that move the field from isolated interventions to coherent, sustainable systems of support. In this respect, the entertainment industries stand at an important crossroads. As the conceptual boundaries of safety continue to expand, so too must the policies, practices, and scholarly attention that support the individuals who bring creative work to life.

Conclusion

This study demonstrates that safety and health research in the entertainment industries is undergoing a clear conceptual shift. Earlier work concentrated on physical and performance-related risks, yet recent trends highlight growing attention to psychosocial pressures, mental health vulnerabilities and the organisational realities of creative labour. The keyword patterns, cluster structures, and narrative synthesis collectively point to a field that is maturing, gradually expanding its boundaries to recognise the emotional, social, and institutional dimensions of risk. This progression underscores the need for more holistic and integrated approaches to occupational safety and health in the entertainment industries, approaches that extend beyond injury prevention to address stigma, mental health governance, and the broader conditions that influence creative work. Ultimately, the sector's future resilience depends on its ability to strike a balance between artistic excellence and a more comprehensive understanding of worker well-being.

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BILINGUALISM AND WORKING MEMORY AMONG YOUNG ADULTS IN MALAYSIA: THE ROLES OF ACQUISITION AGE, SES, PROFICIENCY AND LANGUAGE GAP

*Ramanata Maguiraga*¹

¹Center for graduate Studies, Faculty of Psychology and Social Sciences, University of Cyberjaya (UOC), Malaysia, (Ramanata.Maguiraga@live.com)

Abstract: *This study investigated if there was a bilingual advantage in working memory among Malaysian young adults aged 18 to 25, thereby extending research beyond the predominantly Western, Educated, Industrialized, Rich, and Democratic (WEIRD) contexts that dominate the field. Using a quantitative approach, the relationship between bilingualism and working memory was examined alongside the moderating effects of age of acquisition (AoA), socioeconomic status (SES), and language proficiency, as well as the mediating role of language gap. Results showed no significant association between bilingualism and working memory when SES and AoA were considered, and the language gap did not serve as a significant mediator. However, a significant effect emerged when language proficiency was introduced as a moderator ($b = -0.019$, $SE = 0.007$, $t = -2.71$, $p = .008$, 95% CI $[-0.033, -0.005]$), suggesting that the bilingual advantage may surface primarily at lower proficiency levels, where greater cognitive effort is required to compensate for limited skills. These findings underscore the importance of accounting for individual differences in proficiency and highlight the role of methodological choices, particularly the selection of cognitive tasks and sample size, in evaluating this complex construct. By situating the study in a non-WEIRD context, this research contributes to the growing body of evidence that the cognitive effects of bilingualism are not universal but instead context dependent.*

Keywords: *bilingualism, bilingual advantage, working memory, non-WEIRD*

Introduction

Bilingualism is a common feature of many societies worldwide, particularly in multilingual nations such as Malaysia, where the use of two or more languages is embedded within educational, social, and cultural practices. Despite its prevalence, the cognitive consequences of bilingualism remain contested, with particular debate surrounding the existence of a bilingual advantage in executive functions such as working memory. Early studies proposed that bilingual individuals may demonstrate superior executive control due to the continuous management of multiple language systems (Bialystok, Craik, & Luk, 2012). However, subsequent research has produced mixed results, with many studies failing to replicate these advantages (Paap, Johnson, & Sawi, 2015).

One explanation for these inconsistencies lies in the overrepresentation of WEIRD populations in bilingualism research. In such contexts, bilingualism often co-occurs with migration, higher educational attainment, or socioeconomic privilege, making it difficult to isolate language-related effects from broader contextual influences (Henrich, Heine, & Norenzayan, 2010). In contrast, in Malaysia, bilingualism is normative and spans diverse socioeconomic



backgrounds, providing a valuable setting to re-examine claims of bilingual cognitive advantage.

Additionally, bilingualism is increasingly recognised as a multidimensional construct rather than a binary category. Factors such as age of acquisition, proficiency, language balance, and socioeconomic status may substantially influence cognitive outcomes (Leivada et al., 2021). Contemporary theoretical accounts suggest that bilingual advantages may arise not from bilingualism itself, but from increased cognitive demands associated with managing less automatised or imbalanced language systems. This study therefore investigates bilingualism and working memory in a non-WEIRD context while accounting for key moderating and mediating variables.

Literature Review

Bilingualism and Working Memory

Working memory refers to the capacity to temporarily store and manipulate information to support complex cognitive activities such as reasoning and comprehension (Baddeley, 2012). It is central to executive functioning and has frequently been examined in studies of bilingual cognition. While some research reports enhanced working memory among bilinguals, others find null effects or disadvantages once methodological rigor is increased (Paap et al., 2015).

A major methodological concern involves the operationalisation of bilingualism. Many studies rely on categorical distinctions between monolinguals and bilinguals, failing to capture meaningful variation in language experience. This oversimplification may obscure nuanced relationships between bilingualism and cognitive performance.

Age of Acquisition and Socio-Economic Status

Age of acquisition has been proposed as a key determinant of bilingual cognitive effects, with early bilinguals often assumed to benefit from prolonged experience managing multiple languages. However, AoA is frequently confounded with socioeconomic factors, as early access to additional languages may reflect educational privilege rather than linguistic experience alone. Socioeconomic status is itself a robust predictor of cognitive development, including working memory capacity (Hackman & Farah, 2009). Failure to account for SES may therefore inflate estimates of bilingual advantage.

Language Gap and Language Proficiency

Language proficiency has received increasing attention as a potential moderator of bilingual cognitive outcomes. Lower proficiency may impose greater executive demands, requiring active monitoring and control, whereas high proficiency may rely on automatised processes that reduce cognitive engagement (Green & Abutalebi, 2013). Language gap, defined as the discrepancy between first- and second-language proficiency, has been proposed as a mechanism underlying bilingual cognitive effects, though empirical support remains inconsistent.

Methodology

Design and Participants



A quantitative, cross-sectional design was employed. Participants were Malaysian young adults aged 18 to 25. Bilingualism was treated as a continuous construct to capture variability in language experience.

Measures

Working memory was assessed using standardised cognitive tasks measuring both storage and processing components. Language background was assessed using a structured questionnaire capturing age of acquisition, proficiency across reading, writing, and comprehension, and frequency of language use. Socioeconomic status was indexed using educational and household indicators. Language gap scores were computed as the difference between first- and second-language proficiency.

Data Analysis

Multiple regression analyses examined the relationship between bilingualism and working memory while controlling for SES and AoA. Moderation analyses tested language proficiency, and mediation analyses examined the role of language gap.

Results

No significant main effect of bilingualism on working memory was observed once SES and age of acquisition were controlled for. Both SES and AoA independently predicted working memory performance. Mediation analyses indicated that language gap did not significantly mediate the relationship between bilingualism and working memory.

However, moderation analysis revealed a significant interaction between bilingualism and language proficiency ($b = -0.019$, $SE = 0.007$, $t = -2.71$, $p = .008$, 95% CI $[-0.033, -0.005]$).

Bilingualism was associated with relatively stronger working memory performance at lower proficiency levels, with this effect diminishing at higher proficiency levels.

Discussion

The findings do not support a universal bilingual advantage in working memory. Instead, they suggest that cognitive effects associated with bilingualism depend on individual differences in language proficiency and broader socioeconomic factors. The absence of a mediating role for language gap indicates that imbalance alone does not explain cognitive variation. The moderating effect of proficiency aligns with resource-based accounts proposing that cognitive engagement arises primarily under conditions of increased linguistic demand.

Conducting this study in a non-WEIRD context further demonstrates how sociolinguistic environments shape cognitive outcomes. In settings where bilingualism is normative, its cognitive impact may differ substantially from contexts where it is linked to migration or elite education.

Conclusion



This study provides evidence that bilingualism does not confer a consistent working memory advantage among Malaysian young adults. Cognitive effects appear to be context dependent and moderated by language proficiency. These findings highlight the need for nuanced, multidimensional approaches to bilingualism research and caution against broad generalisations based on WEIRD samples.

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STUDENTS' USE OF CHATGPT IN ACADEMIC WRITING: EFFECTS ON SATISFACTION, WRITING EFFICIENCY, AND LEARNER AUTONOMY

Sharina Saad¹, Alia Nabella Fateha Zolkifli²

¹ Academy of Language Studies, Universiti Teknologi MARA, Kedah Branch (UiTM), Malaysia, (sharina854@uitm.edu.my)

² School of Humanities, Universiti Sains Malaysia (USM), Malaysia, (alianabellafateha01@gmail.com)

Abstract: *The increasing use of generative artificial intelligence tools such as ChatGPT has reshaped how university students approach academic writing tasks. ChatGPT is widely employed to support idea generation, drafting, and revision, yet empirical evidence examining its effects on students' learning experiences remains limited. This study investigates students' use of ChatGPT in academic writing and examines its effects on satisfaction, writing efficiency, and learner autonomy. A quantitative survey design was adopted, involving 41 tertiary students who regularly engage in academic writing tasks such as essays, reports, and article analyses. Data were collected using a structured online questionnaire that measured students' satisfaction with ChatGPT in terms of ease of use, perceived usefulness, and engagement; writing efficiency across the pre-writing, drafting, and revision stages; and learner autonomy related to self-regulation, decision-making, and independent writing development. The findings indicate that students generally report high levels of satisfaction with ChatGPT and perceive it as an effective tool for enhancing writing efficiency, particularly during the pre-writing and drafting stages through idea generation, content organisation, and language support. The results further reveal that most students do not rely on AI-generated content uncritically; instead, they demonstrate autonomous learning behaviours by evaluating, revising, and adapting ChatGPT outputs to meet academic expectations. This suggests that, when used responsibly, ChatGPT can support rather than diminish learner autonomy in academic writing. Overall, the study highlights the dual role of ChatGPT as both a facilitator of writing efficiency and a tool that requires careful pedagogical integration. The findings contribute empirical insights into AI-assisted academic writing and offer practical implications for educators and institutions seeking to integrate ChatGPT in ways that enhance student satisfaction, promote efficient writing practices, and support the development of autonomous learners in higher education.*

Keywords: *ChatGPT, academic writing, student satisfaction, writing efficiency, learner autonomy*

Introduction

Generative AI chatbots such as ChatGPT are increasingly used in higher education to support academic writing tasks including source summarising, idea generation, drafting, and language refinement (Barrot, 2023; Kasneci et al., 2023; Kohnke et al., 2023). This rapid uptake is partly driven by the tool's accessibility and its ability to provide immediate language and content support, making it attractive to students working under time pressure and facing challenges in academic reading and writing. As a result, ChatGPT is becoming embedded in everyday



writing practices, particularly in tasks that require interpreting source texts and producing structured responses.

However, the adoption of ChatGPT in academic writing raises growing concerns. First, AI-generated text can appear fluent while containing inaccuracies, oversimplifications, or fabricated details, which may compromise the quality of academic reasoning and the credibility of written work if students do not verify output carefully (Kasneci et al., 2023; Zhai et al., 2024). Second, critics warn that excessive reliance may reduce students' active engagement with reading and writing processes particularly the cognitive work involved in planning, evaluating evidence, developing arguments, and revising for meaning (Cotton et al., 2024; Thorp, 2023). Third, the use of AI-generated text complicates authorship and originality, creating uncertainty around what constitutes acceptable assistance and potentially increasing academic integrity risks when AI output is reproduced without meaningful transformation (Cotton et al., 2024; Thorp, 2023; Zhai et al., 2024). These concerns are especially salient in academic writing, where learning outcomes emphasise not only the final product but also the development of independent thinking and writing competence.

Despite these debates, emerging evidence suggests that students often perceive ChatGPT as relatively easy to use and useful for writing-related work, shaping overall satisfaction and continued adoption (Strzelecki, 2024; Zou & Huang, 2024). Yet, positive perceptions alone do not clarify whether ChatGPT supports or undermines key educational goals. In particular, the writing process is multi-staged (e.g., pre-writing, drafting, and revision), and the influence of ChatGPT may differ by stage. For example, AI may help students begin writing through brainstorming and outlining, but may also encourage surface-level completion if students accept output without critical evaluation. Similarly, ChatGPT might support learner autonomy by enabling self-directed learning and revision, or it might reduce autonomy if students become dependent and defer decision-making to the tool.

A key research gap lies in the limited integration of three dimensions students' satisfaction, stage-based writing efficiency, and learner autonomy within a single empirical study focused on academic writing tasks. Many studies examine attitudes or acceptance broadly, but fewer investigate how perceived benefits translate into process-level writing support across stages, and how this use intersects with autonomy-related behaviours such as self-regulation, decision-making, and independent development. In addition, more evidence is needed that triangulates closed-ended indicators with students' qualitative explanations of why the tool is useful and how they use it during academic writing tasks.

Accordingly, this study examines students' satisfaction with ChatGPT, perceived writing efficiency across writing stages, and learner autonomy when using ChatGPT for academic writing tasks. This study contributes to the field by offering a process-oriented and learner-centred account of ChatGPT use that links students' acceptance (satisfaction) with perceived efficiency across writing stages and autonomy-related behaviours, providing empirical insights to inform responsible pedagogical integration.

Research Questions

RQ1: What is the level of students' satisfaction with ChatGPT in academic writing in terms of ease of use, perceived usefulness, and engagement?



RQ2: How does the use of ChatGPT affect students' writing efficiency across the pre-writing, drafting, and revision stages?

RQ3: In what ways does ChatGPT use influence students' learner autonomy, particularly with respect to self-regulation, decision-making, and independent writing development?

Structure of the Paper

The remainder of this paper is organised as follows. The next section reviews related literature on ChatGPT in academic writing, focusing on student satisfaction, writing efficiency across writing stages, and learner autonomy. The methodology section then outlines the research design, participants, instrument, and data analysis procedures. The results section presents the quantitative findings and qualitative themes aligned with the research questions, followed by a discussion interpreting the findings in relation to prior research. The paper concludes with implications for practice, limitations, and recommendations for future research.

Literature Review

ChatGPT and Student Satisfaction in Academic Writing

Student satisfaction is commonly conceptualised through perceived ease of use, perceived usefulness, and learner engagement. In higher education studies of ChatGPT adoption, effort expectancy (ease of use) and performance expectancy (usefulness) are strong predictors of students' intention to use the tool and continued uptake (Strzelecki, 2024). In language and writing contexts, ChatGPT's dialogic support and rapid feedback can make writing tasks feel more manageable and engaging (Kohnke et al., 2023; Zou & Huang, 2024).

ChatGPT and Writing Efficiency Across Writing Stages

Writing efficiency refers to students' ability to complete writing tasks in a timely manner while sustaining acceptable quality across the pre-writing, drafting, and revision stages. Prior work suggests that ChatGPT can support pre-writing through brainstorming and outlining, assist drafting by generating candidate sentences and structures, and facilitate revision through language polishing and clarity checks (Barrot, 2023; Zou & Huang, 2024). These efficiencies, however, depend on students' prompt quality and their ability to evaluate and edit AI output.

ChatGPT and Learner Autonomy in Academic Writing

Learner autonomy involves students' capacity for self-regulation, decision-making, and ownership of learning. Although AI-assisted writing tools can help learners improve writing proficiency, researchers have raised concerns about their potential influence on learner autonomy. Learner autonomy refers to learners' capacity to take responsibility for their learning by setting goals and evaluating their own progress (Benson, 2013). Autonomous learners do not wait passively for instruction; instead, they actively plan their learning, seek relevant information, and monitor their ongoing development (Little, 1991). From a self-regulated learning (SRL) perspective, effective language learners employ metacognitive strategies such as planning, monitoring, and self-evaluation to manage and improve their writing (Zimmerman, 2002). However, the convenience of AI-generated content may



encourage overdependence on technology, potentially reducing students' critical engagement and weakening self-reliance if the tool replaces the role of the learners which do not support students' decision-making during writing (Zhai et al., 2024). Therefore, given the widespread adoption of AI in ESL contexts, it is important to examine whether these tools strengthen students' independent writing development or foster long-term reliance.

Research Design

This study employed a quantitative survey design to examine students' use of ChatGPT in academic writing and its perceived effects on satisfaction, writing efficiency, and learner autonomy. Survey research is appropriate for systematically collecting participants' self-reported perceptions and behaviours across a defined group (Creswell & Creswell, 2018). To add contextual depth, the questionnaire also included open-ended prompts that allowed respondents to elaborate on perceived benefits, concerns, and recommendations related to ChatGPT use. This embedded qualitative element enabled the findings to be interpreted more meaningfully by linking numerical patterns to students' explanatory comments (Creswell & Creswell, 2018).

Participants

The participants comprised 41 tertiary-level students enrolled in various academic programmes who regularly engage in academic writing tasks (e.g., essays, reports, and article analyses). The sample included undergraduate, postgraduate, and diploma students from disciplines such as Humanities and Social Sciences, Administrative Science and Policy Studies, and Business and Management. Participants were selected using convenience sampling, which is commonly used when participants are readily accessible and when time and resources are limited, though it may reduce representativeness (Etikan et al., 2016). All participants reported prior experience using AI tools (including ChatGPT) for academic purposes, making them suitable respondents for the present study.

Research Instrument

Data were collected using a structured online questionnaire consisting of four sections aligned with the research variables:

Section A: Demographic Information and AI Experience

This section collected respondents' age, gender, academic level, field of study, and prior experience with AI tools to contextualise responses.

Section B: Student Satisfaction with ChatGPT

This section assessed satisfaction in terms of ease of use (proxy indicators), perceived usefulness, and engagement when using ChatGPT for academic writing. Attitudinal statements used a five-point Likert scale (Strongly disagree to Strongly agree), consistent with Likert-type measurement for attitudes and perceptions (Likert, 1932). In addition, some items were multiple-choice or frequency-based to capture usage and motivations.

Section C: Writing Efficiency Across Writing Stages



This section examined students' perceived efficiency gains when using ChatGPT across pre-writing, drafting, and revision. Items targeted common writing-stage activities such as idea generation, content organisation, language refinement, and revision practices.

Section D: Learner Autonomy in Academic Writing

This section assessed autonomy-related behaviours, including self-regulation, decision-making, and independent writing development. Items included students' reported practices of modifying AI-generated content and exercising judgement before submission.

Finally, open-ended prompts invited students to comment on advantages, concerns, and suggestions for integrating ChatGPT into academic writing. These responses were intended to contextualise the quantitative results and capture nuances not available through fixed-response items (Creswell & Creswell, 2018).

Data Collection Procedure

The questionnaire was administered online using a secure survey platform. Online survey administration supports efficient and flexible participation while allowing respondents to complete the questionnaire at their convenience (Dillman et al., 2014). Prior to participation, respondents were informed of the study purpose and assured that responses would be anonymous and confidential. Participation was voluntary, and informed consent was obtained before respondents proceeded to the questionnaire.

Data Analysis

Quantitative data were analysed using descriptive statistics (frequencies and percentages) to summarise students' reported levels of satisfaction, perceived writing efficiency, and learner autonomy. Frequencies and percentages are appropriate for categorical and ordinal questionnaire responses because they clearly represent how many respondents selected each option (Pallant, 2020).

Responses to the open-ended prompts were analysed using thematic analysis. The analysis followed established procedures for identifying and reporting patterns of meaning within qualitative data (Braun & Clarke, 2006). Coding was conducted inductively to capture recurring themes related to perceived usefulness, stage-based writing support, autonomy-related behaviours (e.g., self-regulation and decision-making), and responsible-use concerns. To strengthen transparency and trustworthiness, themes were refined through repeated review of the dataset and clear documentation of coding decisions (Nowell et al., 2017). The qualitative themes were used to support and contextualise the quantitative findings.

Ethical Considerations

Ethical principles were observed throughout the study. Participation was voluntary, and respondents were informed that they could withdraw at any time without penalty. No identifying information was collected, and all responses were treated as confidential. These procedures align with widely recognised ethical guidance for educational research, including respect for participants, informed consent, and data protection (British Educational Research

Association [BERA], 2018). The study focused on students' perceptions and self-reported practices rather than evaluating individual academic performance.

This study employed a quantitative survey research design to examine students' use of ChatGPT in academic writing and its effects on satisfaction, writing efficiency, and learner autonomy. A survey design was considered appropriate as it enables the systematic collection of students' perceptions, experiences, and self-reported learning behaviours across a defined population. To complement the quantitative data, an open-ended item was embedded in the questionnaire to allow respondents to elaborate on their experiences with ChatGPT, providing contextual depth to the findings.

Results

Section A: Demographics

Table 4.1: Participant demographics (N = 41)

Variable	Category	n	%
Age group	18–21	11	26.8
	22–25	30	73.2
Gender	Female	33	80.5
	Male	7	17.1
	Prefer not to say	1	2.4
Academic level	Undergraduate	36	87.8
	Postgraduate	3	7.3
	Diploma	2	4.9
Field of study (cleaned)	Humanities & Social Sciences	25	61.0
	Administrative Science / Policy Studies	11	26.8
	Business & Management	5	12.2

As shown in Table 4.1, most respondents were aged 22–25 (73.2%), followed by 18–21 (26.8%). Female students constituted 80.5% of the sample, while 17.1% were male and 2.4% preferred not to disclose. In terms of field of study, 61.0% were from Humanities and Social Sciences, 26.8% from Administrative Science/Policy Studies, and 12.2% from Business and Management. Most participants were undergraduates (87.8%), followed by postgraduates (7.3%) and diploma students (4.9%).

Results for RQ1: Students' Satisfaction with ChatGPT in Academic Writing

RQ1: What is the level of students' satisfaction with ChatGPT in academic writing in terms of ease of use, perceived usefulness, and engagement?

Table 4.2: Students' Satisfaction With ChatGPT in Academic Writing by Dimension (N = 41)

Dimension (RQ1)	Item / Indicator	Response category	n	%
Ease of use (proxy)	Prior use of AI tools (Q1)	Yes, regularly	27	65.9
		Yes, occasionally	14	34.1
Ease of use (proxy)	Reliance on AI tools (Q5)	Always	6	14.6
		Frequently	21	51.2
		Sometimes	14	34.1
Perceived usefulness	AI improves assignment quality (Q4)	Strongly agree	16	39.0
		Agree	20	48.8
		Neutral	5	12.2
Perceived usefulness	Primary motivation for using AI (Q3)	Generate ideas	31	75.6
		Summarize articles	4	9.8
		Improve clarity and coherence	3	7.3
		Check grammar and sentence structure	3	7.3
Engagement	Attitude toward AI use (Q2)	Very positive	15	36.6
		Somewhat positive	16	39.0
		Neutral	10	24.4
Engagement	AI enhances critical thinking (Q6)	Yes, significantly	10	24.4
		Yes, to some extent	23	56.1
		Neutral	5	12.2
		No, it reduces critical thinking	3	7.3

Table 4.3: Aggregated Indicators for RQ1 (N = 41)

RQ1 dimension	Aggregated indicator	n	%
Ease of use (proxy)	Used AI tools before (regularly + occasionally)	41	100.0
Ease of use (proxy)	Rely on AI frequently/always	27	65.9
Perceived usefulness	Agree/strongly agree AI improves assignment quality	36	87.8
Engagement	Very/somewhat positive attitude	31	75.6
Engagement	AI enhances critical thinking (some extent/significantly)	33	80.5
Engagement	AI reduces critical thinking	3	7.3

As shown in Table 4.2, students demonstrated moderate-to-high satisfaction with ChatGPT in academic writing across the dimensions of ease of use (proxy), perceived usefulness, and engagement. Regarding ease of use, all respondents reported prior experience using AI tools for academic work, with 65.9% (n = 27) using AI tools regularly and 34.1% (n = 14) using them occasionally. Consistent with this, students reported notable reliance on AI for article

analysis tasks, with 51.2% (n = 21) relying on AI frequently and 14.6% (n = 6) always relying on AI.

In terms of perceived usefulness, most students believed AI improves assignment quality, with 87.8% (n = 36) indicating agreement or strong agreement. Students' reported motivations further supported this perception, as the majority used AI primarily for idea generation (75.6%, n = 31). Finally, engagement indicators were also positive: 75.6% (n = 31) reported a very or somewhat positive attitude toward AI use, and 80.5% (n = 33) perceived that AI enhances critical thinking to some extent or significantly, while only 7.3% (n = 3) felt AI reduces their critical thinking.

To summarise the key indicators (Table 4.3), 100% (n = 41) of respondents reported using AI tools prior to this study, indicating broad exposure and accessibility of AI-based writing support tools. Approximately two-thirds of students (65.9%, n = 27) relied on AI frequently or always when completing article analysis assignments. In addition, the majority perceived ChatGPT as beneficial for academic work, with 87.8% (n = 36) agreeing that AI improves assignment quality. Students also showed strong engagement and acceptance, as 75.6% (n = 31) expressed positive attitudes, and 80.5% (n = 33) believed AI enhances critical thinking to some extent or significantly. These findings collectively suggest that students' overall satisfaction with ChatGPT in academic writing is moderate to high, particularly in perceived usefulness and engagement.

Open-ended Findings Supporting RQ1 (OE1) and Triangulation With Quantitative Data

Among students who provided open-ended responses about the advantages of AI for article analysis (n = 29), four themes emerged: time-saving/faster work (34.5%), idea generation (31.0%), learning support/guidance (31.0%), and summarising/comprehension support (20.7%). These themes triangulate strongly with the quantitative evidence indicating broad adoption and reliance (Q1, Q5), high perceived usefulness (Q4, Q3), and positive engagement and cognitive involvement (Q2, Q6). Collectively, the qualitative data help explain why students report moderate-to-high satisfaction: AI tools are perceived as efficient, supportive for idea development, helpful for learning, and useful for understanding/summarising academic content.

Table 4.4: RQ1 Joint Display: Quantitative Indicators Triangulated With Open-ended Advantages (OE1) (N = 41; OE1 n = 29)

RQ1 Dimension	Quantitative evidence (item)	Key quantitative result	Qualitative theme evidence (OE1)	Theme frequency	Example student excerpts (brief)
Ease of use (proxy)	Prior AI use (Q1)	100% used AI before (65.9% regularly; 34.1% occasionally)	Time-saving / faster work	10/29 (34.5%)	"Save time." / "Improve efficiency."
Ease of use (proxy)	Reliance frequency (Q5)	65.9% rely frequently/always	Time-saving / workflow fit	10/29 (34.5%)	"save time and generate more ideas"

RQ1 Dimension	Quantitative evidence (item)	Key quantitative result	Qualitative theme evidence (OE1)	Theme frequency	Example student excerpts (brief)
Perceived usefulness	AI improves quality (Q4)	87.8% agree/strongly agree	Learning support / guidance	9/29 (31.0%)	“Improved understanding.” / “It helps me to write better.”
Perceived usefulness	Primary motivation (Q3)	75.6% use AI to generate ideas	Idea generation / content development	9/29 (31.0%)	“can elaborate more ideas” / “Can generate idea”
Perceived usefulness	Primary motivation (Q3)	9.8% selected summarising as <i>primary</i>	Summarising / comprehension support	6/29 (20.7%)	“Can summarise it very quickly.” / “AI can quickly summarize articles, extract key points...”
Engagement	Attitude toward AI use (Q2)	75.6% very/somewhat positive	Learning support (active academic use)	9/29 (31.0%)	“help improving knowledge and grammar”
Engagement	Critical thinking (Q6)	80.5% say AI enhances critical thinking (to some extent/significantly)	Learning support (cognitive assistance)	9/29 (31.0%)	“Easy to point out the point.”

Table 4.5: OE1 Thematic Summary: Advantages Supporting Satisfaction (RQ1) (n = 29)

Theme	n	%	Example excerpts (brief)
Time-saving / faster work	10	34.5	“Save time.” / “Improve efficiency.”
Idea generation / content development	9	31.0	“can elaborate more ideas” / “Can generate idea”
Learning support / guidance	9	31.0	“Improved understanding.” / “It helps me to write better.”
Summarising / comprehension support	6	20.7	“Can summarise it very quickly.” / “AI can quickly summarize articles, extract key points...”

As presented in Table 4.4, the quantitative findings indicate moderate-to-high student satisfaction with ChatGPT in academic writing across ease of use (proxy), perceived usefulness, and engagement. All respondents reported prior use of AI tools (Q1), and a substantial proportion relied on AI frequently/always when completing article analysis assignments (Q5: 65.9%). Perceived usefulness was also strong, with 87.8% agreeing that AI

improves assignment quality (Q4), and most students reporting that their primary motivation for using AI was idea generation (Q3: 75.6%). Engagement indicators further supported this pattern: 75.6% reported a positive attitude toward AI use (Q2), and 80.5% perceived that AI enhances critical thinking to some extent or significantly (Q6).

The open-ended advantages responses (OE1) corroborated and explained these quantitative patterns. As summarised in Table 4.5, students most frequently highlighted time-saving and faster task completion (34.5%), followed by idea generation (31.0%) and learning support/guidance (31.0%), with a smaller but meaningful proportion emphasising summarising and comprehension support (20.7%). This qualitative evidence triangulates with the quantitative results by illustrating why students report satisfaction: AI tools are valued for improving efficiency and supporting content development and learning. Notably, while only 9.8% selected summarising as their primary motivation in the closed-ended item (Q3), the open-ended data indicate summarising functions as a common secondary benefit, reinforcing the interpretation of high perceived usefulness within students' academic writing practices.

Results for RQ2: Writing Efficiency Across Writing Stages

RQ2: How does the use of ChatGPT affect students' writing efficiency across the pre-writing, drafting, and revision stages?

The findings suggest AI tools support efficiency most strongly in early writing stages (pre-writing/drafting) and are used as inputs for student-driven revision.

Pre-writing efficiency (idea generation and comprehension). The most dominant motivation was idea generation (75.6%, $n = 31$). A smaller proportion selected summarising articles (9.8%, $n = 4$), but open-ended advantages also highlighted summarising and identifying key points (theme frequency: 20.7% of open-ended advantage responses).

Drafting efficiency (language support). A minority explicitly chose grammar/sentence support (7.3%, $n = 3$) and clarity/coherence (7.3%, $n = 3$); however, open-ended responses also described writing assistance and grammar correction (theme frequency: 13.8%, 4/29).

Revision stage behaviour (strong evidence). Most respondents reported actively modifying AI output:

- 65.9% make substantial edits to ensure originality ($n = 27$)
- 26.8% make minor adjustments ($n = 11$)
- Only 7.3% use AI outputs with minimal changes ($n = 3$)

Table 4.6: RQ2 indicators (N = 41)

Writing stage	Questionnaire indicator(s)	Key results
Pre-writing	Primary motivation; open-ended advantages	75.6% use AI to generate ideas; open-ended: time-saving (34.5%), idea generation (31.0%), summarising (20.7%)

Writing stage	Questionnaire indicator(s)	Key results
Drafting	Reliance frequency; grammar/clarity motives; open-ended advantages	65.9% rely frequently/always; smaller explicit focus on grammar/clarity (each 7.3%); open-ended includes writing/grammar support (13.8%)
Revision	Extent of modifying AI output	92.7% report substantial/minor edits; only 7.3% minimal changes

Results for RQ3: Learner Autonomy

RQ3: In what ways does ChatGPT use influence students' learner autonomy, particularly self-regulation, decision-making, and independent writing development?

The findings suggest that students generally maintain autonomy through self-regulation and evaluative control.

Self-regulation (editing and control). The strongest indicator is revision behaviour: 92.7% report making substantial/minor edits before submission ($n = 38$). This pattern indicates students are not simply accepting AI output but are actively shaping content.

Decision-making (selective and purposeful use). Reliance is high but not universal: 65.9% rely frequently/always, while 34.1% report "sometimes," implying situational decision-making rather than constant dependency.

Independent development (awareness of dependency risks). Open-ended concerns included overreliance and reduced thinking/skills (each 17.9%), indicating awareness that autonomy could be undermined without boundaries.

Open-ended support (integration). Among those who answered integration ($n = 26$), dominant themes were:

- Limit AI to brainstorming/summarising (6/26; 23.1%)
- Teach AI literacy / verification / critical evaluation (6/26; 23.1%)
- AI as supplementary tool, not replacement (5/26; 19.2%)
- Guidelines/policy emphasis (4/26; 15.4%)

Table 4.7 RQ3 indicators ($N = 41$)

Autonomy component	Item(s)	Key results
Self-regulation	Modification extent	65.9% substantial edits; 26.8% minor edits
Decision-making	Reliance frequency	34.1% sometimes; 65.9% frequently/always
Independent development	Critical thinking perception + concerns themes	80.5% say AI enhances thinking; open-ended also flags dependency/skill risks

Discussion

Discussion of RQ1: Satisfaction (Ease of Use, Usefulness, Engagement)

The findings indicate moderate-to-high satisfaction with ChatGPT for academic writing, reflected in high perceived usefulness and positive attitudes. A large majority of students agreed that AI improves assignment quality (87.8%), and most reported positive attitudes toward AI use (75.6%). These outcomes are consistent with prior research that frames AI chatbots as practical support tools for writing-related tasks such as idea generation, drafting, and language refinement, which can strengthen students' perceived value of the technology (Barrot, 2023; Kasneci et al., 2023; Kohnke et al., 2023). In line with acceptance-focused studies, students' positive attitudes also align with evidence that perceived usefulness and low perceived effort contribute to continued adoption of ChatGPT-like tools in learning contexts (Strzelecki, 2024; Zou & Huang, 2024).

Although ease of use was not measured using a dedicated usability scale, the high rate of prior experience and frequent reliance suggests that students experience ChatGPT as accessible and low-barrier, which supports technology adoption patterns reported in the literature (Strzelecki, 2024; Zou & Huang, 2024). Moreover, students' engagement appears primarily academic and task-oriented, as idea generation was the dominant motivation (75.6%) and most students perceived some critical thinking benefit (80.5%). This pattern suggests that, for many learners, ChatGPT is used as a cognitive support tool rather than a recreational application, aligning with research describing AI as a writing assistant that can facilitate conceptual development and communicative clarity when used purposefully (Aljuaid, 2024; Xu & Ismail, 2024).

Discussion of RQ2: Writing Efficiency Across Stages (Pre-writing, Drafting, Revision)

The results suggest that ChatGPT supports writing efficiency most strongly during pre-writing and early drafting, consistent with the view of AI as a "cognitive starter" that reduces the difficulty of beginning academic tasks. Students' dominant use for idea generation indicates that ChatGPT helps learners generate initial content and directions for writing, which aligns with studies reporting that AI writing tools support brainstorming, planning, and early-stage text production (Barrot, 2023; Kasneci et al., 2023). Students' open-ended advantages (e.g., time-saving, idea development, learning guidance) further reinforce this interpretation and are consistent with literature describing AI tools as enhancing efficiency and productivity in writing-related tasks (Aljuaid, 2024; Kohnke et al., 2023).

Importantly, the revision-stage findings suggest that most students remain active writers rather than simply accepting AI output. Only a small portion reported using AI-generated responses with minimal changes (7.3%), while most reported substantial editing (65.9%). This supports an interpretation of ChatGPT as a scaffolding tool rather than a replacement for writing, echoing process-oriented arguments that AI can be constructive when students evaluate and reshape output, rather than copying it wholesale (Kasneci et al., 2023; Zhai et al., 2024). At the same time, the need for revision reinforces concerns raised in the literature that AI-generated text may be fluent but not necessarily accurate or academically appropriate, requiring student verification and higher-order decision-making (Kasneci et al., 2023; Zhai et al., 2024).



Discussion of RQ3: Learner Autonomy (Self-regulation, Decision-making, Independent Development)

Learner autonomy was supported most clearly through students' revision behaviour, which demonstrates self-regulation, judgement, and ownership of the final written product. This aligns with established definitions of learner autonomy as learners taking responsibility for learning through goal-setting and independent evaluation (Benson, 2013), and with descriptions of autonomous learners as actively planning and monitoring their learning development (Little, 1991). From a self-regulated learning perspective, the reported editing practices also reflect metacognitive regulation—particularly monitoring and evaluating—which are central strategies associated with successful language learning and writing development (Zimmerman, 2002).

However, the qualitative findings also indicate that students recognise the potential risks to autonomy if AI use becomes habitual. Open-ended concerns about dependency and skill erosion reflect the caution in the literature that overreliance on AI may reduce critical engagement and weaken independent thinking in writing tasks (Alm, 2024; Thorp, 2023). This concern is consistent with broader critiques suggesting that AI tools may satisfy immediate needs while potentially diminishing deeper communicative or cognitive engagement if they substitute learner effort (Chomsky et al., 2023; Xi, 2024). Notably, students' integration suggestions (e.g., limiting AI to brainstorming/summarising and emphasising verification) align with a balanced stance: ChatGPT can support autonomy when positioned as guided assistance, but instructional design and explicit expectations are needed to preserve independent writing development (Kasneci et al., 2023; Zhai et al., 2024).

This study examined students' satisfaction with ChatGPT in academic writing, its perceived impact on writing efficiency across pre-writing, drafting, and revision stages, and the influence of ChatGPT use on learner autonomy. Overall, students reported moderate-to-high satisfaction, driven by perceived usefulness particularly for idea generation, learning support, and time-saving benefits consistent with prior scholarship on AI-assisted writing support (Barrot, 2023; Kohnke et al., 2023). The findings suggest ChatGPT is most helpful during early writing stages, while revision remains student-driven through active editing and refinement of AI outputs, supporting the framing of AI as a scaffold rather than a substitute (Kasneci et al., 2023; Zhai et al., 2024). In relation to learner autonomy, the results indicate that ChatGPT can support self-regulation and decision-making when students critically evaluate and adapt AI-generated content, aligning with autonomy and SRL perspectives (Benson, 2013; Zimmerman, 2002). At the same time, responsible-use concerns raised by students mirror existing cautions about overreliance and reduced cognitive engagement, underscoring the need for clear guidance and AI literacy to ensure appropriate academic integration (Alm, 2024; Thorp, 2023).

Conclusion

This study investigated students' experiences of using ChatGPT for academic writing by focusing on three outcomes: satisfaction, writing efficiency across pre-writing, drafting, and revision stages, and learner autonomy. Overall, the findings indicate moderate-to-high satisfaction with ChatGPT, driven primarily by perceived usefulness. Most students viewed ChatGPT as beneficial for improving the quality of their work and reported positive attitudes toward its use. The open-ended responses further explained these perceptions, highlighting



practical advantages such as time-saving, idea generation, learning support, and summarising/comprehension assistance, which collectively reinforce students' acceptance of AI tools in writing-related tasks.

In terms of writing efficiency, ChatGPT was perceived as most helpful during the pre-writing and early drafting stages, where it supports brainstorming, planning, and initiating written responses. Importantly, the findings also show that students generally remain active writers during the revision stage. The majority reported making substantial or minor edits to AI-generated output before submission, suggesting that ChatGPT often functions as a scaffold rather than a substitute for writing. Regarding learner autonomy, students' editing practices and selective use of ChatGPT suggest continued self-regulation, decision-making, and ownership of final written work. At the same time, concerns about overreliance and reduced skill development indicate that autonomy benefits depend on how the tool is used—highlighting the importance of purposeful, reflective engagement.

Taken together, the study suggests that ChatGPT can support academic writing when integrated as a guided learning aid: it enhances efficiency and supports idea development while allowing students to maintain control over revision and final outputs. However, to ensure that AI use strengthens rather than diminishes independent writing development, educational practices should emphasise critical evaluation, verification, and responsible use.

Implications for Future Research

Future studies should go beyond self-reported perceptions by incorporating objective indicators of writing outcomes and processes, such as rubric-based ratings of drafts, revision tracking, and time-on-task measures across writing stages. Researchers are also encouraged to employ validated multi-item scales to strengthen measurement of satisfaction, writing efficiency, and learner autonomy, and to examine how different patterns of AI use (e.g., brainstorming versus drafting) relate to independent writing development across disciplines and proficiency levels.

Limitations

This study is limited by its self-report questionnaire design, which captures perceptions rather than direct behavioural or performance evidence. Some constructs (e.g., ease of use and writing efficiency by stage) were measured using proxies rather than detailed multi-item scales or objective indicators. The sample size and context (N = 41; article analysis tasks) may limit generalisability to other settings or writing genres. Finally, not all participants answered the open-ended questions, and qualitative responses varied in depth, which may limit the representativeness of themes.

Contribution of the Study

This study makes several important contributions to the literature on AI-assisted academic writing. First, it provides empirical evidence on students' actual use of ChatGPT in academic writing, moving beyond speculative discussions of AI. Second, it simultaneously examines three critical learning dimensions which are student satisfaction, writing efficiency, and learner autonomy, offering a comprehensive understanding of how ChatGPT affects the academic writing process. Third, the findings demonstrate that ChatGPT can enhance writing efficiency



and satisfaction without necessarily diminishing learner autonomy, provided students engage critically with AI-generated content. Finally, the study offers pedagogical insights for educators and institutions seeking to integrate ChatGPT into academic writing instruction in ways that support effective learning, self-regulation, and independent writing development. These contributions position the study as a timely and relevant addition to research on AI in higher education.

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EXTENDING THE TECHNOLOGY ACCEPTANCE MODEL (TAM) FOR AI-ASSISTED LEARNING IN TECHNICAL EDUCATION: EVIDENCE FROM SQL INSTRUCTION

Norshadila Ahmad Badela¹, Mohd Noor Halmy Ab Latif²

¹Unit Teknologi Maklumat, Kolej Komuniti Sungai Siput (KKSS), Malaysia, (norshadila.pmj@gmail.com)

²Fakulti Kejuruteraan Mekanikal, Universiti Teknologi MARA (UiTM), Malaysia, (halmylatif@gmail.com)

Abstract: Artificial Intelligence (AI) is rapidly transforming educational practices, particularly in technical disciplines where structured problem-solving is essential. This study investigates user acceptance of an AI-assisted learning environment designed to provide contextual feedback during Structured Query Language (SQL) learning via a prompt-based web tutor. Guided by an extended Technology Acceptance Model (TAM) that includes interactivity and satisfaction, quantitative data were collected from 128 participants comprising diploma-level students ($n = 88$) and lecturers ($n = 40$). Descriptive statistics, reliability testing, and Mann–Whitney U analysis were performed to evaluate perceptions of usefulness, ease of use, interactivity, satisfaction, and behavioural intention. Results indicated high perceived usefulness ($M = 4.66$), ease of use ($M = 4.59$), and interactivity ($M = 4.62$), with strong internal reliability (Cronbach's $\alpha > 0.88$). No significant differences emerged between student and lecturer responses, indicating universal acceptance of AI-assisted tools for technical education. The findings validate the extended TAM framework for evaluating AI-based learning environments and emphasize that real-time feedback and interactive design are key determinants of user engagement. This study contributes to ongoing digital education efforts under Malaysia's MyDIGITAL and AI Roadmap initiatives by demonstrating the role of AI-assisted feedback in enhancing usability and engagement in technical education.

Keywords: AI-assisted learning, technology acceptance model, usability, interactivity, SQL instruction

Introduction

The rapid emergence of Artificial Intelligence (AI) in education has transformed teaching and learning dynamics. AI-based systems now provide personalized, data-driven support that adapts to learners' needs (Wang et al., 2024). In technical education, such as computing and data management, AI tools can supply automated hints and corrections that help students grasp abstract logic and syntax faster than traditional materials (Zhang et al., 2023).

Structured Query Language (SQL) is a critical component of computer science and data analytics education. Students often struggle with SQL because it demands both logical reasoning and syntax precision. Common challenges include difficulty translating problem statements into queries, debugging complex statements, and limited opportunities for timely feedback. An AI-assisted learning environment can bridge this gap by providing real-time feedback, scaffolding learners' understanding, and promoting self-directed learning (Dahri et al., 2024).



However, technology alone cannot guarantee effective adoption. User acceptance and satisfaction determine the long-term success of educational innovations. The Technology Acceptance Model (TAM) has been widely used to explain how perceptions of usefulness (PU) and ease of use (PEOU) influence behavioural intention (Davis, 1989). With the evolution of interactive and AI-enabled tools, researchers have extended TAM to include constructs such as interactivity and satisfaction, capturing affective and cognitive engagement factors (Al-Abdullatif, 2024; Wang et al., 2024).

This study aims to:

1. Examine user acceptance of an AI-assisted learning environment for SQL instruction using an extended TAM framework.
2. Validate the reliability of TAM constructs, usefulness, ease of use, interactivity, satisfaction, and behavioural intention, in AI-driven technical education.

The work contributes to Malaysia's digital transformation in higher education, aligned with the National AI Roadmap (2021–2025) (Malaysian Science, 2023) and MyDIGITAL Blueprint (Economic Planning Unit, 2021), emphasizing innovative digital pedagogy.

Literature Review

AI In Education

AI technologies have become pivotal in higher education, offering adaptive feedback, predictive analytics, and personalized pathways (Wang et al., 2024). These tools reduce instructors' workload while supporting individualized learning. According to Dahri et al. (2024), AI tools such as ChatGPT demonstrate metacognitive benefits by enabling students to self-regulate and reflect on learning processes. Similarly, Li et al. (2024) highlight that learner engagement with AI systems is influenced by perceived interactivity and trust in system output, reinforcing the importance of usability design.

In technical subjects, AI's capacity to interpret syntax and logic provides meaningful pedagogical advantages. Systems that emulate intelligent tutoring, such as automated query feedback or error explanations, allow learners to make iterative improvements in problem-solving. Reviews by Mallik & Gangopadhyay (2023) show that both proactive (learner-driven) and reactive (AI-driven) feedback loops can significantly enhance learning efficiency. Recent large-scale reviews emphasize that AI-driven adaptive systems enhance learner engagement and personalized feedback (Wang et al., 2024; Steele, 2023). Systematic reviews also highlight that research on AI in higher education increasingly focuses on pedagogy and ethical implications (Zawacki-Richter et al., 2019).

Challenges in SQL Learning

SQL requires conceptual understanding of relational models and logical composition. Traditional learning environments often provide static exercises that lack contextual feedback. Ghimire and Edwards (2024) suggest that generative AI technologies can mitigate such challenges by producing targeted examples and immediate responses to student inputs. When

embedded into structured curricula, AI support can reinforce active learning and help bridge the instructor–student feedback gap.

Technology Acceptance Model (TAM) and Its Extension

TAM posits that two primary constructs, perceived usefulness (PU) and perceived ease of use (PEOU), determine a user's intention to adopt technology (Davis, 1989). TAM3 (Venkatesh & Bala, 2008) and later models suggest that external variables such as enjoyment and user experience play a significant role in shaping behavioural intention. Similarly, Teo & Noyes (2011) found that perceived enjoyment and attitude significantly influence technology acceptance among pre-service teachers. Over time, TAM has evolved operationalizes interactivity and satisfaction to incorporate variables that reflect modern interaction contexts. Studies show that in AI-assisted education, interactivity and satisfaction are significant determinants of continued use (Wang et al., 2024; Al-Abdullatif, 2024). These findings align with the growing body of research confirming that user engagement, trust, and satisfaction are crucial mediators between system features and behavioural intention (Zhang et al., 2023; Hasan et al., 2023).

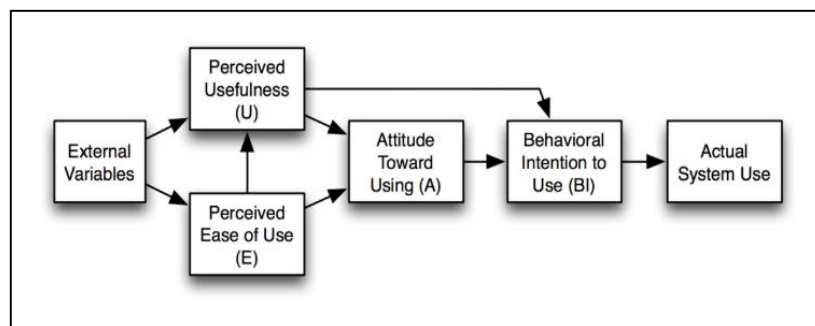


Figure 1: Technology Acceptance Model

Source: (Davis, 1989)

More recently, Bilquise et al. (2024) extended TAM to explore chatbot-based learning in higher education, confirming the relevance of interactivity and satisfaction in AI-driven learning environments. Therefore, this study applies an extended TAM that includes interactivity and satisfaction alongside PU and PEOU to evaluate the acceptance of AI-assisted SQL learning environments.

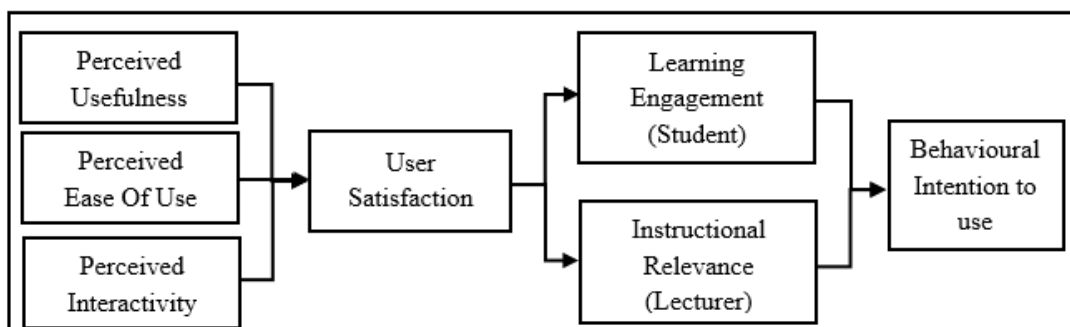


Figure 2: Extended TAM

Source: (Author)



Methodology

Research Design

A quantitative survey design was used to investigate perceptions of an AI-assisted SQL learning environment. The framework was guided by the extended TAM model, as conceptualized by Davis (1989) and later AI education adaptations (Al-Abdullatif, 2024; Dahri et al., 2024).

Participants

The study involved 128 respondents: 88 diploma-level students and 40 lecturers from technical computing programs. Participants had foundational knowledge of SQL and experience with digital learning tools.

Instrumentation

The survey instrument contained items adapted from previous TAM studies (Davis, 1989; Wang et al., 2024). Constructs included Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Interactivity (INT), Satisfaction (SAT), and Behavioural Intention (BI). All items were measured on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Cronbach's α was used to assess internal reliability.

Procedure

Participants accessed the AI-assisted environment, which automatically generated hints, corrected query syntax, and explained SQL logic. After completion, respondents filled out an online questionnaire. Data were analysed using SPSS 29, employing descriptive statistics, reliability tests, and Mann–Whitney U tests for role-based comparison.

Ethical Considerations

Ethical approval was obtained from Jabatan Pendidikan Politeknik & Kolej Komuniti. Participation was voluntary and anonymous. All participants provided informed consent before participation, and no identifying data were collected.

Results

Descriptive Statistics

Table 1: The Mean, Standard Deviation, And Reliability For Each Construct.

Construct	Mean	SD	Cronbach's α
Perceived Usefulness	4.66	0.47	0.92
Ease of Use	4.59	0.52	0.88
Interactivity	4.62	0.50	0.93
Satisfaction	4.63	0.50	0.90

Behavioural Intention	4.61	0.51	0.88

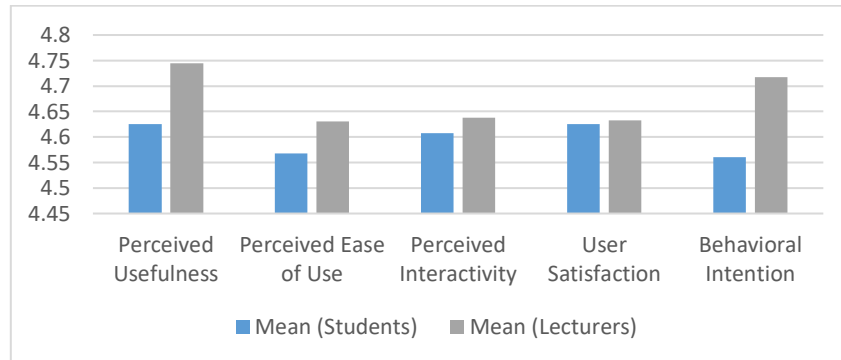


Figure 3: Comparison of Means and Significance

(Source: Author, based on survey data)

Based on Table 1, all constructs achieved mean scores above 4.5, reflecting high acceptance. Reliability coefficients exceeded 0.88, indicating excellent internal consistency.

Reliability Analysis was evaluated using Cronbach's Alpha to determine the internal consistency of each construct. The coefficients ranged from 0.880 to 0.926, surpassing the recommended threshold value of 0.70 (Nunnally, 1978). These results indicate excellent internal consistency and confirm that all measurement constructs, Perceived Usefulness, Ease of Use, Interactivity, Satisfaction, Instructional Relevance, Learning Engagement, and Behavioral Intention, are reliable indicators for assessing user acceptance of the GenAI-integrated SQL learning platform

Group Comparison

Mann-Whitney U results revealed no significant difference between student and lecturer perceptions across constructs ($p > 0.05$). This suggests that both user groups equally value the AI-assisted environment's ease of use, feedback interactivity, and usefulness.

Qualitative Observations

Open-ended feedback from respondents highlighted three recurring themes: (1) real-time feedback enhanced learning motivation, (2) interactive hints improved conceptual understanding, and (3) the system encouraged independent problem-solving.

Based on Table 2 and Figure 2, participants emphasized the value of the system's interactive features and the usefulness of the feedback provided. Many respondents highlighted the clarity of the prompts and the immediate explanations offered by the AI. Others suggested including more complex SQL challenges and improving accessibility on mobile devices.

Table 2: Thematic Analysis of Open-Ended Responses

Theme	Description	Sample Quote

Immediate Feedback	Participants appreciated receiving prompt, AI-generated explanations of their SQL attempts.	“The system quickly pointed out my mistakes and gave reasons.”
Clarity of Guidance	Learners found the hints easy to understand and supportive without revealing full answers.	“The hints were helpful and guided me without giving away the answer.”
Motivation and Engagement	Students reported feeling more motivated and enjoying the learning process.	“Using this tool made learning SQL more enjoyable.”
Suggestions for Enhancement	Respondents requested additional advanced SQL tasks and better mobile usability.	“It would be good to have more challenging SQL examples or mobile access.”
Support for Teaching	Lecturers noted that the tool reduced repetitive explanations and aided students’ independent learning.	“It helped minimize the amount of time spent addressing the same SQL errors.”

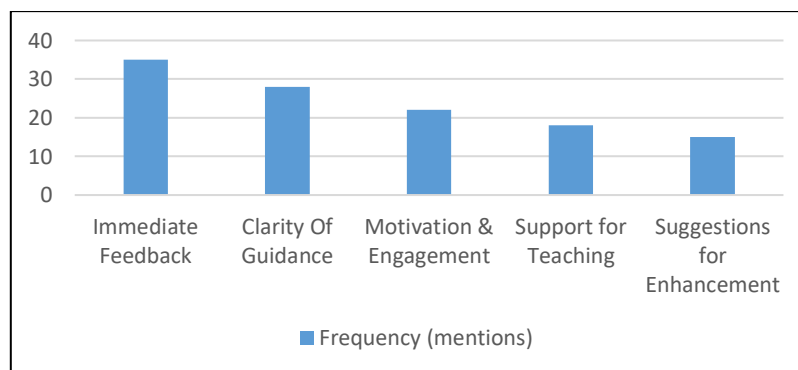


Figure 4: Thematic Analysis of Open-Ended Responses

(Source: Author, based on survey data)

Discussion

The results of this study align with global findings that user satisfaction and interactivity are critical mediators in AI learning adoption (Foroughi et al., 2025). Similarly, Steele (2023) emphasizes that integrating generative AI in learning environments fosters personalized instruction and higher learner engagement, supporting the conclusions drawn here. In addition, Bilquise et al. (2024) reinforce that extending TAM frameworks helps clarify behavioural intention in AI-assisted contexts.

The findings affirm that the extended TAM effectively explains the acceptance of AI-assisted SQL learning tools. High PU and PEOU align with Dahri et al. (2024), who found that metacognitive self-regulation is strengthened when learners perceive AI tools as helpful and easy to use. Similarly, Wang et al. (2024) confirmed that interactivity and satisfaction significantly predict engagement in AI-assisted learning.

The comparable acceptance among students and lecturers suggests that AI-assisted tools provide cross-functional value, for instruction and autonomous practice alike. This aligns with



(Ghimire & Edwards, 2024), who highlighted the pedagogical potential of generative AI for both educators and learners.

These outcomes reinforce the argument that interactivity, in terms of the responsiveness between learner and AI, drives engagement and perceived control. In turn, satisfaction acts as a mediator between usability and behavioural intention, confirming findings from (Li et al., 2024) regarding trust and emotional engagement in AI systems.

This research also supports Malaysia's strategic direction in developing digital learning ecosystems through its National AI Roadmap. Implementing AI-assisted tools in technical subjects can reduce instructors' workload, improve student autonomy, and align with sustainable digital education goals. These findings support Malaysia's ongoing MyDIGITAL initiative to integrate AI into higher education as part of national digital capacity building.

Conclusion and Recommendations

This study validates the applicability of an extended TAM framework to evaluate AI-assisted learning in SQL education. The results reveal that perceived usefulness, ease of use, interactivity, and satisfaction significantly influence behavioural intention. High reliability across all constructs indicates the robustness of TAM for assessing AI-based educational adoption.

Future research should expand to other domains, include larger samples across institutions, and integrate performance-based outcomes to complement usability measures. Exploring long-term behavioural changes and AI literacy among educators would also deepen understanding of technology acceptance in evolving digital ecosystems.

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UNCOVERING THE GENERATIVE MECHANISMS OF TAX EVASION IN CRYPTOCURRENCY AND DECENTRALIZED EXCHANGES

Syed Arslan Abbas¹, Nor Shaipah Abdul Wahab², Firdous Mohd Farouk³

¹Faculty Accounting and Finance, Taylor's University, Malaysia, (syedarslan.abbas@sd.taylors.edu.my)

²Faculty Accounting and Finance, Taylor's University, Malaysia, (norshaipah.abdulwahab@taylors.edu.my)

³Faculty Accounting and Finance, Taylor's University, Malaysia, (firdous.mohdfarouk@taylors.edu.my)

Abstract: *The taxation of cryptocurrency presents considerable difficulties for regulators, especially when transactions take place on decentralized exchanges (DEXs) that function without intermediaries. In Malaysia and Pakistan, rapid increase in bitcoin usage has overtaken regulatory capability, causing major ambiguity about the taxation of decentralized exchanges (DEXs) activities. This study formulates a mechanism-based theoretical explanation for tax evasion in decentralized exchange (DEX) environments, utilizing deterrence theory, socio-technical systems, legal pluralism, and Critical Realism. It delineates four generative mechanisms; decentralization-induced opacity, deterrent diminishment, jurisdictional pluralism, and socio-technical incentive frameworks and elucidates their interactions across the Real, Actual, and Empirical strata of reality. A concise comparative empirical framework utilizing document analysis is presented to inform future testing in Malaysia and Pakistan. Comprehending these mechanisms can facilitate the formulation of coherent, enforceable, and technologically informed cryptocurrency tax regulations.*

Keywords: *Decentralized Exchanges; Tax Evasion; Critical Realism; Generative Mechanisms; Cryptocurrency Regulation*

Introduction

Global regulators face ongoing challenges in taxing cryptocurrency transactions, especially those conducted on decentralized exchanges (DEXs). Decentralized exchange platforms facilitate peer-to-peer trading via smart contracts, eliminating the need for intermediaries that usually gather identity data or aid in tax compliance. In Malaysia, digital assets are acknowledged; however, the tax treatment for income derived from decentralized exchanges remains ambiguous (Nawang & Azmi, 2020). Pakistan experiences significant regulatory fragmentation, as the State Bank discourages cryptocurrency usage, while tax authorities exhibit insufficient technical capacity (Hassan, 2022). Current research identifies compliance challenges (Cumming & Johan, 2019; Foley et al., 2019) yet offers insufficient insight into the underlying causal mechanisms influencing tax evasion in decentralized contexts. Critical Realism (CR) provides a framework for examining underlying generative mechanisms, advancing from superficial observations to more profound structural explanations.

Literature Review

Decentralized Exchanges as Socio-Technical Systems



Decentralized exchanges (DEXs) constitute socio-technical platforms that integrate blockchain protocols, liquidity pools, economic incentives, and user behaviors (Münch et al., 2022). Their architecture eliminates centralized authorities, facilitating self-custody, pseudonymous interaction, and permissionless access (Aspris et al., 2021; Nakamoto, 2008). These attributes foster innovation yet create structural opacity that complicates tax governance.

Rural Regulatory Fragmentation and Legal Pluralism

Cryptocurrency regulation is different among jurisdictions. Legal pluralism elucidates the coexistence of numerous regulatory frameworks (Tamanaha, 2017). In Malaysia, digital assets are acknowledged; nonetheless, the taxation of income associated to decentralized exchanges remains ambiguous. Regulatory ambiguity endures in Pakistan due to contradictory institutional signals. This diversity facilitates tax-arbitrage chances (Oxford Analytica, 2022; Reuters, 2022).

Deterrence Theory and Its Breakdown in DEXs

Deterrence theory asserts that adherence is contingent upon the likelihood of detection and the severity of penalties (Becker, 1968). On decentralized exchanges, the probability of detection diminishes due to the absence of intermediaries that gather identifiable information (Foley et al., 2019). Inadequate surveillance diminishes deterrence, facilitating non-compliance (Scholz, 1997; Stafford & Warr, 1993).

Critical Realism and Mechanism-Based Explanation

Critical Realism differentiates between the Real, Actual, and Empirical layers; structures, events, and observations (Bhaskar, 2010). It facilitates the identification of concealed mechanisms influencing behavior independent of observation (Wynn Jr & Williams, 2012). The rich ontology of CR corresponds with the socio-technical intricacies of cryptocurrency ecosystems.

Generative Mechanisms

Decentralization-Opacity Mechanism

Decentralized exchanges eliminate intermediaries, abolish KYC requirements, and facilitate pseudonymous communications. This creates systemic opacity (Valdivia et al., 2019), especially concerning in Malaysia and Pakistan where tax reporting depends on voluntary disclosure.

Deterrence-Erosion Mechanism

Inadequate enforcement and minimal detection likelihood diminish deterrence (Scholz, 1997). The restricted capability for blockchain analytics in both Malaysia and Pakistan exacerbates tax avoidance.



Jurisdictional Pluralism and Tax-Arbitrage Mechanism

Users relocate activities across jurisdictions to capitalize on advantageous legislation (Milburn & Billings, 1976). Regulatory divergence stimulates arbitrage (Scott, 1987), particularly in contexts where local cryptocurrency tax laws are inadequate.

Socio-Technical Incentive Mechanism

DEX token systems, encompassing staking, liquidity mining, and yield farming, produce numerous taxable events (Buterin, 2013). Users frequently misconstrue or deliberately disregard these tax responsibilities.

Methodology

Document analysis is a valuable approach to conduct studies (Morgan, 2022). This research utilizes a qualitative document analysis approach to develop and enhance a Critical Realist interpretation of tax evasion on decentralized exchanges (DEXs) in Malaysia and Pakistan. Document analysis is appropriate for scrutinizing institutional structures, regulatory frameworks, and policy environments, since it facilitates a systematic evaluation of written texts, including central bank notices, securities guidelines, tax authority publications, and secondary academic literature.

The studied documents encompass regulatory pronouncements and guidance from Malaysian and Pakistani authorities, public reporting on cryptocurrency hazards, and legal documents outlining the regulatory stances of institutions. Secondary academic literature addressing deterrence theory, socio-technical systems, legal pluralism, and Critical Realism was analyzed to facilitate theoretical integration.

In accordance with Critical Realism, the analysis was conducted using contextual reading, thematic coding, and retroductive reasoning (Archer et al., 2013). Contextual reading revealed regulatory frameworks in both jurisdictions. Thematic coding was informed by CR's Real–Actual–Empirical layers, facilitating the categorization of structural circumstances, occurrences, and observable patterns. Retroductive reasoning facilitated the inference of underlying generative mechanisms influencing DEX-based tax evasion behavior.

Conceptual Model

CR layers interact as follows:

Real: decentralization, institutional fragmentation, incentive systems

Actual: anonymous swaps, cross-chain bridging, liquidity-pool interactions

Empirical: observable evasion, low reporting, regulatory failure

Table 1: Conceptual Model

Real	Actual	Empirical
Decentralization	Anonymous swaps	Observable evasion
Institutional fragmentation	Cross-chain bridging	Low reporting
Incentive systems	Liquidity-pool interactions	Regulatory failure

Source: Author

Empirical Framework (Malaysia–Pakistan Comparative)

This comparative framework delineates the empirical examination of generative mechanisms in Malaysia and Pakistan, utilizing document analysis as the principal methodology. Indicators comprise:

- DEX utilization trends documented in regulatory filings.
- The prevalence of pseudonymous wallet interactions is emphasized in public reporting.
- Variations in enforcement capacity as articulated in institutional documents.
- Policy comments highlight worries around cross-border cryptocurrency transactions

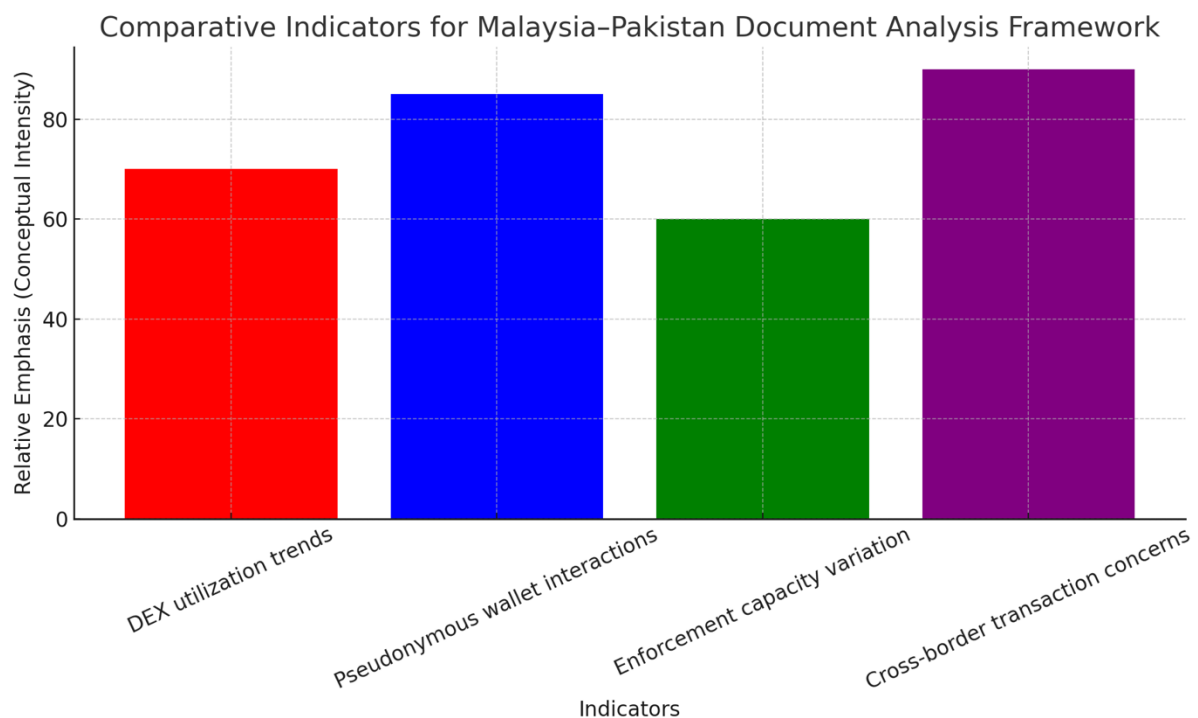


Figure 1: Malaysia and Pakistan Comparative Framework

Source: Author

Figure 1 depicts the comparative significance of important indicators obtained from the document analysis of Malaysia and Pakistan. Pseudonymous wallet interactions and cross-border transaction issues exhibit the greatest conceptual intensity, underscoring their significance in regulatory reports and institutional dialogues. Trends in DEX adoption are receiving significant focus, highlighting increasing policy attention to trading behaviors on decentralized platforms. Conversely, the range in enforcement capacity, although still considerable, seems comparatively diminished, underscoring ongoing institutional deficiencies but with less overt proof than the other variables.

Conclusion

This study provides a comprehensive theoretical analysis of tax evasion within cryptocurrency and decentralized exchange contexts, highlighting the underlying mechanisms of non-compliance in Malaysia and Pakistan. Utilizing a Critical Realist perspective, the analysis transcends superficial symptoms of regulatory failure to uncover the interplay of structural



conditions specifically decentralization-induced opacity, diminished deterrence, jurisdictional pluralism, and socio-technical incentive systems across the Real, Actual, and Empirical domains, resulting in enduring tax-evasion outcomes. The mechanisms illustrate that non-compliance is not merely a behavioral choice, but rather an emergent property of the socio-technical and institutional configurations that characterize DEX ecosystems.

The analysis indicates that Malaysia and Pakistan encounter systemic regulatory ambiguity, limited enforcement capacity, and fragmented institutional responses, which collectively hinder their capacity to govern decentralized financial activities. Ambiguities in tax treatment, insufficient technological capabilities, and inconsistencies in cross-border policies foster an environment where tax evasion is structurally enabled rather than considered anomalous. Addressing these challenges requires more than incremental regulatory adjustments; it necessitates coherent, technologically informed policy design that aligns legal frameworks with the operational realities of decentralized exchanges.

This research theoretically contributes to the emerging scholarship at the intersection of digital taxation, socio-technical systems, and regulatory governance by providing a mechanism-based explanation rooted in Critical Realism. This offers a conceptual basis for policymakers aiming to improve crypto tax compliance within evolving regulatory frameworks. Future research may operationalize and empirically test these mechanisms through expert interviews, blockchain analytics, and comparative institutional analysis to validate and refine the model further. As decentralized financial infrastructures evolve, regulatory strategies must also adapt to address their structural complexities and ensure equitable, enforceable tax governance.

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ENHANCING STUDENT ENGAGEMENT AND PERFORMANCE THROUGH COLLABORATIVE, AI-INTEGRATED ASSESSMENTS IN HIGHER EDUCATION

Khin Than Myint¹, Wendy Li Ling Law², Ling Yew Hua³

¹Faculty of Business, Curtin University Malaysia, (k.t.myint@curtin.edu.my)

²Faculty of Business, Curtin University Malaysia, (wendy.law@curtin.edu.my)

³Faculty of Business, Curtin University Malaysia, (yh.ling@curtin.edu.my)

Abstract: *This study investigates how redesigned assessments that integrate collaboration, artificial intelligence (AI) tools, and critical thinking activities enhance student engagement and academic performance in higher education. Grounded in Self-Determination Theory, Social Interdependence Theory, and Assessment for Learning principles, the research positions assessment design as a key driver of motivation and learning. A mixed-methods approach was employed, collecting data from 88 undergraduate students enrolled in a first-year commerce unit at a private offshore university. Quantitative data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), while qualitative responses were thematically examined. Results indicate that collaboration quality ($\beta = 0.510, p < .001$), AI integration ($\beta = 0.168, p < .001$), and critical thinking skills ($\beta = 0.250, p < .001$) significantly improve student engagement, which strongly predicts academic performance ($\beta = 0.810, p < .001$). Qualitative findings corroborate these results, highlighting gains in teamwork, communication, analytical thinking, and responsible AI use. The study demonstrates that collaborative, AI-integrated assessment design can substantially enhance engagement and performance, offering actionable insights for educators seeking to align assessment practices with 21st-century learning outcomes.*

Keywords: *Student Engagement, AI In Education, Collaborative Learning, Assessment Design, Higher Education*

Introduction

The evolving demands of the 21st-century workplace require graduates to demonstrate strong communication, collaboration, cross-cultural competencies, and proficiency with emerging technologies such as artificial intelligence (AI). However, traditional assessment structures in higher education often struggle to effectively cultivate these capabilities. In the Analytics for Decision Making unit, while students are introduced to analytical tools such as Excel and Tableau, existing assessments, including quizzes, an individual portfolio, and a final examination, offer limited opportunities for collaborative learning, applied problem solving, and analytical writing. The absence of group-based and authentic assessment tasks hinders students' development of essential workplace skills, contributing to the perception that assessments lack depth, relevance, and real-world applicability.

These limitations underscore the need for a redesign of assessments that aligns learning outcomes with contemporary workplace expectations. In response, this study introduces a redesigned portfolio assessment that integrates collaboration, diversity and inclusion, and AI-



supported learning within a real-world financial analytics task. Students work in groups of three to apply Modern Portfolio Theory (MPT) to optimise two stock portfolios, analyse risk–return trade-offs, and calculate the Sharpe Ratio using Excel’s Solver tool. To foster critical thinking and digital literacy, students compare their analytical outputs with AI-generated recommendations from ChatGPT and critically evaluate the accuracy and practical relevance of these recommendations. Assessment outputs include a structured business report, a detailed Excel model, and a group participation form to document individual contributions.

More broadly, the rapid digital transformation of higher education has intensified calls for innovative assessment approaches that move beyond traditional formats such as standardised tests and individual essays. Such assessment practices have been criticised for their limited capacity to capture higher-order skills, including collaboration, problem solving, and critical thinking (Boud & Soler, 2016). At the same time, the growing presence of AI in educational contexts presents new opportunities to design authentic assessments that reflect contemporary professional practices, while also raising questions about appropriate integration and evaluation (Holmes et al., 2019; Kasneci et al., 2023).

Student engagement is widely recognised as a critical determinant of academic success, encompassing behavioural, cognitive, and emotional dimensions that support persistence and achievement (Kuh et al., 2008; Reeve, 2023). Engagement is shaped by contextual factors such as collaborative learning environments, the meaningful integration of digital tools, and assessment designs that support students’ needs for autonomy, competence, and relatedness (Carless & Winstone, 2023). Research on assessment for learning emphasises that well-designed assessments can function as powerful drivers of engagement by promoting active participation, reflection, and shared responsibility for learning (Nicol, 2009).

Despite extensive literature on engagement and performance, important gaps remain. Existing studies frequently examine collaboration, AI integration, or critical thinking as isolated predictors of learning outcomes. Less is known about how these elements can be intentionally combined through assessment redesign to create integrated learning experiences that enhance both student engagement and academic performance. Furthermore, while AI has been widely explored in adaptive learning systems and automated feedback, its role as a comparative analytical tool within assessment contexts remains underexplored.

Addressing these gaps, this study proposes and empirically tests a conceptual framework in which redesigned assessments integrating collaboration, AI tools, and critical-thinking activities enhance student engagement, which in turn contributes to improved academic performance. Drawing on Self-Determination Theory (Ryan & Deci, 2020), Social Interdependence Theory (Johnson & Johnson, 2009), and Assessment for Learning perspectives (Nicol, 2009), this research positions assessment design as a central mechanism for fostering engagement and learning outcomes in higher education.

The objectives of this study are to:

1. Foster collaboration, communication, and cross-cultural skills through group-based assessment activities.
2. Integrate AI tools into assessment tasks to develop students’ analytical and critical-thinking capabilities.



3. Evaluate the impact of the redesigned assessment on student engagement, academic performance, and self-perceived learning outcomes using a mixed-methods approach.

Literature Review

Theoretical Perspectives

This study integrates three complementary theoretical perspectives to explain how redesigned assessments can enhance student engagement and academic performance.

First, Self-Determination Theory (SDT) posits that when instructional design satisfies learners' needs for autonomy, competence, and relatedness, students are more likely to internalise motivation, demonstrate stronger engagement, and achieve higher levels of performance (Ryan & Deci, 2020). Recent research further suggests that behavioural, cognitive, and emotional dimensions of engagement are differentially predictive of academic outcomes, highlighting designable pathways through which need-supportive assessment practices influence learning (Reeve, 2025).

Second, Social Interdependence Theory explains why the quality of collaboration within group-based assessments matters. Positive interdependence fosters promotive interaction, individual accountability, and shared goal pursuit—conditions that enhance individual learning and achievement. Contemporary research in higher education consistently links well-structured group work and high-quality peer interaction to improved learning outcomes and student satisfaction (Johnson & Johnson, 2009; McKay et al., 2024).

Third, the Assessment for Learning (AfL) and Self-Regulated Learning (SRL) perspective conceptualises assessment as a central driver of engagement through feedback, transparency of criteria, and student agency. Recent studies emphasise dialogic and partnership-oriented assessment practices that build students' feedback literacy and self-regulatory capacity, thereby supporting sustained engagement and improved academic performance (Nicol, 2009; Carless & Winstone, 2023; Chan & Chen, 2023).

Taken together, these perspectives suggest that redesigned assessments incorporating collaboration, AI-supported analytical comparison, and structured critical-thinking activities can (1) satisfy students' psychological needs (SDT), (2) create productive interdependence among peers (Social Interdependence Theory), and (3) promote self-regulated learning through feedback-rich assessment design (AfL/SRL). Through these mechanisms, assessment redesign is expected to enhance student engagement and ultimately improve academic performance.

Hypotheses Development

Collaboration quality

Collaboration is effective when tasks promote interdependence, shared meaning-making, and mutual responsibility (Stahl et al., 2014). High-quality collaborative interactions not only improve academic outcomes but also stimulate students' motivation, participation, and sense of belonging, which are the key dimensions of engagement (Fredricks et al., 2004; Kahu, 2013). Peer assessment and feedback processes strengthen this engagement by encouraging active involvement and reflection (Strijbos & Sluijsmans, 2010; Cho & Cho, 2011). Recent research

emphasises that collaboration quality, rather than mere participation, enhances satisfaction and deep learning experiences in digital and blended settings (McKay et al., 2024; Bach et al., 2024). Therefore, high-quality collaboration is expected to foster greater behavioural, emotional, and cognitive engagement among students. In this study, high-quality collaboration is expected to foster greater behavioural, emotional, and cognitive engagement among students. Therefore:

H1: Collaboration quality has a positive effect on student engagement.

AI integration

Integrating AI in higher education through adaptive tutoring systems, chatbots, and intelligent feedback tools has shown promising effects on student learning and motivation. Meta-analytic reviews reveal that AI applications enhance cognitive engagement by providing adaptive feedback and personalised learning experiences (Holmes et al., 2019). In higher education contexts, AI-driven chatbots promote interactivity and immediacy, thereby strengthening students' behavioural and emotional engagement (Winkler & Söllner, 2018). Recent meta-analyses have further demonstrated that AI-supported learning tools enhance complex learning and reflective thinking, indicating a deeper cognitive involvement (Yan et al., 2025; Winkler & Söllner, 2025). In this study, students were encouraged to utilise AI tools, such as ChatGPT, to gather recommendations and critically analyse business contexts, an approach that fosters participation, reflection, and sustained interest. The integration of AI tools is expected to enhance student engagement. Therefore:

H2: AI integration has a positive effect on student engagement.

Critical thinking and analytical skills

Critical thinking is a foundational competency that underpins effective learning and engagement in higher education. Meta-analyses indicate that instructional interventions have a significant impact on improving critical-thinking skills, which in turn enhance students' cognitive and behavioural engagement in learning (Hattie et al., 2014; Abrami et al., 2015). Students with strong analytical skills are more likely to interpret, evaluate, and apply knowledge critically, processes central to cognitive engagement. Recent evidence confirms that critical-thinking interventions not only improve achievement but also stimulate reflective participation and persistence (Batdi, 2024). Similarly, large-scale assessments demonstrate that higher education fosters continuous growth in analytical and reflective capacities, contributing to more meaningful engagement with learning (Van Damme et al., 2023). In this study, students were required to critically analyse AI-generated recommendations and assess their practical relevance, which encouraged deeper thinking and sustained attention. In this study, it is expected that critical thinking and analytical skills are expected to influence student engagement positively. Therefore:

H3: Critical thinking and analytical skills have a positive effect on student engagement.

Student engagement

Prior studies show that engagement is significantly associated with higher grades and persistence, even after controlling for background characteristics (Kuh et al., 2008; Carini et al., 2006). Recent longitudinal evidence similarly confirms that engagement predicts achievement over time, though effects may vary across learners (Zepke, 2018). Furthermore, the meta-analytic evidence demonstrates a moderate association between student engagement



and academic achievement, with behavioural engagement often the strongest predictor (Wong et al., 2024; Reeve, 2025). Kassab et al. (2024)'s longitudinal studies in higher education confirm that engagement mediates the relationship between learning environments and academic performance. In this study, student engagement is expected to enhance academic performance. Therefore:

H4: Student engagement has a positive effect on academic performance.

Research Gaps

Although existing literature provides strong evidence linking engagement, collaboration, AI integration, critical thinking, and academic performance, several important gaps remain.

First, prior studies have often examined these constructs in isolation, focusing on either engagement (Wong et al., 2024; Reeve, 2025), collaboration (McKay et al., 2024), or critical thinking (Batdi, 2024) without considering how they interact within a single framework. This limit understanding of how multiple factors jointly shape student learning outcomes. Second, while AI integration has received increasing attention recently, most research emphasizes its role in adaptive tutoring or feedback systems (Yan et al., 2025; Winkler & Söllner, 2025). Less is known about how AI can be purposefully embedded within assessment design to enhance engagement. Third, critical thinking and analytical skills are frequently conceptualised as higher education outcomes, yet limited empirical work has examined their direct contribution to academic performance within redesigned assessment contexts (Van Damme et al., 2023). Finally, although theoretical perspectives such as Self-Determination Theory (Ryan & Deci, 2020), Social Interdependence Theory (Johnson & Johnson, 2009), and Assessment for Learning (Carless & Winstone, 2023; Chan & Chen, 2023) provide valuable insights, few empirical studies have combined these with contemporary innovations, particularly AI and authentic assessment redesign in a unified conceptual framework.

This study addresses these gaps by testing a model that redesigned assessments, integrated collaboration, AI tools, and critical-thinking activities, enhanced student engagement, and improved academic performance. By positioning assessment design as the central intervention, this research offers theoretical, empirical, and practical contributions to higher education engagement and performance scholarship.

Conceptual Framework

The conceptual framework illustrates the relationships between redesigned assessments and student learning outcomes. It is grounded in established theories of engagement, collaboration, skill development, and technology adoption in education. Student engagement has been widely recognized as a multidimensional construct encompassing behavioral, cognitive, and emotional involvement in learning (Fredricks et al., 2004; Wong et al., 2024). Higher engagement is consistently associated with persistence, achievement, and long-term learning outcomes. Similarly, collaboration quality plays a critical role in shaping performance, as high-quality peer interactions foster accountability, co-construction of knowledge, and deeper learning (Laal & Ghodsi, 2012; McKay et al., 2024).

AI integration represents the use of emerging digital tools to support personalization, analysis, creativity, and efficiency in learning. Recent meta-analyses confirm that AI-based educational

technologies enhance academic outcomes when appropriately embedded into curricula and assessment practices (Dwivedi et al., 2023; Yan et al., 2025). In parallel, critical thinking and analytical skills are essential competencies for navigating complex information and solving problems. These skills, which can be cultivated through structured assessment tasks, have been linked to both academic performance and graduate employability (Facione, 1990; Batdı, 2024).

The framework therefore provides a holistic understanding of how innovative assessment practices can strengthen engagement and prepare students for contemporary, career-oriented challenges.

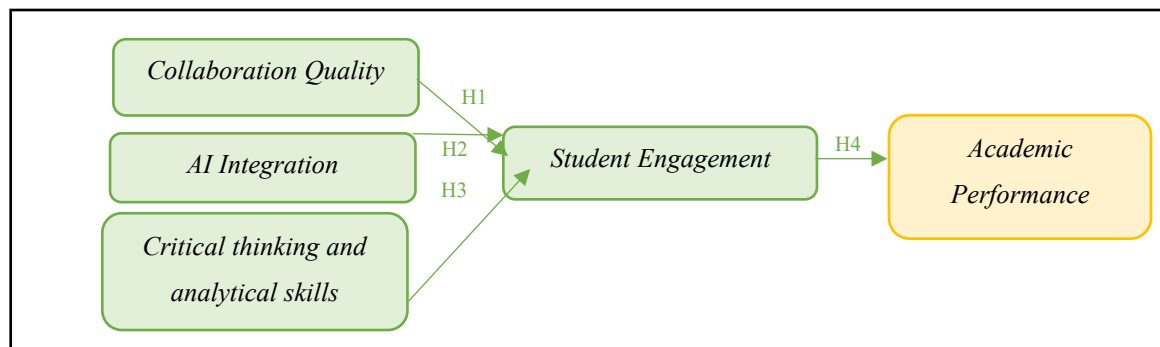


Figure 1: Conceptual Framework of Redesigned Assessments

Building on this conceptual framework, the present study empirically tests the hypothesised relationships between student engagement, collaboration quality, AI integration, critical thinking skills, and academic performance. By situating these constructs within an integrated model, the research seeks to examine the direct effects of each variable.

Methodology

A mixed-methods design was adopted to capture both quantitative and qualitative insights. Quantitative data were collected through a structured questionnaire measuring collaboration quality, AI integration, critical thinking and analytical skills, student engagement, and academic performance. Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to analyse the relationships among variables. Qualitative data were gathered through open-ended reflections to provide deeper insights into students' experiences with the redesigned assessment. A mixed-methods approach is appropriate given the study's aim to capture both measurable learning outcomes and students' perceptions of collaboration, AI integration, and critical thinking development (Creswell & Plano Clark, 2018).

Context and Participants

The study will be conducted in the first-year Bachelor of Commerce (BComm) core unit, Analytics for Decision Making unit at a private offshore University. This large-enrolment unit attracts a diverse cohort of students from accounting, finance, economics, and management majors. Data will be collected from students enrolled in Semester 1 and 2, 2025. Participation in the research component (survey and interviews) will be voluntary, with informed consent obtained from all participants.

Demographic Profile



The demographic characteristics of the respondents indicate that the sample was predominantly female (70.5%), with male students comprising 28.4% and 1.1% preferring not to disclose their gender. Most participants were between 20 and 24 years old (70.5%), followed by those under 20 (23.9%) and a smaller proportion aged 25–29 (5.7%). Consistent with the target cohort, the majority were first-year students (93.2%), with only 5.7% from the second year and 1.1% from the fourth year and above. Prior experience with AI varied: 52.3% reported using AI multiple times, 45.5% had used it only a few times, and 2.2% had no prior exposure. Similarly, AI familiarity levels showed that 65.9% used AI occasionally, 26.1% used it regularly, and 8.0% had never used AI. Overall, the sample reflects a largely first-year cohort with moderate to substantial exposure to AI technologies.

Intervention: Redesigned Assessment

The redesigned assessment aims to align with 21st-century workplace demands by embedding collaboration, advanced data analysis, and AI-supported decision-making. The mid-semester group assessment requires students to apply Modern Portfolio Theory (MPT) in teams of three to evaluate and optimize stock portfolios. Using Excel's Solver tool, students will calculate risk-return trade-offs and determine the optimal Sharpe Ratio.

To integrate AI tools, students will incorporate recommendations generated by ChatGPT into their analysis and critically assess the reliability and limitations of these outputs. Deliverables include a group business report and an Excel model. This design seeks to foster not only technical skills but also academic writing, communication, and teamwork, while reinforcing critical thinking through real-world application.

Variables and Measurement

To empirically test the proposed hypotheses, the study defines key constructs and their measurement items based on established scales in the literature. Latent constructs (student engagement, collaboration quality, AI integration, and critical thinking) will be measured using multi-item Likert scales adapted from prior studies, while academic performance will be assessed using objective scores from the course assessments.

Each construct in this study is operationalised using validated measurement items adapted from established literature to suit the higher education assessment context. Student engagement is conceptualised as the behavioural, emotional, and cognitive investment students demonstrate in learning activities. It is measured through items assessing active involvement in the redesigned assessment, motivation to participate, perceived relevance of the task, and the effort dedicated to completing it, drawing from Fredricks et al. (2004) and Wong et al. (2024). Collaboration quality captures the extent to which students shared responsibilities and interacted constructively during group work. Adapted from Laal and Ghodsi (2012) and McKay et al. (2024), the items evaluate students' enjoyment of teamwork, effectiveness of communication, perceived improvement in collaboration skills, and feelings of inclusion within the group.



AI integration reflects students' perceptions of the usefulness, reliability, and overall impact of AI tools in supporting the assessment process. Guided by Dwivedi et al. (2023) and Yan et al. (2025), the items assess perceived usefulness of tools such as ChatGPT, their role in enhancing group discussion quality, comfort with incorporating AI into learning, and the value of AI-generated insights. Critical thinking and analytical skills, grounded in Facione (1990) and Batdi (2024), are measured through items evaluating students' ability to analyse problems from multiple angles, generate innovative solutions, strengthen problem-solving skills, and work effectively with peers from diverse backgrounds.

To capture academic performance, the study draws on Richardson et al. (2012), assessing students' confidence in completing the redesigned assessment successfully. Finally, the redesigned assessment intervention itself is measured as a construct that integrates collaboration, AI tools, and critical-thinking activities. Items adapted from Carless and Winstone (2023) and Evans et al. (2023) examine the perceived effectiveness of the new format, its inclusiveness, relevance to real-world applications, and students' willingness to recommend the assessment for future cohorts. Collectively, these established instruments enhance both the content validity and the comparability of findings with prior research. All constructs are grounded in validated measures from reputable studies, with adaptations made to suit the higher education context. Using these well-established instruments ensures both content validity and comparability with prior research. The redesigned assessment itself functions as the intervention, operationalized through group-based tasks integrating collaboration, AI tools, and critical thinking activities.

Data Analysis Techniques

Quantitative data will be analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. PLS-SEM is appropriate for this study because the model includes multiple latent constructs and emphasizes prediction of academic performance (Hair et al., 2021). PLS-SEM is also suitable for studies with complex models and relatively smaller sample sizes, making it robust for exploratory and applied educational research. The analysis will follow a two-stage approach, measurement model assessment and structural model assessment (Hair et al., 2021).

Furthermore, qualitative data from open-ended survey responses will be analyzed thematically (Braun & Clarke, 2022) to complement quantitative findings. The integration of quantitative and qualitative results will provide a comprehensive understanding of the impact of redesigned assessments on student engagement and academic performance.

Results

Assessment of Measurement Model

In this study, all constructs were modelled as reflective constructs. For the reflective measurement model, reliability and validity were assessed in terms of scale reliability, convergent validity, and discriminant validity. Scale reliability was evaluated using composite reliability (CR). The CR values for all five constructs ranged from 0.920 to 0.974, exceeding the recommended threshold of 0.70, thereby indicating satisfactory internal consistency.



Convergent validity and discriminant validity at the item level were assessed using factor loadings and cross-loadings, respectively. All items demonstrated factor loadings above 0.60 (ranging from 0.828 to 0.968) and loaded highly on their respective constructs while loading low on other constructs. These results confirm adequate convergent and discriminant validity at the item level.

At the construct level, Average Variance Extracted (AVE) was used to assess convergent validity. In contrast, the Fornell–Larcker criterion, which compares the square root of each construct’s AVE with the inter-construct correlations, was employed to assess discriminant validity. The square roots of AVEs, ranging from 0.791 to 0.924, were all greater than the corresponding inter-construct correlations, providing evidence of satisfactory convergent and discriminant validity at the construct level. Furthermore, a more robust assessment of discriminant validity was conducted using the Heterotrait–Monotrait Ratio of Correlations (HTMT) criterion. The HTMT values ranged from 0.600 to 0.885, which are below the recommended threshold of 0.900, thus further confirming discriminant validity. Overall, the results indicate that the measurement model demonstrates adequate reliability, convergent validity, and discriminant validity, supporting the soundness of the constructs used in this study.



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Construct	Item Code	Outer Loading	Cronbach's Alpha	CR	AVE
Collaboration Quality (CQ)	CQ1	0.968	0.973	0.974	0.924
	CQ2	0.942			
	CQ3	0.980			
	CQ4	0.955			
AI Integration (AI)	AI1	0.934	0.956	0.962	0.884
	AI2	0.941			
	AI3	0.929			
	AI4	0.956			
Critical Thinking and Analytical Skills (CT)	CT1	0.940	0.930	0.951	0.828
	CT2	0.926			
	CT3	0.942			
	CT4	0.828			
Student Engagement (SE)	SE1	0.886	0.915	0.940	0.798
	SE2	0.938			
	SE3	0.907			
	SE4	0.840			
Academic Performance (AP)	AP1	0.916	0.912	0.917	0.791
	AP2	0.865			
	AP3	0.912			
	AP4	0.862			

Assessment of Structural Model

After confirming the adequacy of the measurement model, the structural model was assessed to examine the hypothesised relationships among the constructs. The assessment included tests for path coefficients, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). Path coefficients were used to evaluate the strength and significance of the hypothesised relationships. The results indicate that all hypotheses are supported.

H1: Collaboration Quality $\rightarrow$ Student Engagement ($\beta = 0.510$, $t = 3.872$, $p < 0.001$)

H2: AI Integration $\rightarrow$ Student Engagement ($\beta = 0.168$, $t = 2.103$, $p < 0.001$)

H3: Critical Thinking and Analytical Skills $\rightarrow$ Student Engagement ($\beta = 0.250$, $t = 2.173$, $p < 0.001$)

H4: Student Engagement $\rightarrow$ Academic Performance ($\beta = 0.810$, $t = 16.581$, $p < 0.001$)

These results suggest that collaboration quality, AI integration, and critical thinking and analytical skills have a significant and positive impact on student engagement, which in turn has a strong and positive effect on academic performance. Among the predictors, collaboration quality ($\beta = 0.510$) exhibited the strongest influence on student engagement. The R^2 value for Student Engagement (SE) was 0.687, indicating that collaboration quality, AI integration, and critical thinking and analytical skills jointly explain 68.7% of the variance in student engagement. The R^2 for Academic Performance (AP) was 0.656, suggesting that student engagement accounts for 65.6% of the variance in academic performance.

The f^2 values show the individual contribution of each exogenous construct to the endogenous variables.

Collaboration Quality → *Student Engagement*: 0.314 (medium effect)

AI Integration → *Student Engagement*: 0.061 (small effect)

Critical Thinking → *Student Engagement*: 0.074 (small effect)

Student Engagement → *Academic Performance*: 1.904 (large effect)

The Q^2 predict values, obtained via the PLS-Predict procedure, ranged from 0.298 to 0.666 for Student Engagement indicators and from 0.409 to 0.613 for Academic Performance indicators. All Q^2 values were greater than zero, confirming that the model has strong predictive relevance for both endogenous constructs.

In summary, both the measurement and structural model assessments demonstrate that the model is reliable, valid, and theoretically robust. The findings highlight the pivotal role of student engagement as a direct outcome of collaboration quality, AI integration, and critical thinking, and as a significant predictor of academic performance. These results provide a strong empirical foundation for further discussion on the implications of these relationships in the following section.

Qualitative Findings

To complement the quantitative analysis conducted using SmartPLS, qualitative data were collected from 88 student responses to three open-ended questions. These questions explored students' perceptions of the redesigned assessment's benefits, challenges, and their experience of using AI in group tasks. The responses were coded and analysed thematically using NVivo. Three key themes emerged from the analysis: (1) perceived benefits of the redesigned assessment, (2) challenges encountered, and (3) experiences with AI integration. The qualitative insights provide a deeper understanding of students' learning experiences and support the quantitative results.

Perceived Benefits of the Redesigned Assessment

Analysis of 88 qualitative responses revealed that students identified multiple benefits of the redesigned assessment, primarily related to real-world skill development, proficiency in Excel, collaboration, communication, and the integration of AI tools. These insights highlight that the redesigned assessment successfully promoted active, authentic, and skill-based learning experiences.

Collaboration and teamwork emerged as the most frequently mentioned benefit, particularly in relation to working across campuses and cultural backgrounds. Students highlighted shared responsibility, peer learning, and exposure to diverse perspectives as valuable aspects of the group task:

“Understand and work with different people from other campuses, different backgrounds and so on.” (Student 5)

Development of real-world and analytical skills was another prominent theme. Students described the assessment as relevant and aligned with practical applications, enabling them to



apply theoretical knowledge to realistic decision-making contexts. Eight participants noted that the assessment helped improve their communication skills, particularly in articulating ideas clearly during group discussions.

"The format and question asked is relevant to real world applications." (Student 84)

In addition, students reported improvements in *digital and technical skills*, particularly in Excel and analytical modelling. Hands-on engagement with Excel functions and portfolio optimisation tools was perceived as beneficial for future employability:

"Doing the MPT model in Excel was beneficial, as it taught us how to use it well."
(Student 82)

Overall, these findings suggest that the redesigned assessment fostered active, skill-based learning and strengthened students' engagement through collaboration and the design of authentic tasks.

Challenges of the Redesigned Assessment

Despite the overall positive perceptions, students also reported several challenges that influenced their learning experience. These challenges were grouped into three main areas: understanding assessment requirements, teamwork and coordination issues, and technical or digital difficulties. Some students experienced difficulty *understanding assessment instructions and expectations*, particularly when engaging with unfamiliar tools and datasets:

"The guideline document was a bit confusing." (Student 81)

Teamwork and coordination challenges were also evident, especially in relation to unequal participation, communication breakdowns, and scheduling across campuses and time zones:

"Unequal contribution." (Student 7)

In addition, *technical challenges*, particularly related to Excel functions and data handling, were frequently reported. While these difficulties initially caused frustration, several students acknowledged that overcoming them contributed to learning persistence and skill development:

"Excel quite challenging when I found out there is small mistake and need to rewatch the video again." (Student 73)

These challenges highlight areas for improvement in future iterations, including clearer guidance, structured milestones, and targeted technical support to enhance students' confidence and collaboration.

Experiences of Using AI in Group Assessment

Students reported mixed but largely positive experiences with integrating AI tools, such as ChatGPT, into their group assessments. Two key themes emerged: AI as a learning aid and concerns regarding reliability and trust. Most students perceived AI as a *useful and efficient support tool*, particularly for brainstorming, clarification, and refining ideas when used responsibly:

"AI helps you learn things in a more efficient way saving your time." (Student 28)

However, some students expressed *caution regarding AI accuracy and reliability*, noting the need to verify outputs and avoid over-reliance:

“AI cannot be fully trusted because it gives me inaccurate figures.” (Student 61)

These reflections indicate that students adopted a reflective and critical stance towards AI use, recognising both its educational potential and limitations. The findings suggest that AI can enhance engagement and learning when embedded within structured tasks that emphasise ethical use and critical evaluation.

Overall, the qualitative findings reveal that the redesigned assessment effectively supported student engagement by promoting collaboration, authentic learning, and digital skill development, while also presenting challenges related to coordination, technical complexity, and the responsible use of AI. These insights complement the quantitative results by illustrating how and why the redesigned assessment influenced students’ engagement and academic experiences.

Discussion

The findings provide robust empirical evidence that redesigned assessments integrating collaboration, AI tools, and critical thinking significantly enhance student engagement and academic performance. In alignment with Self-Determination Theory, the redesigned tasks fulfilled students’ intrinsic needs for autonomy, competence, and relatedness. The strong effect of collaboration quality ($\beta = 0.510$) confirms the vital role of social learning and shared accountability in engagement (Johnson & Johnson, 2009). Students reported improved communication and an increased appreciation for diverse perspectives, consistent with previous studies that have emphasised the impact of cooperative learning on motivation and achievement (Reeve, 2025).

The inclusion of AI tools yielded a moderate but significant influence on engagement ($\beta = 0.168$). This aligns with emerging literature that positions AI as a facilitator of personalised and feedback-rich learning environments (Winkler & Söllner, 2025; Yan et al., 2025). Students’ reflections revealed growing digital literacy and ethical awareness, underscoring the importance of teaching responsible AI use to complement, not replace, human judgment.

Critical thinking and analytical skills also showed a notable effect ($\beta = 0.250$), supporting prior findings that authentic, problem-based assessments cultivate deeper cognitive engagement (Batdı, 2024). By embedding real-world scenarios, the redesigned tasks encouraged higher-order thinking and applied learning, thereby bridging the gap between academic and professional skill development. Overall, the study presents a comprehensive model that demonstrates how technology-enhanced and collaborative assessment can enhance both student engagement and academic achievement.

Conclusion

This study advances the understanding of student engagement in higher education by demonstrating how redesigned assessments that integrate collaboration, AI tools, and critical thinking can enhance learning outcomes. Students not only developed analytical and digital competencies but also strengthened essential soft skills, including teamwork, communication,



and ethical reasoning. For educators, the findings underscore the value of intentionally designed assessments that align with authentic, real-world problem-solving. Institutions should incorporate structured opportunities for collaboration, guided AI use, and reflective practice within assessment frameworks. Training on academic integrity and the responsible application of AI is crucial for sustaining responsible innovation.

Limitations and Recommendations for Future Research

While this study provides valuable insights into how redesigned assessments enhance engagement and academic performance, several limitations should be acknowledged. First, the study was conducted within a single university context and involved a relatively small sample ($n = 88$), which may limit the generalizability of findings. Second, the reliance on self-reported data may introduce response bias, as students' perceptions might not fully reflect actual performance. Third, the cross-sectional design limits the ability to establish causality between assessment redesign and long-term learning outcomes. Despite these limitations, the study offers a strong empirical foundation and provides meaningful implications for educators seeking to improve assessment practices through collaboration, AI integration, and critical thinking.

Future research could expand across disciplines and contexts to validate the model's applicability. Longitudinal studies are recommended to explore lasting impacts on employability and lifelong learning. Additionally, future studies could employ paired-samples t-tests or pre- and post-assessment designs to measure how students' engagement, critical thinking, and academic performance improve before and after implementing redesigned assessments. Such approaches would provide stronger evidence of causal relationships and the sustained effects of assessment redesign. As education continues to evolve in an AI-augmented era, purposeful assessment redesign offers a transformative pathway for fostering engagement, equity, and excellence in higher learning.

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LEARNER PERCEPTIONS OF USABILITY, ATTENTION AND RELEVANCE OF AN AI-GENERATED VIDEO ON SELECTIVE BREEDING AND GMOs

Nur Assyakirin Mohamed Paid¹, Norhayati Jais@Mohd Said²

¹Department of Agrotechnology and Bio-Industry, Politeknik Nilai (PNS), Malaysia, (assyakirin.paid@polinilai.edu.my)

²Department of Commerce, Politeknik Nilai (PNS), Malaysia, (hayati_jais@polinilai.edu.my)

Abstract: This study was conducted to evaluate students' perceptions of an AI-generated educational video titled "GMO? Not Always!", with particular emphasis on perceived usability, attention and relevance. A descriptive survey research design was employed, involving a total of 289 respondents. The research instrument was adapted from the Instructional Materials Motivation Survey (IMMS) and previously validated instruments, with high reliability indicated by strong Cronbach's alpha values. The AI-generated video was developed using multiple artificial intelligence technologies such as ChatGPT, Runway, Veo 3, Suno and ElevenLabs. The video presents a narrative-based discussion aimed at addressing and clarifying common misconceptions between selective breeding and genetically modified organisms (GMOs). Findings revealed that the overall mean score was at a high level, with an average mean of 4.14 (SD = 0.78). Descriptive analysis indicated that all three dimensions recorded high mean scores, with usability ($M = 4.28$, $SD = 0.73$), attention ($M = 4.09$, $SD = 0.78$), and relevance ($M = 4.06$, $SD = 0.80$). These results reflect a positive level of acceptance among respondents. Overall, the findings suggest that the video was positively evaluated in terms of content suitability, delivery effectiveness, and its potential application in educational settings. Therefore, the integration of AI-generated instructional videos shows strong potential in enhancing learner engagement and correcting misconceptions in biotechnology education, particularly in topics related to selective breeding and GMOs.

Keywords: Artificial Intelligence (AI), Biotechnology Education, GMO Misconceptions, Selective Breeding, Instructional Video

Introduction

The integration of digital technologies into educational settings has introduced new possibilities for instructional strategies, enabling educators to design more engaging, flexible and student-centered learning environments. Recent studies have shown that effective teaching and learning processes are strongly influenced by the instructional methods and pedagogical skills employed by educators to stimulate learner motivation, attention and active engagement with learning content (Khatter et al., 2024). Multimedia learning resources such as instructional videos have been increasingly adopted to enhance conceptual understanding by combining visual, auditory, and narrative elements that support cognitive processing and meaningful knowledge construction in learners (Mayer, 2024). In this evolving educational landscape, educators are expected to create high quality learning environments that are information-rich, pedagogically sound, and supported by up-to-date instructional materials. The use of emerging technologies such as artificial intelligence has enabled educator to explore innovative instructional approaches and support personalized learning experiences that respond to diverse

learner needs, enhance engagement and improve the quality of educational content (Ruiz-Rojas et al., 2023). Among digital learning resources, instructional videos remain a widely accepted and effective medium due to their capacity to structure information, support visualization of abstract concepts, and sustain learner attention. Recent research highlights that the effectiveness of instructional videos in STEM education depends not only on their design quality but also on the extent to which learners actively engage with the content. While instructional videos are widely used to support learning, meaningful learning outcomes are strongly influenced by learners' cognitive engagement including their attention, strategic interaction with video content and perceived relevance of the material. A recent study demonstrated that students' active engagement with instructional videos significantly support understanding of complex and abstract concepts in science-related subjects (Kuhlmann et al., 2024). In biotechnology education, misconceptions surrounding scientific concepts such as selective breeding and GMOs remain prevalent and can hinder meaningful learning if not explicitly addressed. Koć-Januchta et al. (2022) found that the use of an AI-enhanced biology e-book supported students' conceptual understanding providing clear, accessible explanations and promoting meaningful cognitive processing. Therefore, the use of AI-generated instructional videos presents a promising approach to clarify such misconceptions by delivering accurate scientific explanations in an engaging and accessible manner.

Problem Statement

Although biotechnology concepts such as selective breeding and GMOs are commonly included in the science syllabus, persistent misunderstandings continue to affect learners' conceptual clarity (Koć-Januchta et al., 2022). Aslett et al. (2022) shows that digital media environments facilitate the spread of simplified or misleading information which can reinforce persistent misperceptions about complex issues. In the context of biotechnology, such representations may blur the distinction between conventional breeding practices and genetic engineering. Despite the growing adoption of AI-generated educational media, empirical evidence examining learners' perceptions of usability, attention, and relevance of such videos remains limited, particularly in the context of biotechnology education. Therefore, this study seeks to evaluate learners' perceptions of an AI-generated instructional video designed to address misconceptions related to selective breeding and GMOs.

Methodology

Research Design

This study employed a quantitative research design using a descriptive survey approach to examine three main dimensions in the evaluation of an AI-generated instructional video titled "GMO? Not Always!", which are usability, attention, and content relevance. This approach was selected to obtain a comprehensive overview of respondents' perceptions regarding the acceptance and suitability of the video as a learning support material in teaching and learning. Usability refers to the ease of use, clarity and overall viewing experience perceived by respondents when engaging with the instructional video. This dimension evaluates the extent to which the video is easy to understand, well-structured, and appropriate for instructional purposes. In educational technology research, usability is regarded as a critical factor influencing learners' interaction with digital learning materials and their willingness to engage with instructional content (Koć-Januchta et al., 2022). Attention measures the ability of the instructional video to capture and sustain learners' interest throughout the viewing process.



This dimension encompasses elements such as visual appeal, character design, narrative flow, and clarity of presentation. Prior research has shown that instructional materials incorporating well-designed visual representations are effective in maintaining learner attention and supporting cognitive engagement especially when addressing complex scientific concepts (Guo et al., 2020). When combined with narrative structures, instructional materials may further enhance learners' engagement and understanding. Relevance refers to the extent to which the content of the instructional video aligns with learning objectives and is perceived as meaningful and applicable within the learning context. In this study, relevance evaluates how well the video content supports conceptual understanding related to selective breeding and GMOs. Learning materials that are perceived as relevant have been shown to enhance learner motivation among students (Jamaluddin et al., 2020; Loorbach et al., 2014).

Sample

A total of 289 respondents participated in this study, comprising of students from various departments at a polytechnic in Malaysia. The respondents were selected using a convenience sampling method based on their willingness to watch the AI-generated video and complete an online questionnaire.

Research Instrument

Data were collected using a structured questionnaire adapted from the Instructional Materials Motivation Survey (IMMS). The instrument was designed to measure respondents' perceptions of the AI-generated instructional video across three dimensions, namely usability, attention, and relevance. The questionnaire consisted of items modified to suit the context of evaluating an instructional video on selective breeding and GMOs. All items were measured using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The adapted instrument was reviewed to ensure clarity and suitability for the study context, and it was administered online to facilitate data collection. The IMMS is a well-established instrument grounded in the ARCS Model of Motivational Design and has demonstrated high internal consistency and reliability in previous validation studies. For instance, Junaidah Jamaluddin et al. (2020) and Loorbach et al. (2014) reported an overall Cronbach's alpha value of 0.94, with alpha values exceeding 0.76 across individual constructs, indicating strong reliability of the instrument.

Data Collection and Analysis

Respondents were required to independently watch the AI-generated instructional video via a provided link before completing an online questionnaire administered using Google Forms. The questionnaire comprised demographic information and respondents' evaluations of the video content based on three main constructs, namely usability, attention, and relevance. This procedure ensured that all respondents had adequate exposure to the instructional video prior to providing their responses. The data collected were analysed using Microsoft Excel. The analysis involved descriptive statistical methods, including the calculation of mean scores and standard deviations for each item and construct. In addition, mean comparisons were conducted based on respondent categories such as gender and age to provide further insight into perception patterns. Mean scores were interpreted using a five-point Likert scale interpretation

table, adapted from the guidelines proposed by Joshi et al. (2015) and Nur Hawa and Ghazali (2018) to determine the levels of respondents' perceptions.

Results

Overall Perception of the Instructional Video

The overall analysis indicates that respondents demonstrated a high level of acceptance towards the AI-generated instructional video "GMO? Not Always!". The overall mean score across all constructs was 4.14, with a standard deviation of 0.78. Based on the five-point Likert scale interpretation adapted from Joshi et al. (2015) and Nur Hawa and Ghazali (2018), usability was interpreted at a very high level while attention and relevance were interpreted at a high level as presented in Table 2.

Table 1: Interpretation of Mean Scores for the Five-Point Likert Scale

Mean Score Range	Interpretation
1.00 – 1.80	Very Low
1.81 – 2.60	Low
2.61 – 3.40	Medium
3.41 – 4.20	High
4.21 – 5.00	Very High

Source: Joshi et al. (2015); Nur Hawa & Ghazali (2018)

Table 2: Overall Mean Scores for Each Construct

Construct	Mean	Interpretation
Usability	4.28	Very High
Attention	4.09	High
Relevance	4.06	High

Perception Based on Usability

The usability dimension recorded the highest mean score among the three constructs, indicating that respondents perceived the instructional video as highly user-friendly and suitable for learning purposes. Responses to the usability items suggest that the video was easy to understand, clearly presented, and effective in supporting the learning process, with particular emphasis on clarity of explanation, concise presentation, and good audio quality.

Table 3: Summary of Questionnaire Items for the Usability Aspect

No	Item	Mean	SD
1	The video helps facilitate my learning process.	4.26	0.70
2	The video enhances my understanding of the topic.	4.41	0.68
3	The video is concise and does not require excessive time to watch.	4.26	0.74
4	The video is easy to understand.	4.33	0.70
5	I would consider using this video as a learning tool.	4.15	0.79
6	I am satisfied with my experience watching this video.	4.25	0.74
7	The video has clear audio quality.	4.31	0.77
Mean Average		4.28	0.73

The positive usability perceptions indicate that the instructional video did not impose unnecessary cognitive or time demands on learners, allowing them to focus on conceptual understanding rather than technical aspects of the media.

Perception Based on Attention

The attention construct recorded a mean score of 4.09 with a standard deviation of 0.79, indicating a high level of attention based on the five-point Likert scale interpretation adapted from Joshi et al. (2015) and Nur Hawa and Ghazali (2018). This result suggests that respondents generally demonstrated positive perceptions towards the ability of the instructional video to capture and sustain their attention. As presented in Table 4, the mean scores for the attention-related items indicate that respondents perceived the video as visually engaging and able to maintain interest throughout the viewing process. Overall, the findings show that the AI-generated instructional video was effective in attracting respondents' attention at a high level.

Table 4: Summary of Questionnaire Items for the Attention Aspect

No	Item	Mean	SD
1	There is something interesting at the beginning of the video that captures my attention.	4.13	0.79
2	The video is visually appealing and engaging.	4.24	0.74
3	The content of the video is meaningful.	4.13	0.76
4	The way information is organised in the video helps maintain my attention throughout.	4.12	0.76
5	The information presented in the video stimulates my curiosity.	4.10	0.76
6	I encountered several surprising and unexpected elements while watching the video.	3.89	0.84
7	The balance of audio-visual elements in the video keeps me engaged with the content.	4.05	0.83
Mean Average		4.09	0.78

Perception Based on Relevance

The relevance construct recorded a mean score of 4.06 and a standard deviation of 0.81, indicating that respondents generally perceived the video content as relevant and appropriate to the learning objectives related to selective breeding and genetically modified organisms (GMOs). This finding suggests that the instructional video was perceived as meaningful and applicable within the context of biotechnology education.

Table 5: Summary of Questionnaire Items for the Relevance Aspect

No	Item	Mean	SD
1	The video clearly shows how the content relates to my existing knowledge.	4.01	0.79
2	Successfully completing the learning from this video feels important to me.	4.05	0.76

3	The content presented in the video is relevant to my interests.	3.98	0.87
4	The video provides clear explanations or examples of how knowledge can be applied.	4.12	0.78
5	The audio and visual content of the video effectively conveys the importance of the topic.	4.10	0.77
6	I can relate the content of this video to things I have seen, done, or thought about in my own life.	4.00	0.83
7	The content of this video is useful to me.	4.09	0.83
8	The instructional video serves as a good reinforcement of concepts I already know and helps deepen my understanding.	4.13	0.77
Mean Average		4.06	0.80

Discussion

Overall, the findings of this study indicate that learners held positive perceptions of the AI-generated instructional video, suggesting that it has potential as an effective learning support resource in biotechnology education. The high mean score for the usability construct shows that learners perceived the video as easy to understand, well-structured, and comfortable to engage with, which is particularly important when addressing complex and misconception-prone topics such as selective breeding and genetically modified organisms (GMOs).

The positive usability perceptions suggest that the instructional video presented information in a clear and logically organised manner, enabling learners to focus on understanding key scientific concepts rather than managing presentation-related difficulties. According to the Cognitive Theory of Multimedia Learning, learners benefit when instructional materials are designed to minimize unnecessary cognitive demands and present information in a structured and cognitively manageable way, thereby supporting meaningful learning processes (Mayer, 2024). When learning materials are easy to navigate and understand, learners are better able to allocate their cognitive resources on understanding core content.

Furthermore, respondents' perceptions indicate that the narrative delivery, together with the quality of the audio-visual elements, supported comprehension without imposing unnecessary cognitive or time demands. This finding is consistent with research showing that the usability of digital learning materials plays a crucial role in reducing extraneous cognitive load, which in turn facilitates learner engagement and effective interaction with content (Koć-Januchta et al., 2022). Reduced extraneous cognitive load allows learners to concentrate on constructing meaningful knowledge rather than coping with poorly designed instructional features.

In addition, previous studies have shown that well-designed digital learning resources with high usability support easy and clear interaction with learning content and enhance the overall effectiveness of instructional materials (Djuwari et al., 2025). In the context of this study, the clear presentation, concise delivery, and coherent storyline of the AI-generated video may have contributed to an efficient learning experience by presenting essential biotechnology concepts in an accessible manner. This suggests that good usability in educational resources is a key factor in supporting learners' understanding and engagement, particularly in science education where abstract concepts and misconceptions are common.

Although the attention and relevance constructs recorded slightly lower mean scores compared to usability, both constructs remained at a high level indicating positive learner perceptions towards the AI-generated instructional video. These findings suggest that the video was still effective in capturing and sustaining learners' interest throughout the viewing process. The positive attention-related perceptions suggest that the instructional video was able to maintain learners' focus through its visual presentation, narrative flow, and overall pacing. Attention is a key component for meaningful learning as it functions as the gateway between information and cognitive processing. Learners must first attend to instructional content before they are able to actively process and integrate new information, particularly when dealing with complex scientific concepts such as selective breeding and genetically modified organisms (Keller et al., 2020). When learners remain attentive, they are more likely to actively process information rather than engage in passive viewing. Prior research has shown that instructional videos that successfully sustain learner attention support deeper cognitive engagement and improve learning experiences, especially in STEM-related contexts (Kuhlmann et al., 2024).

The use of a narrative-based structure may have contributed to maintaining learners' attention by contextualizing scientific explanations within a coherent storyline. Tobler et al. (2025) report that narrative elements can help learners follow the progression of ideas more easily and remain engaged with the content, rather than becoming overwhelmed by isolated facts. Research on instructional video design indicates that videos which integrate engaging structures and meaningful sequencing are more effective in sustaining attention and supporting cognitive engagement than purely expository formats (Lackmann et al., 2021).

In terms of relevance, the high mean score indicates that learners were motivated to engage with the AI-generated video when the content is perceived as meaningful and applicable. This suggests that the video helped them relate the concepts of selective breeding and GMOs to their existing knowledge and learning needs. Within Keller's 1987 ARCS motivational framework, relevance is a key factor in sustaining learners' motivation by ensuring that instructional materials align with learners' goals, interests and real-world context (Soydaş & Akyazı, 2021). Johansen et al. (2023) demonstrated that increasing content relevance significantly enhances autonomous forms of motivation, effort, and vitality among higher education STEM students, as learners are more likely to internalize learning activities when they perceive clear value and personal meaning in the content. Similarly, studies by Loorbach et al. (2014) and Jamaluddin et al. (2020) have shown that instructional materials perceived as relevant are more effective in promoting learner motivation and engagement. Specifically, instructional videos that simplify complex topics and connect them to real-world contexts have been shown to enhance perceived value among learners and foster more engaging learning experiences (French et al., 2023). In the context of this study, the contextualization of biotechnology concepts within commonly encountered misconceptions may have enhanced learners' perceptions of relevance, thereby supporting deeper conceptual understanding.

Conclusion

In conclusion, this study investigated the perceptions towards the AI-generated instructional video "GMO Not Always" by looking into three different constructs which were usability, attention and relevance. Our findings reveal that it was positively perceived by students across all three constructs indicating that the video was easy to understand, engaging to watch and valuable for supporting their academic understanding of complex biotechnology concepts. This



suggests that the integration of artificial intelligence in instructional video development can contribute positively to the design of engaging and meaningful learning resources. As educational contexts increasingly demand learning materials that are interactive, relevant, and aligned with learners' real-world experiences, AI-driven instructional design offers promising opportunities for educators to innovate their teaching practices. The use of narrative and multimedia elements can help bridge the gap between abstract scientific concepts and learners' existing knowledge. In conclusion, this study supports the use of AI-generated narrative-based instructional videos as a potential learning support tools in biotechnology education. Future studies are encouraged to extend this work by examining the impact of such instructional videos on learning outcomes and conceptual change, as well as exploring their application across different educational contexts and disciplines.

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THE INTEGRATION OF TRADITIONAL MALAY ARCHITECTURAL PRINCIPLES INTO THE DESIGN OF MODERN MALAYSIAN THEME RESORTS

Ping Xu¹, Fauzi Naeim Mohamed²

¹Faculty of Creative Industry, City University Malaysia, Malaysia, (18992729568@163.com)

²Centre of Graduate Studies, City University Malaysia, Malaysia, (naeim@unikl.edu.my)

Abstract: *The intersection of culture, architecture, and tourism has become an essential dimension in shaping the identity and competitiveness of contemporary theme resorts. This literature review examines the integration of traditional Malay architectural principles—such as spatial planning, material use, climatic adaptability, and symbolic expression—into the design of modern Malaysian theme resorts. Drawing on multidisciplinary sources from cultural tourism, architectural sustainability, and hospitality design, the review highlights how vernacular Malay architecture embodies eco-friendly and socio-culturally responsive practices that align with global sustainability trends. Case studies including Kampung Tok Senik, Pelangi Beach Resort & Spa, and Marang Eco-Resort illustrate how architectural authenticity, local craftsmanship, and cultural storytelling contribute to guests' emotional attachment and enhance community engagement. However, the rapid modernisation of Malaysia's construction industry and the dominance of homogenised global design trends threaten the preservation of traditional design logic and identity. The review concludes that reinterpreting traditional Malay architectural values within contemporary resort frameworks offers both aesthetic distinctiveness and cultural sustainability. By aligning cultural heritage with modern design innovation, Malaysia's theme resort industry can achieve a competitive advantage that supports heritage conservation, environmental responsibility, and authentic visitor experiences.*

Keywords: *Malay architecture, theme resort design, cultural heritage, sustainable tourism, Malaysia, vernacular architecture, cultural authenticity*

Introduction

Background of the Study

Cultural tourism has become a key area of the global hospitality industry in recent years as seeing a convergence of architecture, tourism, and culture. Recent research indicates that Culture is a significant factor in determining a tourist's intention to visit and their level of satisfaction (Wang, Yang, & Li, 2021). Tourism is the social mechanism which allows for culture to influence a visitor's perceptions of places (Mousavi, 2016). As a result, the design of buildings should not only provide an aesthetic approach and functional purpose but also serve as an imaginative expression of cultural identity that delivers heritage value and experience to visitors. The theme resort industry is a perfect example of merging culture and design. Theme resorts all over the world provide opportunities for visitors to be immersed in their cultural environment by providing an immersive cultural experience that highlights the identity, lifestyle, and traditions associated with a particular region. From Disney's fantasy architecture to Korea's Hanok-style guesthouses, themed environments represent an important part of the



way that visitors experience local culture and tell local stories (Gottdiener, 2020; Kang, 2016). In Malaysia, the global trend towards creating theme resorts can be used as a basis for blending the rich diversity and richness of Malaysia's own culture and architecture through the modern reinterpretation of Malay design principles within contemporary resort architecture. The Traditional Malay House is an example of how to create a climate-responsible, sustainable, culturally embedded design. Traditional Malay architecture is a result of the adaptation to tropical climates over centuries and refers to using natural materials, such as timber, bamboo, and palm fronds, using design principles that provide optimum ventilation, shading, and spatial flow (Ali Ariff et al., 2024; Noor & Kovács, 2024). The rapid pace of modernisation and the globalisation of architecture have gradually replaced traditional forms with modern forms (Beh et al., 2023). Therefore, the majority of contemporary Malaysian resort architecture lacks cultural integrity and a clear sense of place.

Although over the last few decades, the theme park industry has adopted cultural theming, the majority of modern theme parks do not reflect a true cultural representation of Malaysian culture. There is research conducted that states the majority of regional-cultural themed hotels will have a set standard design with very minimal local/regional variations. By doing this, it weakens cultural representations, as well as, decreasing visitor satisfaction (Sun, 2021; Buchanan, 2019). The biggest issue facing modern-day theme parks isn't just the aesthetics of copying, but how the traditional values of Malay Architecture (which include, harmony with nature, symbolism, and communal spaces) will be interpreted and integrated into modern-day resorts and theme parks. With that said, modern-day resorts and theme parks have lost many of the original spiritual aspects, adaptive qualities, craftsmanship, and natural materials within the modern design relying upon many of imported construction materials and design concepts to produce these types of structures. Although multinational hotel companies tend to focus on providing a luxury product, many of the spiritual elements of the Malay architectural identity provide little to no guidance or direction for how this will be integrated into the design of modern-day theme park resorts (Samat et al., 2024; Yusof et al., 2025). The disconnect of these two elements creates two problems for Malaysia — the loss of its architectural heritage, as well as the homogenising effect where all forms of tourism are created to look similar.

Research Objectives

1. Identify the core design principles and cultural values inherent in traditional Malay architecture.
2. Examine how these principles have been applied or reinterpreted in selected Malaysian theme resorts.
3. Evaluate the impact of such integration on guest experience, cultural authenticity, and sustainability.
4. Propose strategies for architects and designers to enhance cultural identity through architectural innovation.

Research Questions

1. ·What are the defining architectural characteristics and symbolic meanings of traditional Malay dwellings?
2. ·How are these architectural principles reflected in the design of contemporary Malaysian theme resorts?



3. ·In what ways does integrating traditional Malay elements influence guest perceptions and cultural experiences?
4. ·What challenges and opportunities exist in balancing modern functionality with cultural authenticity?

Significance of the Study

This research contributes to the body of knowledge regarding vernacular architecture and cultural sustainability by illustrating how a traditional Malay architectural style and logic may be interpreted in the context of contemporary hospitality operations as an approach to design. Furthermore, it builds on the existing research that has explored the relationship between a culture's identity and the development of its tourism industry (Thompson 2012, Lee 2020, Perry 2023) by presenting architecture as an avenue for people to experience and maintain their culture.

This research provides a framework for architects and resort developers to incorporate traditional Malay architectural knowledge into their resort designs while ensuring they are commercially viable. By adopting Malay architectural values that include such concepts as natural ventilation, elevated structures, and intricate ornamentation, modern resorts can be both ecologically sustainable and culturally authentic. Additionally, building relationships with local craftspeople and communities—as evidenced in resorts such as Kampung Tok Senik and Marang Eco-Resort—provides for economic participation of these groups in the design process and product development (Rizal and Ahmad 2025, Petrucci 2023).

For policymakers, this study identifies the need for support of culturally relevant tourism architecture through incentives, design guidelines, and heritage preservation programs. The incorporation of a Malay architectural identity into the framework of Malaysia's tourism infrastructure also supports the country's long-term national goals for cultural preservation, sustainable development, and differentiation of its tourism destinations from others worldwide.

Scope and Limitations

The focus of this research is on Malaysian themed resorts using cultural thematic or architectural themes specifically based on Traditional Designs of Malay. Global examples provide context, but the primary emphasis remains that of Malaysia's own domestic architectural development. Analysis uses secondary sources only - i.e., secondary sources, such as published research, architectural reviews and case studies. As such, the results of this analysis will be interpretive/conceptual in nature and designed to support future empirical investigations.

Literature Review

Cultural Influence on Theme Resort Design

Tourism destinations are influenced by culture. Culture has a profound influence on the design, identity, and experiential quality of the tourism destinations where tourists will visit. It governs not only how spaces are perceived but also how they convey meaning and emotions to visitors. Culture has been shown in many studies of cultural tourism to be an important factor in an individual's likelihood of visiting a tourism destination. Culture plays a role in an individual



's motivation and satisfaction when visiting a tourism destination (Wang, Yang & Li, 2021). Because tourism is a social process, culture has a transformative relationship to cultural attitudes and opinions, and it affects how individuals understand and connect to the place they have visited (Mousavi, 2016). Kang (2016) and Thompson (2012) also note that culture influences visitor behaviour and enhances the educative experience that visitors can have at tourism destinations; this makes tourism destinations spaces where visitors can recreate and learn about the culture(s) to which they belong. Lee (2020) identifies the concept of cultural worldview as the way an individual evaluates and interprets a tourism destination based upon the individual's own cultural values and beliefs. Visitors to a tourism destination often use a "lens of perception" to engage with the culture, so guests often compare their cultural knowledge to the culture they have experienced (Huang et al., 2022). Visitors' cultural identity is therefore an important asset for tourism destinations and resorts. When architecture reflects the culture, it provides beauty and creates a story of belonging for the visitor. The Hanok is an example of how a traditional structure is a cultural artefact and experiential vehicle for culture. Staying in a Hanok provides an embodied understanding of the traditional way of life, and therefore architecture becomes a means of cultural education (Kang, 2016). In theme resorts, culture is the basis for differentiating the resorts and creating a competitive advantage. Madeddu and Zhang (2017) state that the addition of cultural theming to the design of theme resorts adds depth and meaning to the resort's design. Theme resorts are transformed into environments where storytelling and symbolic expression can occur. Sun (2021) has noted that when theme resorts use local culture, they establish a unique selling proposition for their guests, enriching their experiences through meaningful immersion instead of superficial decorations. However, the theme is often rapidly commercialised and, in the process, mimics the excess of commercialisation found in Western theme parks, such as Disneyland (Gottdiener, 2020; Shaw & Williams, 2004) and other locations and therefore loses its authentic cultural narrative. The examples above illustrate the dual nature of cultural theming. On the one hand, there may be opportunities for immersion through cultural theming. Conversely, excessive commercialisation can trap culture and reduce it to mere spectacle. The challenge for Malaysian resorts will be to create distinction through both cultural authenticity and experiential immersion.

Global Infrastructure and Challenges of Theme Resorts

As a direct result of tourist expectations changing from just safety and comfort, to an increase in the number of people that want to escape somewhere, resorts have emerged as a theme-based way of escaping to a hotel that is more like a museum of some sort. Unlike standard hotels or resorts, themed resorts provide visitors with a sense of belonging and experience and allow for them to engage with a history or story about the culture, environment, or area they are staying in (Hsu & Huang, 2015). Research continues to identify a problematic trend with resort themes where even though many guests are attracted to the idea of cultural themes; many resorts do not represent the actual culture of the community that is being presented in their design of the resort. In the case of resorts in China, the resort designs are primarily the same type of style or theme, with minimal uniqueness in design or creativity, or cultural specifics, leading to reduced levels of guest satisfaction and bad reputations (Buchanan, 2019; Soflaei, 2016; Sun, 2021). When creating a theme resort the priority of the developer is to create an aesthetic experience rather than being authentic or representative of the culture of the area or community in which the resort is located. Cultural authenticity is critical when creating a theme-based resort.



Alfakhri (2017) stresses that theme resorts which utilise authentic aspects of the local culture must include the traits derived from that area or community and not those of a foreign or synthetic origin. Similarly, García-Hernández (2017) stresses that a theme-based resort's decorative and spatial style should visually suggest a recognisable cultural identity while still being distinctive both functionally and emotionally. Types of design elements such as interior room configuration or layout, the types of ornamental pieces that are used to develop the character of each themed area, and the types of materials used to create the resort are critical in expressing the meaning of culture. Brown (2018) notes the first point of contact in the resort (e.g., the lobby) should reflect the local/region's character to develop a sense of place. A resort's infrastructure and the way it provides services may also play a role in how the resort transmits a message about its culture. Jiang and Ritchie (2016) argue that a culture's identity can be reinforced by the type of uniform worn by resort employees, the types of food served within the resort, and any symbols or motifs associated with the service design. Brown (2017) also emphasises that the quality of infrastructure influences a guest's perception of authenticity and comfort. Resort owners that provide access to local food cultures, include artisan skills in constructing the resort, and include a safety-conscious design create more than just a practical place for their guests to reside; they provide their guests with a cohesive story or culture about the resort. Thus, a themed resort's infrastructure must be viewed as an holistic unit of architecturally designed space paired with service delivery, and a descriptive representation of a themed resort.

Malaysian Architectural Identity in Theme Resort Design

Architectural design is influenced by cultural, environmental and social factors and reflects the needs and capabilities of those conditions in a manner that provides both aesthetic value and functional advantage. In Malaysia, traditional or indigenous architecture, particularly the house of the Malay people, represents an advanced integration of architectural form with the climatic characteristics of the regions of Malaysia and the ceremonial cultural association of the design elements of Malay architecture, thereby creating an identity within the architectural discourse. The "Malay house" exemplifies 'green' or sustainable design principles, which include higher floor level for ventilation purposes, the use of sloped roof to drain water away from the structure, and natural construction materials such as timber, bamboo, and palm fronds. While there are many reforms taking place in the Malaysian construction sector, Beh et al. (2023) indicate that these reforms have negatively impacted the traditional style of construction, displacing traditional influences and eroding the sustainable design aspects that are fundamental to Malay architecture. Nonetheless, vernacular architecture is still a viable model for designing resort properties in the contemporary context due to the established relationship between sustainable design principles and continued culture.

Architecture as a Cultural and Experiential Medium

Architecture at themed resorts functions as a bridge between culture and experience. It represents the community's social and environmental values, as well as how the visitor will perceive and interact with that environment. Williams (2006) and Wang (2017) state that authentic cultural assets integrated into the design will help define the aesthetic identity and competitiveness of the resort. The trend in modern resort design is shifting from functionally minimalistic designs to experience-driven design. Resort Designs now focus on the combination of narrative-driven architecture, visual design, sensory engagement and local



symbolism. Floričić (2022) troubleshoots the new importance of sensory design -especially scent, light and material texture- and how they create emotional connections between guests and place. In the cultural context of Malaysia, the cultural identity expressed through architecture is evolving into a construct of “living heritage” where guests are actively involved in the local story. This method supports cultural sustainability by enabling the preservation of traditional values in a manner that is dynamic rather than static.

Methodology

This chapter provides a methodological framework for investigating how traditional Malay architecture can be integrated into the design of modern Malaysian themed resorts. It will provide details of the research design, the means of collecting, analysing and interpreting the data, and the ethical considerations which have guided the study. The methodological framework developed for the research is primarily qualitative and interpretative, which allows the researcher to explore ways in which cultural values and architectural identity are embedded in the built environment and how these design elements contribute towards sustainability and guest experiences.

Research Design

This study takes an exploratory approach; therefore, it uses qualitative methods to explore the qualitative aspects of architecture. Qualitative inquiry allows one to better understand the meaning, narrative, and symbolism within the discipline of architecture, particularly regarding those elements and buildings that represent cultural or aesthetic phenomena that cannot easily be quantified (Creswell & Poth, 2018). This research study is structured as a descriptive/interpretive case study and uses the case study methodology to conduct an in-depth analysis of existing examples of Malaysian-themed resorts which show varying levels of integration of traditional Malay architecture. This study aims to provide insights into the analytical generalisation of findings rather than develop statistical generalisation, in that the findings of the study are meant to provide consultants with ideas about how to develop concepts and the ability to use them in actual design practice. This research methodology combines two major methodologies; Literature-Based Analysis - A systematic literature review that investigates academic literature regarding vernacular Malay architecture, cultural sustainability, and themed resort design. Comparative Case Study Analysis - A comparative analysis of selected examples of Malaysian-themed resorts that illustrate how designers have reinterpret the integration of traditional Malay architecture within contemporary hospitality designs.

Research Framework

Within the study, three overlapping theoretical perspectives are utilized and found in the literature review: Vernacular Architecture Theory - considers the relationship between the way buildings were created from their geographic settings (environment), the construction materials used (material culture), and how these structures represent the values and beliefs of a society (socio-spiritual context) (Soini & Dessein, 2016). A Framework for Cultural Sustainability - focuses on the need to conserve local culture and identity through the use of modern day designs (Williams, 2006; Wang 2017). A Theory of Experiential Design - identifies architectural spaces as an opportunity for emotional connection and storytelling about diverse



cultures, often through tourism (Williams, 2006; Wang, 2017). Each of these theoretical frameworks helps to establish research questions, provide a framework to interpret findings, and evaluate the authenticity of a design and the experience it offers to guests.

Data Collection

This research draws heavily upon earlier research or documentation. Examples include; academic journals, conferences and thesis etc. about vernacular architecture, theme parks, and tourism., Also referred to architectural case studies of resorts in Malaysia. Examples of periodicals/literature reviewing some of the many forms of Malay architecture include; books (e.g., "Traditional Architecture in Malaysia"), reports concerning tourism Development in Malaysia and principles of sustainable development related to architecture. This literature has been reviewed by the authors and helps develop an understanding of the concepts and principles pertaining to design, culture, and sustainability for the purpose of aiding the identification of the design principles, cultural characteristics and sustainability concepts that apply to the design of Malay vernacular architecture.

Three resorts located in Malaysia were selected for this study because they implemented Malay architectural themes, used cultural stories as part of their design, and included sustainable design elements: Kampung Tok Senik Resort (Langkawi) - Represents the way kampungs (villages) used to be built by having raised platforms where the chalets sit, as well as very elaborate wood carvings around the outside of the chalets that reflect the true Kampung way of living. Pelangi Beach Resort & Spa (Langkawi) - Provides a beachside setting along with modern conveniences, while incorporating elements of the Coastal Malay building style, including the use of steep-pitched roofs and open-air verandas. Marang Eco-Resort (Terengganu) - The eco-resort model represents how *rumah serambi*, or Rumah Serambi, typologies have adapted to their ecological surroundings by incorporating Natural Ventilation, Building on Stilts, and using locally-sourced materials to create a sustainable coastal building design. The selection criteria included direct references to Malay architectural principles within the design documentation and/or marketing materials; the visible use of traditional materials and/or spatial planning; and recognition for sustainability and/or cultural authenticity within the academic and/or professional documents. Collectively, these examples illustrate how the architectural heritage of the Malay culture has been reinterpreted through the use of different typologies (e.g., rural, coastal, eco-resort).

Data Analysis

Using the thematic analysis technique to evaluate the data collected enabled identification of patterns among cultural symbolism, design principles and sustainability practices.

The process of familiarization included reading and reviewing all literature relevant to architecture, as well as architectural examples and visual information. The goal was to identify the major characteristics of architecture and culture. Additionally, through coding, themes related to material types, organisation of spaces, symbolic use of ornamentation, and ways of adapting to climate conditions were developed. Through this process of coding, patterns emerged that indicated overarching or general concepts, such as sustainability based on vernacular knowledge, symbolism and identity, and meaning through experience. The newly



developed themes were examined in concert with the theories identified in earlier chapters—vernacular architecture theory; cultural sustainability; experiential design—to maintain consistency with the aims and objectives of this research.

The four analytical dimensions used to evaluate each of the case study resorts were derived from the literature: architectural authenticity, cultural integration, environmental responsiveness, and guest experience. Architectural authenticity measures how well each resort is designed with respect to authentic Malay architectural forms, motifs, and materials. Cultural integration measures how well the design of the resort facilitates interaction and engagement with local communities and represents living traditions. Environmental responsiveness measures how well each resort uses environmentally friendly design as well as the use of sustainable materials made from local resources. Finally, which are measured by how the arrangement of the rooms and the quality of design of the rooms affect the emotional/physical reactions of the customers to our resorts.

As this study's methodological approach is based on an interpretation of actual data rather than using any statistical methods to obtain results, it enables a more thorough analysis of how resort designs reflect Malay architectural heritage. The interpretation of this data allows for greater cultural and environmental cohesion between the resorts and their associated Malay architectural heritage.

Findings and Discussion

The chapter highlights the results of researching literature and conducting case-study analysis, using both sources to investigate how Malay architecture was integrated into modern hotels located in Malaysia. It examines how the vernacular design logic, cultural symbolism, and environmental adaptation of traditional Malay architecture are being interpreted and applied in the context of modern hotel development. The chapter also discusses how the use of traditional Malay architectural principles influences the guest's experience at the hotel, how it promotes sustainable practices, and how it helps to create a culturally authentic environment. The findings have been categorised into four themes: architectural authenticity, cultural integration, environmental responsiveness and guest experience. The rationale for using these four themes for discussion is based on the data from the case study as well as the related theoretical literature outlined in Chapter 2.

Architectural Authenticity

The authentic expression of architectural form is one of the hallmarks of how Malay architecture is conceptualised in the design of resorts. Architectural authenticity is the authentic use of building forms, materials and construction techniques found within the culture, as opposed to a decorative or imitative reproductions of these elements. An example of a truly authentic architectural design in a resort is Kampung Tok Senik Resort in Langkawi. Kampung Tok Senik Resort's design incorporates the same organic arrangement of traditional Malay kampung's (village) raised timber chalets, peaked roofs, wide sweeping verandahs and ornamental timber panels (ukiran kayu). These elements are not only visually compatible with traditional Malay architectural styles, but are also significant symbols of cultural beliefs concerning humility, community and harmony with nature. Wood, fast growing, locally-



harvested timbers and traditional Japanese-style joinery are used for construction, along with design principles that allow for a more flexible use of space within the resort. This approach has resulted in the preservation of the architectural authenticity and environmental sustainability inherent in Malay culture, while at the same time allowing the use of architectural techniques and designs to satisfy contemporary hospitality functions. Conversely, Pelangi Beach Resort & Spa utilises the characteristic design language of traditional coastal Malay architecture, but the design is an adaptation for the purpose of creating luxury accommodations within a resort-style complex. The resort incorporates vernacular design principles such as pitched roofs, wide open pavilions and timber framing into a more conventional architecture of a structured resort complex. Although some resort structures are constructed of modern building materials, the rhythm of the spatial shapes of the various spaces, and the design vocabulary, are consistent with the Malay culture. Therefore, the authenticity of design for Pelangi Beach Resort & Spa does not mean to solely reproduce the visual elements of the traditional Malay architecture; rather, the design of Pelangi Beach Resort & Spa demonstrates that authentic design is possible when traditional design elements are reinterpreted in a sensitive manner that maintains their symbolic intent and their contextual relationship to the environment. A further example of the convergence of architectural authenticity and sustainability can be seen in Marang Eco Resort in Terengganu, which is a hybrid of both of these styles. Inspired by the traditional rumah serambi architectural design, the Marang Eco-Resort utilises raised timber platforms, large overhanging eaves, and natural ventilation in its design. The use of these features is an example of how to adapt traditional design solutions to continue to achieve both the visual and the environmental objectives of the design. Taken as a whole, these examples demonstrate that architectural authenticity is not based on replicating the visual components of traditional Malay architecture, but is based on the continuation of the logic of culture and the adaptation to the environment that is inherent in Traditional Malay Architecture.

Cultural Integration and Symbolism

The second theme, cultural integration, is about how architecture, whether through their design or representation, represents/reflects the local culture, community, and way of life. The findings of the research suggest that the most effective way of utilising theme in a resort involves going beyond visual theming and creating a unique spatial and experiential identity within the resort that incorporates the culture of the local community. For example, the Kampung Tok Senik resort demonstrates this through its community-oriented spatial organisation. By clustering chalets around shared courtyards and gathering spaces, the resort reflects the traditional gotong-royong (community) way of life in a Malay village. By giving guests and staff a space to interact and build relationships, the resort provides a living cultural experience, rather than simply a place to stay (Ali Ariff et al., 2024). Additionally, symbolism plays an important role in expressing the cultural identity of the Malay people through architecture and decorative elements. Traditional Malay motifs, including landscape, animal, and geometric patterns shaped by Islamic beliefs, are represented through wood carving, latticework, textiles, and fabric. For example, batik patterns create a visual connection to the use of natural materials in the design of the Pelangi Beach Resort & Spa's interior (Noor & Kovács, 2024; Huang et al., 2022). Similarly, traditional materials like bamboo, rattan, and palm weave are used to both build and decorate the structural components of the resort. The Marang Eco-Resort takes cultural integration one step further by having artisans from the local area participate in making wooden screens, furniture, and decorative elements, thus ensuring



that the representation of the culture of the local community is genuine, as well as economically beneficial to the communities involved. Through this collaborative approach, the Marang Eco-Resort is preserving traditional craftsmanship and aligns with the goal of cultural sustainability by creating an economic benefit to the local community through the inclusion of social value in design. The research results support the statement that true cultural integration in resort design requires community involvement, symbolic representation of the culture, and continuity of the intangible cultural heritage.

Environmental Responsiveness and Sustainability

One of the most important characteristics of integrating the Malay design principles is their environmental responsiveness. The traditional Malay homes were naturally sustainable over the centuries due to their adaptation to life in Malaysia's humid and tropical environment. The findings from the examples presented in this article indicate when these vernacular design strategies are utilized on current structures as a part of the sustainable design process, they significantly enhance the overall sustainability of the built environment in Malaysia. For instance, the elevated wooden design of Kampung Tok Senik and Marang Eco-Resort aids in providing maximum airflow under the structure, which lessens the humidity of the indoor air conditioning system and increases the effectiveness of mechanical cooling. By strategically orienting the roofs and verandahs toward the correct dimension for the sun's rays and the rain, along with cross-ventilation through the home, both structures exhibit the principles underlying the vernacular Malay design and construction process (Ali Ariff et al., 2024; Noor & Kovács, 2024). In the same way, Marang Eco-Resort incorporates the use of recycled timber and other natural materials such as nipah and ijok leaves for roofing, which help to maintain thermal comfort while minimising damage to the environment. The planning of the Marang Eco-Resort exhibits a low impact on the environment, as it has designed the building in harmony with the natural landscape rather than in opposition to it. This reinforces the principles of bioclimatic design and support for Malaysia's aspiration for sustainable tourism (Yusof et al., 2025). Pelangi Beach Resort & Spa combines hybrid methods of sustainability by blending the principles of traditional Malay vernacular architecture with the latest contemporary building designs. For example, large windows, shaded corridors, and open terraces take advantage of natural light and offer residents natural ventilation, thus limiting dependence on mechanical cooling. Additionally, the Pelangi Beach Resort has implemented green landscape and restoration efforts on the coastline to help protect the local ecological system. Collectively, the examples presented in this paper demonstrate how re-application of traditional Malay vernacular architectural principles can significantly contribute to the implementation of sustainable architecture within Malaysia. Vernacular architecture does not oppose modernity; rather, it serves as a means of supporting sustainable development through the culturally and environmentally intelligent design of resorts.

Guest Experience and Emotional Connection

The building design of a Malay-themed resort has emotional and sensory impacts on the experience of guests in the resort. It has been found that the use of traditional Malay architecture allows the spaces to provoke feelings of warmth, familiarity, and serenity, which are not present in standard modern hotel environments. The Kampung Tok Senik Resort creates a complete experience, where the architecture, landscape, and community come together to provide a sense of living in a traditional village. The closeness of space, the tactile quality of



natural materials, and the rhythm of life in the local area create an emotional as well as nostalgic and authentic connection (Kang, 2016; Thompson, 2012). The guest experience at the Pelangi Beach Resort & Spa is further enhanced by the combination of sensory and symbolic elements in the design of the resort. The combination of natural textures, ambient lighting, and breezes from the sea creates an environment that allows guests to relax and also acknowledges the richness of their culture. This mirrors the research by Floričić (2022), which found that sensory aspects of experiences, including smell, sound, and touch, are major contributors to the uniqueness of the guest experience. The Marang Eco-Resort also emphasises a tranquil and mindful visit, allowing guests to experience simplicity and connection with nature, like the traditional way of living in Malay culture. The presence of cultural shows, traditional foods, and artisans' work gives guests a multisensory experience that creates a life-changing travel experience. These results suggest that when buildings are designed with emotion in mind, or as a medium for telling a story, it creates an emotional attachment and engagement. Architecture can also create a way for guests to feel the spirit of the Malay culture both aesthetically and by providing empathy for the culture.

Synthesis and Discussion

Throughout the 3 case studies, where the contemporary resort theme was achieved through a synthesis of Malay cultural values with traditional architecture, we have seen a consistent connection among culture, sustainability and experiential aspects of a project. The research shows that genuine use of vernacular architecture provides not only visual identity to the resort, but also emotional and environmental balance. The combination of cultural dimensions and architectural integrity allows for resorts to be more than just commercial themed facilities, and to be true representatives of the respective cultures. Additionally, these findings support the theoretical perspective that architecture is a form of communication that provides insight into cultural heritage and ethical principles related to the natural environment (Williams, 2006 & Wang, 2017). The Malay architectural tradition provides timeless principles to help guide the development of ecologically-responsible and culturally rich resorts with regard to climate, spirituality, community. This research also identifies challenges associated with designing the resort, such as the disconnection between empirical design elements, market-driven aesthetics and authentic cultural expression, as well as a need for artisans to continue their craft in the face of ongoing industrialisation. As a result, designing resorts by utilizing traditional elements of Malay architecture is not merely a nostalgic view toward the past, but rather an effective design approach to meld the past with contemporary commercial innovation. An added benefit is that it provides Malaysia's burgeoning tourism industry with a distinct and sustainable competitive advantage based on the authenticity of cultural heritage, identity, and the depth of experience provided to their customers.

Conclusion and Recommendations

Based on the findings of the research, the incorporation of traditional Malay architecture into modern Malaysian theme resorts provides opportunities for promoting sustainable, culturally relevant forms of tourism. All evidence from this research document supports the use of vernacular architecture (architecture that reflects local climatic conditions, local resources, and

community organization) in the design of modern hospitality facilities, even though there aren't many instances of this kind of architecture being used today... The three case studies indicate that a harmonious connection with vernacular architecture will enhance environmental sustainability and strengthen cultural identity at Malaysian theme resorts, as well as enhance the guest experience by creating an emotional and cultural connection to their surroundings. Therefore, designers and policymakers should be encouraged to use local resources and artisans, as well as involve the community in the design process; develop socio-cultural frameworks for promoting sustainability; and work with traditional Malay architectural heritage to help create a unique blend of innovative and traditional elements within a theme resort, both for future tourism development as well as architectural design processes.

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TREATMENT TECHNOLOGIES FOR PALM OIL MILL EFFLUENT: CURRENT PRACTICES, CHALLENGES, AND FUTURE PERSPECTIVES

Azmi Ahmad¹

¹Department of Petrochemical Engineering, Politeknik Tun Syed Nasir Syed Ismail, Pagoh, Johor, Malaysia,
(azmi.ahmad@ptsn.edu.my)

Abstract: *Palm Oil Mill Effluent (POME) is a high-strength industrial wastewater generated during palm oil processing, characterized by high biochemical oxygen demand, chemical oxygen demand, suspended solids, oil and grease, and nutrient concentrations. If inadequately treated, POME can cause serious environmental impacts, including water pollution, eutrophication, soil degradation, and greenhouse gas emissions, particularly methane from anaerobic decomposition. This mini review presents a structured overview of the characteristics and environmental impacts of POME, followed by a critical discussion of current treatment technologies applied in the palm oil industry. Conventional treatment methods, including physical, chemical, and biological processes, are reviewed, with particular emphasis on biological treatment systems such as anaerobic digestion and integrated anaerobic–aerobic processes, which remain the most widely adopted due to their effectiveness in handling high organic loads and their potential for biogas recovery. The roles of physical and chemical treatments as pre-treatment and polishing stages are also discussed. In addition, emerging and advanced technologies, including membrane-based systems, electrochemical treatment, microalgae-based processes, and hybrid nature-based solutions, are highlighted for their potential to enhance treatment efficiency and support sustainable resource recovery. Despite technological advancements, challenges related to cost, land requirements, sludge management, and greenhouse gas mitigation remain significant. Future POME treatment strategies are expected to focus on integrated systems, circular economy principles, and sustainable resource-oriented approaches. This review aims to provide useful insights for researchers and industry stakeholders in selecting and optimizing appropriate POME treatment technologies for environmentally responsible palm oil production.*

Keywords: *Palm Oil Mill Effluent (POME); Wastewater Treatment; Anaerobic Digestion; Biological Treatment; Advanced Treatment Technologies*

Introduction

The palm oil industry plays a crucial role in meeting the global demand for edible oils, oleochemicals, and bio-based products. Southeast Asian countries, particularly Malaysia and Indonesia, dominate global palm oil production due to favourable climatic conditions and well-established plantation systems. However, alongside economic growth, the industry generates substantial volumes of wastewater, commonly known as Palm Oil Mill Effluent (POME). POME is generated during the sterilization, clarification, and hydro-cyclone operations in palm oil milling. It is a viscous brown liquid with high organic content, characterized by an average biochemical oxygen demand of 25,000 mg/l and a pH of 4 to 5 (Abdurahman et al., 2013).

POME is classified as a high-strength industrial wastewater due to its exceptionally elevated biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, oil and grease, and nutrient concentrations. If discharged without adequate treatment, POME can severely degrade receiving water bodies by causing oxygen depletion, eutrophication, and ecological imbalance (Tan et al., 2022). In addition, uncontrolled anaerobic decomposition of POME contributes to greenhouse gas emissions, particularly methane, further exacerbating climate change concerns. As environmental regulations become increasingly stringent, especially in major palm oil-producing countries, the need for effective and sustainable POME treatment strategies has become a critical priority (Kusnadi et al., 2025).

Conventional POME management practices have historically relied on biological treatment systems, particularly anaerobic lagooning, due to their simplicity, low operational cost, and suitability for treating high organic loads. Anaerobic processes are effective in reducing organic pollutants while enabling biogas generation, which can be utilized as a renewable energy source. However, traditional lagoon systems require large land areas, long hydraulic retention times, and may result in uncontrolled methane emissions if biogas capture systems are not implemented. These limitations have prompted increasing interest in improving existing treatment technologies and exploring alternative or integrated treatment approaches (Negi & Sinharoy, 2024).

In recent years, a wide range of POME treatment technologies has been developed and applied, encompassing physical, chemical, biological, and advanced or hybrid systems. Physical and chemical methods are commonly employed as pre-treatment steps to reduce suspended solids, oil content, and pH variability, thereby enhancing the efficiency of downstream biological processes. Biological treatments, including anaerobic digestion, aerobic polishing, and integrated anaerobic-aerobic systems, remain the backbone of industrial-scale POME treatment due to their economic feasibility and environmental compatibility. Meanwhile, advanced and emerging technologies such as membrane bioreactors, electrochemical treatment, microalgae cultivation, and constructed wetlands have gained attention for their potential to improve effluent quality, reduce treatment footprint, and enable resource recovery.

Despite significant progress in POME treatment research and implementation, several challenges remain. These include high capital costs associated with advanced systems, operational complexity, sludge management issues, and the need to balance treatment efficiency with economic and environmental sustainability. Furthermore, the increasing emphasis on circular economy principles and zero liquid discharge (ZLD) concepts has shifted attention toward treatment strategies that not only remove pollutants but also recover valuable resources such as energy, nutrients, and reusable water.

In this context, a concise and structured review of existing POME treatment methods is essential to provide clarity on current technological capabilities, limitations, and future directions. This mini review aims to summarize the characteristics and environmental impacts of POME, critically discuss conventional and emerging treatment technologies, and highlight key challenges and future trends in sustainable POME management. By consolidating recent developments and treatment strategies, this review seeks to support researchers, engineers, and industry stakeholders in selecting and optimizing appropriate treatment solutions for environmentally responsible palm oil production.

Composition and Characteristics of POME

Palm Oil Mill Effluent (POME) is generated as a by-product of the wet processing of fresh fruit bunches (FFB) during palm oil extraction. The major sources of POME include sterilizer condensate, clarification wastewater, and hydro cyclone effluent. Although POME is non-toxic, it is considered highly polluting due to its elevated organic load, suspended solids, oil content, and acidic nature. The exact composition of POME varies depending on factors such as mill capacity, processing technology, water usage, and operational efficiency (Yashni et al., 2021). Raw POME is typically discharged at high temperatures, ranging between 80 and 90 °C, and exhibits an acidic pH of approximately 3.4 - 5.2, primarily due to the presence of organic acids formed during fruit sterilization and oil extraction. The effluent contains extremely high concentrations of biodegradable organic matter, reflected by biochemical oxygen demand (BOD) values commonly reported in the range of 10,250 – 43,750 mg/L, while chemical oxygen demand (COD) values may reach 15,000–100,000 mg/L. These values are several hundred times higher than the typical discharge limits imposed by environmental regulatory authorities, indicating the necessity for effective treatment prior to disposal or reuse (A Aziz et al., 2020).

In addition to its high organic strength, POME contains significant amounts of suspended solids (SS), typically between 5000 and 54,000 mg/L, which consist mainly of cellulosic fibers, soil particles, and residual fruit debris. The oil and grease (O&G) content of raw POME is also considerable, usually in the range of 2,000–8,300 mg/L, originating from residual palm oil losses during milling operations. These components can cause operational challenges in downstream treatment systems, such as sludge accumulation, scum formation, and reduced mass transfer efficiency in biological reactors (Mohammad et al., 2021a). Nutrient-wise, POME contains appreciable concentrations of nitrogen and phosphorus, with total nitrogen typically reported between 180 - 1400 mg/L and total phosphorus between 60 - 1500 mg/L. While these nutrients contribute to eutrophication if discharged untreated, they also present opportunities for resource recovery when integrated with biological processes such as anaerobic digestion, composting, or microalgae cultivation. Furthermore, POME contains volatile fatty acids (VFAs), which enhance its biodegradability and make it particularly suitable for anaerobic treatment processes (Chin et al., 1996). The high biodegradability of POME is reflected by its relatively favorable BOD/COD ratio, often exceeding 0.5, indicating that a substantial fraction of the organic matter can be biologically degraded. This characteristic has driven the widespread adoption of biological treatment systems, particularly anaerobic digestion, as the primary treatment approach in palm oil mills. However, the presence of high suspended solids, oil and grease, and fluctuating organic loading rates necessitates appropriate pre-treatment to ensure stable and efficient biological performance (A Aziz et al., 2020). Overall, the complex yet biodegradable nature of POME makes it both an environmental liability and a valuable resource. A clear understanding of its composition and characteristics is essential for selecting appropriate treatment technologies, optimizing process performance, and developing sustainable strategies for pollution control and resource recovery in the palm oil industry.

Environmental Impacts of Untreated POME

The discharge of untreated or inadequately treated Palm Oil Mill Effluent (POME) poses significant environmental risks due to its extremely high organic load, suspended solids, and

nutrient content. When released directly into water bodies, POME rapidly consumes dissolved oxygen during microbial degradation, often resulting in severe oxygen depletion. Given its high biochemical oxygen demand (BOD) and chemical oxygen demand (COD), even small volumes of untreated POME can cause extensive deterioration of surface water quality, leading to fish mortality and the collapse of aquatic ecosystems. One of the most critical impacts of POME discharge is organic pollution, which disrupts the natural balance of receiving waters. Elevated concentrations of suspended solids and oil and grease reduce light penetration and interfere with photosynthetic activity, while the accumulation of organic matter promotes excessive microbial growth. This process can result in anaerobic conditions, the release of malodorous compounds, and long-term sediment contamination. In rivers and streams, such conditions significantly impair water usability for domestic, agricultural, and recreational purposes (Karno et al., 2024).

In addition to organic pollution, POME contains substantial amounts of nitrogen and phosphorus, which can trigger eutrophication when discharged into freshwater systems. Excessive nutrient loading stimulates algal blooms, followed by oxygen depletion during biomass decay, further exacerbating ecological stress. Prolonged eutrophication can alter species composition, reduce biodiversity, and create persistent water quality problems that are costly and difficult to remediate (Wurtsbaugh et al., 2019). Land application of untreated or poorly treated POME, although sometimes practiced as a low-cost disposal method, may also lead to soil and groundwater contamination. High organic and nutrient concentrations can exceed soil assimilation capacity, resulting in nutrient leaching, increased soil acidity, and contamination of underlying groundwater resources. Moreover, excessive oil and grease accumulation may adversely affect soil structure and microbial activity, reducing long-term soil fertility (Nmaduka et al., 2018).

Beyond water and soil pollution, POME treatment systems particularly conventional open anaerobic lagoons are recognized sources of greenhouse gas emissions, primarily methane. Methane emissions from uncontrolled anaerobic degradation contribute significantly to the carbon footprint of palm oil production. Without proper gas capture and utilization, these emissions undermine the environmental sustainability of the industry and conflict with global climate change mitigation efforts (ABU BAKAR, 2023; Saryono Putro et al., 2019).

Overall, the environmental impacts of untreated POME extend across water, soil, and atmospheric systems, highlighting the necessity for effective and sustainable treatment strategies. Addressing these impacts is essential not only for regulatory compliance but also for improving the environmental performance and public perception of the palm oil industry.

Treatment Technologies for Palm Oil Mill Effluent

Physical Treatment Methods

Physical treatment methods are commonly employed as pre-treatment steps in Palm Oil Mill Effluent (POME) management to remove coarse solids, residual oil, and floating materials before downstream chemical or biological processes. These methods are particularly important due to the high suspended solids and oil and grease content present in raw POME, which can adversely affect the efficiency and stability of subsequent treatment stages.



Screening and sedimentation are the most basic physical processes used in palm oil mills. Screening removes large debris such as fibers, shells, and fruit residues, while sedimentation allows heavier suspended solids to settle under gravity. These processes can achieve suspended solids removal efficiencies of 40–60%, depending on retention time and particle size distribution. Although simple and low-cost, sedimentation alone is insufficient for meeting discharge standards due to the presence of dissolved organic matter (Askari Lasaki et al., 2023).

Oil skimming and flotation techniques are applied to reduce oil and grease concentrations in POME. Gravity oil traps and skimmers exploit density differences between oil and water, while dissolved air flotation (DAF) enhances oil removal by attaching air bubbles to oil droplets, allowing them to float to the surface. Oil and grease removal efficiencies of up to 60–90% have been reported using flotation-based systems, making them effective as a pre-treatment step prior to biological processes (Scharnberg et al., 2023).

Filtration and centrifugation are also used in certain mills to further reduce suspended solids and recover valuable oil residues. Centrifugal separation, in particular, is effective for fine particle removal and oil recovery, but its application is often limited by high capital and energy costs. Consequently, these methods are more commonly applied in large-scale mills or as polishing units rather than primary treatment systems (Dong et al., 2017). Despite their effectiveness in reducing solids and oil content, physical treatment methods do not significantly reduce BOD or COD, as dissolved organic compounds remain largely unaffected. Therefore, physical processes are rarely used as standalone treatment systems and are instead integrated with biological or chemical treatment stages. Nevertheless, effective physical pre-treatment is essential for preventing clogging, reducing sludge accumulation, and improving the overall performance and longevity of downstream POME treatment systems.

Chemical Treatment Methods

Chemical treatment methods are primarily applied in Palm Oil Mill Effluent (POME) management as supplementary or polishing processes, particularly when rapid removal of suspended solids, colloidal particles, and residual oil is required. These methods are less commonly used as standalone treatment systems due to their relatively high operational costs and sludge generation, but they play an important role in improving effluent quality prior to discharge or advanced treatment. Coagulation–flocculation is the most widely investigated chemical approach for POME treatment. Common coagulants include aluminum sulfate (alum), ferric chloride, polyaluminum chloride, and synthetic polymers. Through charge neutralization and particle aggregation, coagulation–flocculation can achieve suspended solids and turbidity removal efficiencies exceeding 80%, along with COD reductions of 50–70%, depending on coagulant type and dosage. However, the process generates large volumes of chemical sludge, which requires proper handling and disposal, limiting its large-scale application (Ratnasari et al., 2022).

pH adjustment and neutralization are often required when chemical treatment is integrated with biological processes, as raw POME is typically acidic. Lime or sodium hydroxide is commonly used to raise pH to neutral levels, improving microbial activity and enhancing treatment efficiency. While effective, excessive chemical dosing can increase operating costs and contribute to secondary pollution issues (Mekwichai et al., 2024). Advanced chemical processes, particularly Advanced Oxidation Processes (AOPs), have gained research attention

for their ability to degrade recalcitrant organic compounds in POME. Techniques such as the Fenton reaction, ozonation, and UV-based oxidation generate highly reactive hydroxyl radicals that can break down complex organic molecules. AOPs have demonstrated COD removal efficiencies of up to 85%. However, their practical application is constrained by high chemical consumption, energy requirements, and operational complexity (Zheng et al., 2025) .

Overall, chemical treatment methods offer rapid and effective pollutant removal but are generally considered less sustainable for full-scale POME treatment due to economic and environmental concerns. As a result, these methods are most effectively employed in combination with physical and biological processes, where they enhance treatment performance while minimizing chemical usage and sludge production

Biological Treatment Method

Biological treatment methods represent the core technology for Palm Oil Mill Effluent (POME) management due to the effluent's high biodegradability and organic strength. These methods are widely adopted in the palm oil industry because they are cost-effective, environmentally friendly, and capable of achieving substantial reductions in organic pollutants. Biological treatment of POME is commonly categorized into anaerobic, aerobic, and integrated anaerobic–aerobic systems, each with distinct operational characteristics and performance outcomes. Anaerobic digestion is a widely adopted method for treating POME, effectively converting organic matter into biogas, primarily methane and carbon dioxide. Various reactor configurations, including Upflow Anaerobic Sludge Blanket (UASB) and Continuous Stirred Tank Reactors (CSTR), demonstrate significant chemical oxygen demand (COD) removal efficiencies, typically ranging from 65% to 94.89% depending on operational parameters. The biogas yield from POME treatment is substantial, with reported values between 20 and 30 m³ per m³ of POME treated, contributing to renewable energy generation (Soo et al., 2023; Wang et al., 2015). Despite these advantages, conventional anaerobic lagoon systems suffer from several limitations, including long hydraulic retention times (30–90 days), large land requirements, and the potential for uncontrolled methane emissions when biogas capture systems are absent. To address these issues, covered lagoon systems and high-rate anaerobic reactors have been increasingly adopted, offering improved gas capture efficiency, reduced footprint, and enhanced process control (Zieliński et al., 2022).

Following anaerobic treatment, aerobic processes are often employed as polishing steps to further reduce residual organic matter and meet stringent discharge standards. Common aerobic systems include activated sludge processes, aerated lagoons, oxidation ponds, and sequencing batch reactors (SBR). Aerobic treatment can achieve additional BOD removal efficiencies exceeding 90%, producing effluents with BOD concentrations below regulatory limits, typically ≤ 100 mg/L. However, aerobic processes are energy-intensive due to aeration requirements and generate larger quantities of biological sludge, increasing operational and disposal costs (Yap et al., 2025). To maximize treatment efficiency, integrated anaerobic–aerobic systems are widely implemented in industrial POME treatment plants. In such systems, anaerobic digestion serves as the primary treatment stage for bulk organic removal and energy recovery, while aerobic treatment acts as a secondary or tertiary stage for effluent polishing. This integrated approach offers several advantages, including improved overall removal efficiency, reduced energy consumption compared to fully aerobic systems, and enhanced compliance with environmental regulations (Yap et al., 2025). In addition to conventional

biological systems, land application and composting of POME solids have been practiced in some regions as sustainable waste management strategies. Treated POME sludge, rich in organic matter and nutrients, can be applied as biofertilizer or soil conditioner. However, careful management is required to prevent nutrient leaching, soil acidification, and groundwater contamination.

Overall, biological treatment methods remain the most practical and widely adopted solution for POME management. Nevertheless, ongoing efforts to improve reactor design, shorten retention times, reduce greenhouse gas emissions, and enhance resource recovery are driving the evolution of more efficient and sustainable biological treatment systems.

Advanced and Hybrid Technologies

In response to increasing regulatory pressure, land constraints, and sustainability goals, advanced and hybrid treatment technologies have emerged as promising alternatives to conventional POME treatment systems. These approaches aim to enhance treatment efficiency, reduce system footprint, and promote resource recovery, particularly in scenarios where stringent effluent quality standards must be met. Membrane-based technologies, especially membrane bioreactors (MBRs), have gained attention due to their ability to produce high-quality effluent suitable for water reuse. MBRs integrate biological degradation with membrane filtration, enabling effective separation of biomass and suspended solids. Studies have reported COD and BOD removal efficiencies exceeding 95% using MBR systems for POME treatment. However, challenges related to membrane fouling, high capital costs, and intensive maintenance requirements currently limit large-scale implementation (Iorhemen et al., 2016).

Electrochemical and electrocoagulation methods have also been investigated as advanced treatment options for POME. These techniques facilitate pollutant removal through electrochemical reactions that destabilize colloidal particles and oxidize organic compounds. COD removal efficiencies of 85-97% have been reported, particularly when electrochemical treatment is used as a polishing step following biological processes. Nevertheless, high energy consumption and electrode material costs remain key barriers to widespread adoption (Nasrullah et al., 2022). Microalgae-based treatment systems offer a nature-based and sustainable approach for POME management by simultaneously removing nutrients and capturing carbon dioxide. Microalgae cultivation in POME can achieve significant reductions in nitrogen and phosphorus while generating biomass that may be valorized for biofuel production, animal feed, or biofertilizers. Despite these benefits, operational challenges such as light availability, biomass harvesting, and process scalability must be addressed before full-scale application.

Hybrid biological–natural systems, including constructed wetlands and bioreactor–wetland combinations, have been explored as low-energy treatment solutions for small to medium-scale palm oil mills. These systems utilize natural processes involving plants, microorganisms, and substrates to remove organic matter and nutrients. While treatment efficiency is generally lower than that of engineered systems, hybrid green technologies offer advantages in terms of simplicity, low operating costs, and environmental compatibility (Dominic & Baidurah, 2022).

Overall, advanced and hybrid treatment technologies present significant potential for improving the sustainability and efficiency of POME treatment. However, their large-scale implementation requires further optimization, economic assessment, and long-term performance evaluation. Consequently, these technologies are currently best suited as complementary or polishing stages within integrated POME treatment systems rather than as standalone solutions.

Challenges and Future Perspectives

Despite extensive research and widespread implementation of treatment technologies, the management of Palm Oil Mill Effluent (POME) continues to face several technical, economic, and environmental challenges. One of the primary issues is the high capital and operational cost associated with advanced treatment systems, such as membrane bioreactors and electrochemical processes, which limits their adoption, particularly among small- and medium-scale palm oil mills. In contrast, conventional lagoon-based systems, although cost-effective, require large land areas and long hydraulic retention times, making them less suitable in regions with space constraints (Mohammad et al., 2021).

Another significant challenge is the control of greenhouse gas emissions, particularly methane released from anaerobic treatment systems. Palm oil mill effluent (POME) can contribute up to 85% of total mill GHG emissions, mainly as methane from anaerobic ponds without gas capture. Untreated POME typically emits 0.18–0.35 m³ CH₄ per kg COD removed, and national methane emissions reach millions of tonnes where open lagoons dominate. Open anaerobic ponds without gas capture contribute substantially to the carbon footprint of palm oil production. While covered lagoons and biogas recovery systems offer effective mitigation, their implementation requires additional investment, technical expertise, and long-term maintenance, which may not be readily available at all mill locations (Judijanto, 2025).

Sludge management and disposal also remain critical concerns in POME treatment. Chemical treatment processes generate large quantities of sludge that require proper handling and disposal to prevent secondary pollution. Similarly, biological treatment systems produce excess biomass that must be stabilized and managed safely. Inadequate sludge management can negate the environmental benefits achieved through wastewater treatment (Anjum et al., 2016; Zainal, 2018). From a regulatory perspective, increasingly stringent discharge standards and sustainability certification requirements are driving the need for higher treatment efficiency and effluent reuse. Many palm oil-producing countries now enforce strict limits on effluent quality, prompting the industry to explore zero liquid discharge (ZLD) systems and water recycling strategies. However, ZLD implementation is often associated with high energy demand and complex system integration, posing additional challenges (Sapie et al., 2019).

Looking forward, future POME treatment strategies are expected to align closely with circular economy principles, emphasizing resource recovery rather than waste disposal. Anaerobic digestion with optimized biogas recovery, nutrient recovery for biofertilizer production, and treated effluent reuse for industrial or agricultural purposes represent promising directions. In addition, the development of low-energy, nature-based solutions, such as constructed wetlands, natural coagulants, and microalgae-based systems, offers potential pathways toward more sustainable and decentralized treatment options.



Overall, addressing these challenges will require integrated treatment approaches, supportive regulatory frameworks, and continued research to improve cost-effectiveness, scalability, and environmental performance. Advancing POME treatment from conventional waste management toward sustainable resource recovery will be essential for enhancing the long-term environmental sustainability of the palm oil industry.

Conclusion

Palm Oil Mill Effluent (POME) represents one of the most significant environmental challenges associated with the palm oil industry due to its high organic load, suspended solids, oil and grease, and nutrient content. If inadequately treated, POME can cause severe water pollution, soil degradation, and greenhouse gas emissions. However, its high biodegradability also presents valuable opportunities for sustainable treatment and resource recovery. This mini review has highlighted the characteristics and environmental impacts of POME, along with a critical evaluation of conventional and emerging treatment technologies. Biological treatment methods, particularly anaerobic digestion followed by aerobic polishing, remain the most widely adopted and effective approach for large-scale POME management due to their cost-effectiveness and ability to handle high organic loads. The integration of anaerobic systems with biogas recovery further enhances sustainability by reducing greenhouse gas emissions and enabling renewable energy generation.

Physical and chemical treatment methods play important supporting roles as pre-treatment and polishing stages, improving overall system performance and effluent quality. Meanwhile, advanced and hybrid technologies such as membrane bioreactors, electrochemical processes, microalgae cultivation, and nature-based systems offer promising pathways for improving treatment efficiency, reducing system footprint, and promoting circular economy practices.

However, challenges related to cost, operational complexity, and scalability currently limit their widespread implementation.

Looking ahead, the future of POME treatment lies in integrated and resource-oriented systems that balance environmental protection, economic feasibility, and regulatory compliance. Emphasis on methane capture, water reuse, nutrient recovery, and low-energy treatment solutions will be crucial in advancing sustainable palm oil production. Continued research, technological innovation, and supportive policy frameworks will play a vital role in transforming POME management from conventional wastewater treatment toward a more sustainable and circular approach.

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THE ACTION RESEARCH ON THE CHINESE CHARACTER MICRO-LECTURE TEACHING METHOD FOR CHILDREN BASED ON MULTIPLE INTELLIGENCES

Yong Hui Wen¹

¹Centre For the Promotion Of Knowledge And Language Learning, University Malaysia Sabah (UMS), Malaysia (Yonghuiwen21@ums.edu.my)

Abstract: *With the advent of the information era, micro-lecture was introduced and widely applied in classes by educators due to its “short and precise”, “specified topic”, and “space-time unlimited sharing” characteristics. As the educators eagerly try to leverage the modern educational technology for teaching, micro-lecture has becoming one of the smart choices especially in children’s classroom. As a Mandarin teacher, it was found that learning Chinese characters is always one of the greatest fear and challenge to the children. As a solution to this issue, this study attempts to create the Chinese character micro-lecture by integrating micro lecture with Gardner’s Theory of Multiple Intelligences, and then to investigate how does it affect the children’s learning performance in learning Chinese characters. Thus, two rounds of teaching action researches were carried out among a group of 7 to 9 years old’s third graders. The result shows that: 1. The design of the Chinese character micro-lecture based on Multiple Intelligences was proved to align more closely with students’ needs for learning Chinese characters. 2. The student’s learning interest and assessment result were raised by adopting the Chinese character micro-lecture based on Multiple Intelligences in Mandarin class. 3. There are five factors affecting the application of the mentioned micro-lecture in class.*

Keywords: *Micro-Lecture; Multiple Intelligences; Chinese Characters Teaching Method; Action Research*

Introduction

In the field of Mandarin language teaching, teaching Chinese characters is always one of the greatest challenges for Mandarin teachers as Chinese characters are hard to teach and learn due to their complicated strokes and structures. As a Malaysian, it was found that the challenge seems to be greater when it comes to teaching Chinese characters in Malaysia, a multi-racial country, as the students are all having different racial and language backgrounds. As an educator, we should seek for a solution that ease the study burden on students, raise the study interest and learning effectiveness, such as providing a self-study learning material. Therefore, adopting micro-lecture is one of the smart choices.

Literature Review

Micro-Lecture in Teaching Chinese Characters

The development trajectory of Micro-lecture can be traced back to the “60 Second Course” introduced by Professor LeRoy A. McGrew, University of Northern Iowa on 1993 and “The One Minute Lecture (OML)” introduced by T.P.Kee, Napier University on 1995, and then gradually turned out to be a systematic teaching method. Micro-lecture has been a hot topic

among researchers in the past ten years and won the affirmation of academic experts. (Garber, 2019b; Scholtenhuis et al., 2020; Rebong, 2022) Many researchers and educators have also implemented research on the application of micro-lecture in Mandarin teaching, and have obtained positive results. (Zhang C., 2015; Wu, 2015; Zhang & Li, 2016; Ban, 2019; Li S., 2019; Wang L., 2020; Yang, 2019; Wang H., 2022)

Compare to research on Chinese as first language, there is significantly less research on applying micro-lecture in teaching Chinese as foreign language (TCSOL) especially on Chinese characters. Yu (2015), Ou (2016), Li D. (2020), Hu X. (2020) focused on the principles and elements in designing Chinese characters micro-lecture, Zhang S. (2017), Li D. (2020) focused on teaching method in Chinese characters micro-lecture, and Xiao (2021) conducted thematic research on the Chinese characters with easily confused components. However, only Ou (2016) highlighted the integration of design theory to create Chinese character micro-lecture. She proposed integrating Schema Theory into micro-lessons on Chinese characters, but unfortunately, no practical research has been conducted.

Multiple Intelligences in Teaching Chinese Characters

The concept of “Multiple Intelligences” was first proposed in the 1980s by American psychologist and educator Howard Gardner. Today, it is widely recognized as one of the most accepted educational theories, receiving broad acknowledgment across educational circles. In his book *Frames of Mind: The Theory of Multiple Intelligences* (1983), Dr. Gardner introduced the idea that humans possess seven distinct intelligences: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, intrapersonal, and interpersonal. Later, he added a naturalistic intelligence, bringing the total to eight. Since the introduction of the theory of multiple intelligences, numerous studies have combined it with teaching practices. However, research on applying this theory to Chinese language teaching did not commence until the 21st century, and these research findings showed positive outcomes. (Wang Y., 2012; Zheng, 2013; Cai, 2013; Liu, 2013; Guo, 2020) In Malaysia, this concept has not yet been widely applied in TCSOL, however, positive outcomes have been reported in many other fields of education. (Chew Fong Peng, 2011; Looi Lin Eng, 2011; Senam Kaur d/o Sarjit Singh, 2015)

Objectives

Therefore, this research aimed to carry out action research on the Chinese character micro-lecture for children based on multiple intelligences, in which the researcher applied the micro-lectures that were designed based on eight basic intelligences in teaching Chinese characters, to investigate the effectiveness of the students learning Chinese characters.

This study aimed to solve these research problems:

1. How to design the Chinese characters micro-lecture based on the Multiple Intelligences theory?
2. How does the Chinese characters micro-lecture based on the Multiple Intelligences affects the teaching outcomes?
3. What are the factors affecting the application of the Chinese characters micro-lecture based on the Multiple Intelligences in Mandarin class?

Methodology

This study arranged 2 rounds of action research whereby 5 weeks per round, in a Malaysia international school, among 7 to 9 years old third-grade students, by implementing the method of “Plan → Act → Observe → Reflect → Re-plan → Re-act → Re-observe → Re-reflect”, and finally get a conclusion from the action research. The researcher acted as both the practitioner and researcher and, through the systematic statistical analysis, seek for the solution and observe the improvement. All the progress and results are open and public.

A. The design of Chinese character micro-lecture

As the three main characteristics of a micro-lecture are “concise and focused”, “clear themes” and “online-video based” (Hu T., 2011; Li J., 2013; Jiao, 2013), the Chinese characters micro-lecture were designed based on four principles: concise and focused, clear themes, online-video based, adapting Multiple Intelligence theory. There were four micro-lectures were designed adapting the different multiple intelligences:

Table 1: The Chinese Characters Micro-Lecture And The Adapted Multiple Intelligences

No	Title of Chinese Characters Micro-lectures	Multiple Intelligences
1	Hanzi the Storyteller	Naturalistic Intelligence, Spatial Intelligence, Intrapersonal Intelligence
2	The Singing Hanzi	Musical Intelligence, Linguistic Intelligence, Intrapersonal Intelligence
3	The Dancing Hanzi	Bodily-kinesthetic Intelligence, Interpersonal Intelligence, Intrapersonal Intelligence
4	The Hanzi Costume	Logical Mathematical Intelligence, Intrapersonal Intelligence

B. The classroom observation

Participant observation and qualitative observation were applied to systematically record the actual classroom teaching situation based on specific focuses. An “Observation Rubric for Assessing Learning Objectives in Chinese Character Micro-lecture” was designed based on Shen, Lin, Wu, and Cui (2007) Classroom Observation Framework (Revised Edition), to observe the student’s interest in learning Chinese characters. Also, 10 teaching journals were written immediately after each class to record observations and reflections that could lead to improvements.

C. The questionnaire survey

The questionnaire named “Student Feedback for Chinese Character Micro-lecture based on Multiple Intelligences” was designed as the preference survey after the 2 rounds action research.

D. The participant’s “Multiple Intelligences Test”

The participants were 11 third-grade students (7-9 years old) from a private international school. To collect the student’s multiple intelligences inclinations, a set of modified “Multiple

Intelligences Test” was given to the students before the action research began. The test was modified based on “An MI Inventory for adults” in the book “Multiple Intelligences in the Classroom 3rd Edition” (Armstrong, 2009, p. 11). However, given that the participating students were only between 7 and 9 years old and their self-awareness was still developing, the third-grade class teacher was invited to complete an additional instrument, the “Multiple Intelligences Checklist for Students” based on her daily observations and interactions with the students. This checklist was designed based on “Multiple Intelligences Checklist for Students” (Armstrong, 2009, p. 35-38) from the same book.

Result And Discussion

The first round of the action research was carried out for 5 weeks, whereby the participants were given 4 lessons of Chinese characters micro-lecture as the materials for preview, in-class learning and revision on the first four weeks, and completed the “Chinese Character Assessment (1)” on the fifth week.

There were 3 data collected from the first round of action research: the records of classroom observation, teaching journals, and the result of “Chinese Character Assessment (1)”.

A. The records of classroom observation

Based on the 4 records of Observation Rubric for Assessing Learning Objectives in Chinese Character Micro-lecture”, it was shown that the micro-lecture “Hanzi the Storyteller” and “The Dancing Hanzi” were proved to raise the student’s study interest and achieved the learning objective in learning Chinese characters, while the impact of the rest of the two micro-lectures was not notable. The main problems were shown in the records: the length of the micro-lecture video was longer than 7 minutes, the new Chinese characters were more than 5 words, there were some rooms of improvements on the design of the micro-lectures (refer to the table below).

Table 2: The Multiple Intelligences And The Problems And Suggestions

No	Multiple Intelligences	Problems and suggestion
1	Interpersonal Intelligence	The interaction between the students should be increased.
2	Linguistic Intelligence	The words choice in the “rhyming nursery rhyme” was too hard for the students.
3	Musical Intelligence	Students were not familiar with the “rhyming nursery rhyme”. The popular rhyming nursery rhyme should be selected as the rhythm of the verse, such as “两只老虎”.
4	Intrapersonal Intelligence	The method of collecting the answer or feedback from the students during the self-check part should be arrange as “answer personally” instead of “answer in group” to ensure the data collection can be clearer.

B. The teaching journals

Based on the teaching journals, it was proved that adapting micro-lecture in teaching Chinese characters can improve the teaching effectiveness, as the students can preview before the lesson, stay more focus during the lesson and revise after the lesson. As for the absentees, they have the opportunity to get their self-study done through online-learning.

C. The result of Chinese Character Assessment (1)

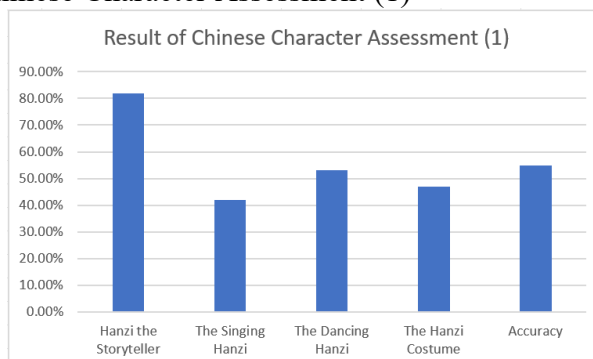


Figure 1: The Result Of Chinese Character Assessment (1)

The second round of the action research took another 5 weeks, same routine, with the other batch of Chinese characters and another four improved micro-lecture videos. After the four lessons, participants took the Chinese Character Assessment (2).

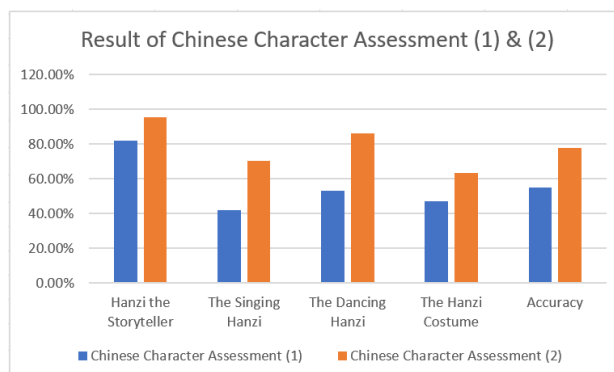


Figure 2: The Compared Result Of Chinese Character Assessment (1) & (2)

Based on the second round of action research data - records of classroom observation, teaching journals, and the result of “Chinese Character Assessment (2)”, it was clearly shown that the student’s learning interest, effectiveness and result were all improved.

Conclusion

The research shows that:

1. The design of the Chinese character micro-lecture teaching method based on multiple intelligences was proved to align more closely with students’ needs for learning Chinese characters. It raises the effectiveness of teaching and learning Chinese characters.
2. The interest of students in learning Chinese characters was raised and the result of the students’ Chinese Character Assessment was improved after the Chinese character micro-lecture teaching method based on multiple intelligences applied in the Mandarin class. The research shows that the more the design of the micro-lectures is related to



students' stronger intelligences, the higher the interest of the student in learning Chinese characters, which then leads to better results in the Chinese Character Assessment and better effectiveness in teaching Chinese characters.

3. There are five factors affecting the application of the Chinese character micro-lecture teaching method based on multiple intelligences in class: the alignment between students' learning status and the design of Chinese character micro-lectures, the student's proclivity in the multiple intelligences, the combination of micro-lecture videos and physical in-class teaching, the cooperation of the student's parents, and the amount of revision time.

From the above observations, it was proved that the Chinese character micro-lecture teaching method for children based on multiple intelligences brought us a new and systematic teaching method that can be customized according to the student's proclivity of specific intelligences, to raise the effectiveness of teaching Chinese characters. The research hopes to contribute to the field of international Chinese language education by providing the conclusion of this teaching action research as a future reference.

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SCAN-TO-HBIM IMPLEMENTATION FOR HERITAGE BUILDING DOCUMENTATION: A CASE STUDY OF MUZIUM SUNGAI LEMBING, MALAYSIA

Julia Md. Tukiran¹, Mohd Ghazali Harun², Rosmiza Wira³, Halim Baharudin⁴, Nurfaridah Mohd Rozi⁵, Muhammad Zharfan Zaim Khalid⁶

¹Civil Engineering Department, Politeknik Sultan Haji Ahmad Shah, Malaysia, (julia@polisas.edu.my)

²Civil Engineering Department, Politeknik Sultan Haji Ahmad Shah, Malaysia, (ghazali@polisas.edu.my)

³Civil Engineering Department, Politeknik Sultan Haji Ahmad Shah, Malaysia, (rosmiza@polisas.edu.my)

⁴Civil Engineering Department, Politeknik Sultan Haji Ahmad Shah, Malaysia, (halim@polisas.edu.my)

⁵Civil Engineering Department, Politeknik Sultan Haji Ahmad Shah, Malaysia, (nurfaridah@polisas.edu.my)

⁶Jurukur Mahabob & Co. Sdn. Bhd., Kuantan, Pahang, Malaysia, (zharfanzaimm@gmail.com)

Abstract: *Heritage Building Information Modelling (HBIM) has progressively gained popularity as a digital tool for heritage documentation; however, the practice is challenging, primarily due to the consolidation and integration of complex geometries and disparate databases. This paper explores the development of a Scan-to-HBIM workflow for heritage building documentation, using Muzium Sungai Lembing in Malaysia as a case study. Terrestrial laser scanning (TLS), UAV-based photogrammetry, and the use of immersive visual documentation are examined throughout the research to help facilitate the building of an information-rich HBIM model. A qualitative case study approach was employed to explore the implementation process and assess a route for systematically incorporating multiple digital datasets into a structured workflow. Results are presented through four main steps: data acquisition, data processing, modelling of the HBIM and workflow documentation and analysis. TLS presented dense geometrical information for both inside and outside spaces, while UAV photogrammetry completed the data acquisition, covering roof parts as well as upper facades. 3D volumetric visualisation facilitated spatial validation and model interpretation. The HBIM model was produced to Level of Detail (LOD) 300 and identified as a suitable level of detail for balancing geometric accuracy against modelling effort for heritage documentation. It is shown that an organised Scan-to-HBIM process can help facilitate document completion and provide a reusable digital repository. This research offers tangible lessons learnt regarding workflow deployment, technical challenges, and considerations for the broader adoption of such an approach within a similar heritage context.*

Keywords: *Scan-to-HBIM, Heritage building documentation, Terrestrial laser scanning, UAV photogrammetry, Case study*

Introduction

Heritage Building Information Modelling (HBIM) has been increasingly used to document and manage heritage buildings in digital format, yet the application of HBIM encounters difficulties, including complex geometry structures with discontinuous historical records and data integration issues (Liu et al., 2023; Penjor et al., 2024; Sampaio et al., 2023). While many authors have contributed to outlining the conceptual framework and workflow for HBIM, reports on real-world evidence of implementation remain relatively scarce, especially for

historic buildings with irregular structures and poor as-built documentation (Rocha et al., 2020).

Recent studies emphasise the necessity for a bridge between theoretical HBIM models and practical heritage documentation in the form of Scan-to-HBIM workflows. Fill in this gap by applying implementation-oriented studies; this is therefore essential for advancing the adoption of HBIM in practice (Penjor et al., 2024). To fill this void, this paper reports the implementation of a Scan-to-HBIM workflow at Muzium Sungai Lembing, Malaysia. These case studies aim to illustrate how several digital recording techniques can be combined for heritage building documentation, as well as the workflow of creating an HBIM model.

Case Study Background: Muzium Sungai Lembing

In research on HBIM, case study-based approaches are typically adopted to test workflows in actual heritage sites, as they provide an understanding of practical constraints and site-specific limitations (Mustafa et al., 2020; Yusoff & Brahim, 2021). The Muzium Sungai Lembing was selected as the representative heritage building for testing a Scan-to-HBIM workflow.



Figure 1: Muzium Sungai Lembing, Pahang, Malaysia: exterior and interior views of the heritage building selected as the case study for the Scan-to-HBIM implementation.

Source: The Authors

A museum in Sungai Lembing, shown in Figure 1 as a case study, was chosen based on its historical value, site challenges, concerning architectural complexity, and lack of proper as-built documentation. Muzium Sungai Lembing is situated in Sungai Lembing, Pahang, Malaysia. The site was the former home of PCCL, which operated one of the largest underground tin mines in the world during the 20th century. The building we see today has evolved over the years to become a museum that tells us about mining and the social culture of that period. The structure is, Architecturally, a mix of colonial and vernacular, with wood construction and raised floors, featuring irregular open plans. No complete as-built plans exist, and in conjunction with dialectic changes over the years, it is a challenge to use documentation techniques commonly. These features render Muzium Sungai Lembing a suitable pilot study for investigating the adoption of the Scan-to-HBIM workflow.

Methodology

This study utilises a case-based qualitative research approach to investigate the practice of HBIM for heritage documentation. Muzium Sungai Lembing was chosen as a test bed to assess the implementation of digital documentation technologies and to experiment with the detailed process flow of HBIM modelling.

The methodology focuses on two primary objectives:

- (i) testing the applicability of selected technological tools for heritage data acquisition, and
- (ii) examining the process of developing an information-rich HBIM model based on the collected data.

The overall workflow follows a Scan-to-HBIM approach, encompassing data acquisition, data processing, HBIM modelling, and workflow analysis. This approach allows the study to document implementation challenges and identify lessons learned from a real-world heritage context.

Research Approach

A case-based qualitative research design is employed in this study to investigate the implementation of HBIM for heritage building documentation (Quattrini et al., 2015). Rather than focusing on theory development or performance testing, the emphasis here is on process implementation stories, which detail how digital technologies and computational workflows are actually applied to heritage problems in a practical setting (Argasiński & Tomczak, 2025). The chosen approach will allow an analysis of the integration of diverse data acquisition technologies and the subsequent generation of a knowledge-enriched HBIM model. By establishing the implementation processes, it is expected that this study will contribute to an empirical understanding of what is needed to make Scan-to-HBIM workflows feasible and practical. This method is of special interest for heritage documentation investigations because the complexity of buildings and site-specific restrictions hinder the application of standardised experiments.

Case Study Selection

In this research, Muzium Sungai Lembing in Pahang, Malaysia, was chosen as the case study to fulfil the implementation-related items of the purpose. The structure is representative of architectural and historical features typically found in heritage buildings, such as irregular geometries, overlaid spatial arrangements, and a scarcity or absence of complete existing as-built record documents. These characteristics present practical challenges for conventional documentation techniques, making the site suitable for testing the applicability of a Scan-to-HBIM workflow. The selection of Muzium Sungai Lembing allows the study to examine how multiple digital documentation technologies can be integrated within a structured workflow to support accurate and systematic heritage building documentation. Furthermore, the case study provides an opportunity to evaluate the workflow in a regional heritage context, contributing empirical evidence to complement existing HBIM literature.

Overview of Scan-to-HBIM Workflow

To achieve a systematic and replicable HBIM integration, this research adopted an official Scan-to-HBIM workflow that has been widely popularised as an applicable guideline for the planning of complicated heritage documentation works, which can ensure coherence across 3D data acquisition, processing and formatting input for analysis (Khan et al., 2022; Liu et al., 2022). The workflow chosen in this study is based on these practices, but it has also been adapted to respond to local demand for heritage documentation.

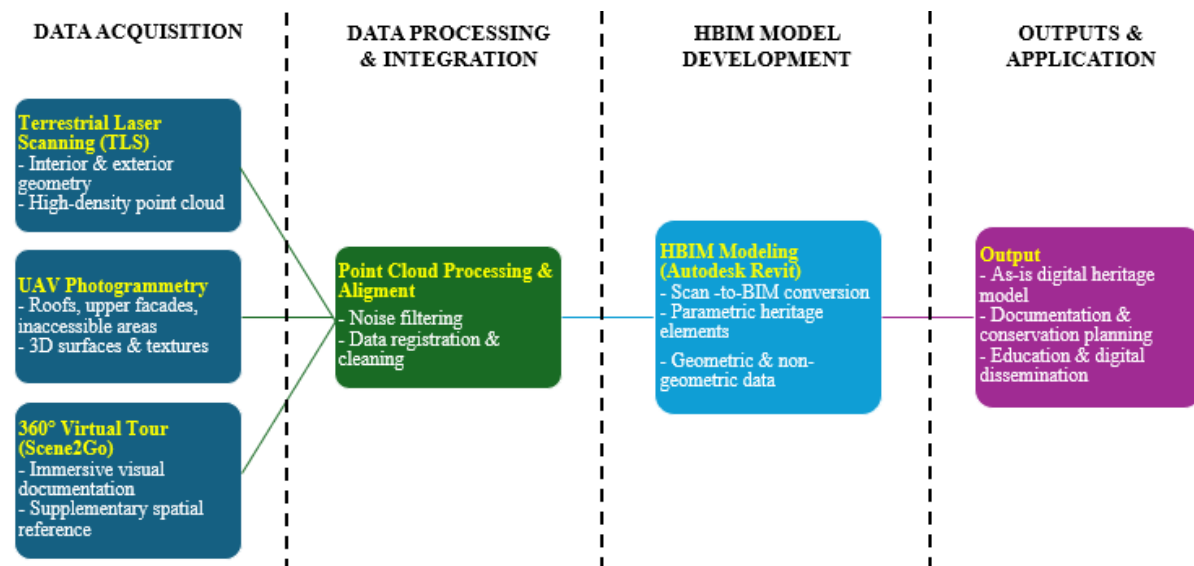


Figure 2: Scan-to-HBIM workflow

Source: The Authors

As illustrated in Figure 2, the workflow begins with the integration of three primary technological tools for data acquisition: terrestrial laser scanning (TLS), UAV-based photogrammetry, and immersive visual documentation using a 360-degree virtual tour platform. TLS was utilized as the main source of geometric data for capturing interior and exterior architectural elements, while UAV photogrammetry complemented the dataset by documenting roof structures and upper façade components that were inaccessible from ground level. The 360-degree virtual tour provided supplementary visual information to support spatial understanding and model interpretation.

After this, the workflow advances to the second stage of data processing, in which the captured datasets are processed to develop an HBIM model. This stage includes point cloud registration, noise removal, and alignment to ensure geometric coherence and data reliability. Processed datasets are used as a comprehensive reference for the models quantifying the workflow. The last part of the workflow process refers to HBIM modelling within a BIM (Autodesk Revit). Reconstructed point cloud data will serve as the primary reference for modelling architectural features, and the addition of non-geometric information will help better report the documentation value of the model. The process is completed by generating an intelligent HBIM model that serves as a digital repository for heritage documentation. In conclusion, the Scan-to-HBIM workflow described in Figure 2 provides a consistent framework that combines the tools and technological resources used, as well as the digital processes followed and documentation generated throughout all phases of data acquisition, processing, and modelling.

Findings and Results

The findings of this study are presented according to four main stages of the Scan-to-HBIM workflow implemented at Muzium Sungai Lembing.

Data Acquisition

Terrestrial laser scanning (TLS) and UAV-based photogrammetry integration are widely acknowledged as an efficient approach for achieving complete spatial documentation in level of detail studies of heritage buildings, particularly for complex or difficult-to-reach architectural elements (Martínez-Carricondo et al., 2021). The data acquisition approach chosen in this study follows these guidelines, utilising TLS, UAV photogrammetry, and immersive visualisation documentation.

Terrestrial Laser Scanning (TLS)

The TLS technique was applied as the primary method to obtain the geometry data of Muzium Sungai Lembing. The scanning tool used herein was a FARO Focus M70 laser scanner, which has a maximum scanning distance of 70 m, a minimum distance for short-range measurement of 0.6 m, and a maximum point cloud capture rate of 488,000 points per second. The scanner can acquire high-density point cloud data as well as panoramic images, which are indispensable for design documentation and visual references.



Figure 3: On-site discussion among the research team during the preliminary site survey to determine suitable TLS scan positions and scanning routes at Muzium Sungai Lembing.

Source: The Authors

Before scanning, a thorough site survey was performed to gain an understanding of the overall building structure, spatial arrangement, and potential obstacles. This initial investigation facilitated the identification of appropriate scanning positions by the research team. Additionally, it provided a basis for discussing an efficient scanning strategy with the research team members on site, as shown in Figure 3. The early coordination made it possible to adjust the flight path for optimal coverage within the short timeframe of the fieldwork schedule. TLS scanning was conducted to record the interior and exterior areas of the building on the first and

second floors. Zig-zag scanning patterns were applied both inside and out to guarantee an adequate overlap between scanning stations and correlation of the scan positions during post-processing. Such scanning helped ensure superior registration and data continuity between separate building sections.

In total, 62 scan stations were set up and completed in approximately 6 hours. All scans were performed using a pre-defined medium resolution scanning profile (which offers a trade-off between geometric accuracy and scanning efficiency). The scans took on average five to seven minutes, comprising scan station preparation, laser scanning, and panoramic image acquisition. As with the earlier phones, non-HDR panoramas were captured at each station to aid in post-processing for data colourisation. During the scanning process, spherical and checkerboard targets were used to aid in the registration of scans. We put the targets less than 10 m, which is an essential criterion for a good re-scanning alignment, in correspondence with the optimal gravity centre of reconstruction point clouds. The TLS data acquisition during fieldwork with the FARO Focus M70 scanner is shown in Figure 4.



Figure 4: Terrestrial laser scanning activities using the FARO Focus M70 during data acquisition at the case study site

Source: The Authors

360-Degree Virtual Tour

In addition to geometry recording, the TLS process provided a 360-degree virtual tour created from panoramic images captured by the FARO Focus M70 scanner, recorded in the scene. These panoramic images were used to develop full 360° tours of the property, providing an immersive visual representation of on-site facilities. We utilised all 62 panoramic image locations that correspond to the TLS scan stations to create the virtual environment. Although the 360-degree visual data were not directly used in geometric modelling, these immersive views supplied supplementary, geographically sensitive information for spatial identification, interpretation of architectural elements, and validation of the HBIM model during modelling.

UAV-Based Photogrammetry

UAV imaging surveying was used to scan building elements that were not only inaccessible but also challenging to monitor using surface-based methods, namely the roof structures and top frontage facades. An aerial image (i.e., no photography from an aircraft) of the site, captured with a DJI Phantom 4 drone, is provided. For roof mapping, the flight height was

carefully chosen to achieve good image overlap and spatial resolution for photogrammetric processing. For safety's sake, the minimum height for a planned flight was set at 15 m above the highest obstruction on site. This method guaranteed safe drone flight and provided sufficient coverage for 3D reconstruction. The workflow for aerial image acquisition, achieved with the help of a DJI Phantom 4 drone, is illustrated in Figure 5.



Figure 5: Aerial image acquisition using a DJI Phantom 4 drone for roof and upper façade documentation at Muzium Sungai Lembing

Source: The Authors

Data Processing

Reliable scan registration and data processing are crucial in Scan-to-HBIM workflows, as it is necessary to maintain the geometric consistency and usability of the point cloud data in order to model it for further applications (Ahmad Jamal et al., 2022; Liu et al., 2022). The use of the utilisation of FARO SCENE and Pix4D in the present case study provides insight into processing pathways frequently presented in recent HBIM literature.

TLS Data Processing Using FARO SCENE

The raw terrestrial scanning data collected during fieldwork were first processed using FARO SCENE 2023, the core software for filtering, registration, and management of point cloud datasets obtained from FARO laser scanners. All raw scan data files were loaded into FARO SCENE, and the first check of the unregistered data and project settings was completed here. In FARO SCENE, the raw scan data were filtered for noise and then registered and aligned, so that disparate individual scan stations were seamlessly merged into a single project point cloud. We processed and registered 62 scan stations in this work, resulting in a super-dense 3D point cloud dataset with approximately 1,298,844,704 points. This highly detailed 3D dataset offers a precise geometric representation of the building's internal and external layout. Figure 6 shows the main interface of FARO SCENE 2023, employed for the Muzium Sungai Lembing project, which includes the project structure and scan management environment. Fig. 7 The registered and processed point cloud dataset, illustrating the three-dimensional data as complete (filled) and continuous in the TLS data processing pipeline. The employment of FARO SCENE enabled the rapid registration of scans through target-based alignment using spherical and checkerboard targets, as well as cloud-to-cloud registration methods. The processed point cloud was the main geometric base on which further HBIM modelling processing was based.

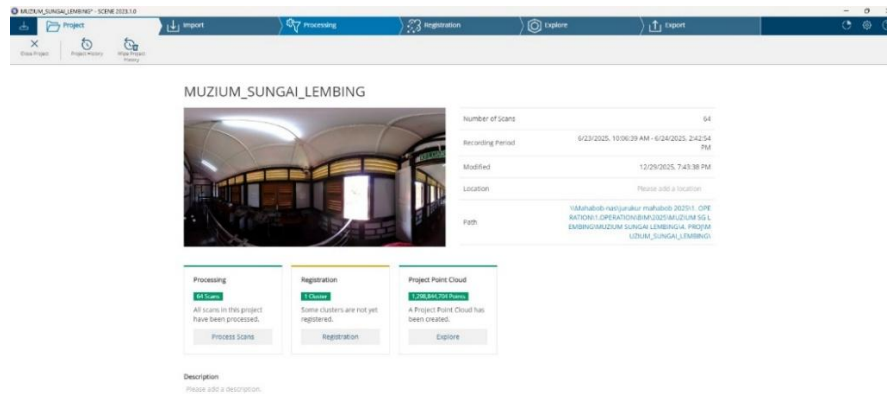


Figure 6: Main interface of FARO SCENE 2023 used for TLS data processing and scan registration in the Muzium Sungai Lembing project

Source: The Authors

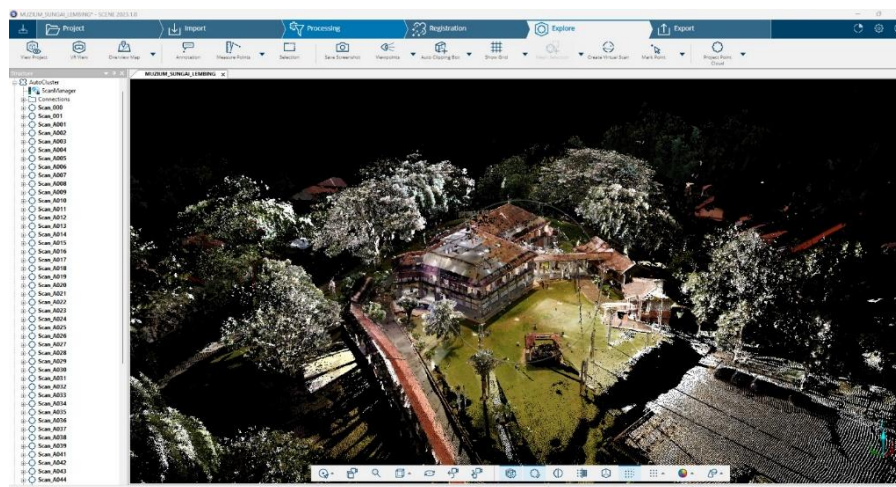


Figure 7: Processed and registered TLS point cloud of Muzium Sungai Lembing generated in FARO SCENE

Source: The Authors

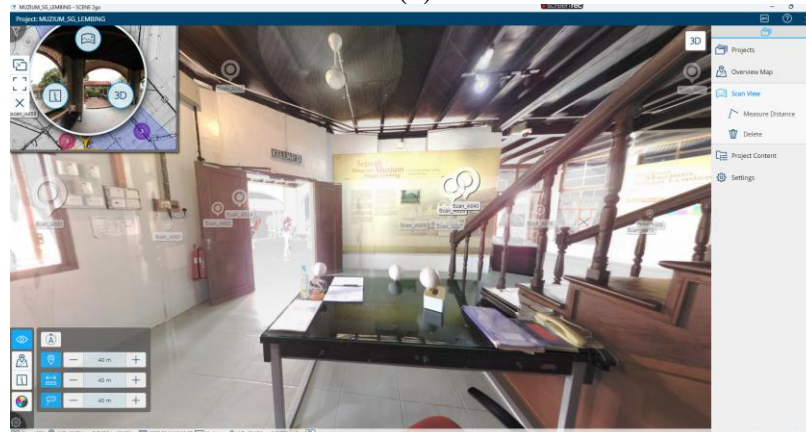
Processing of 360-Degree Virtual Tour Using Scene2Go

Apart from point cloud processing, 360-degree virtual tours and immersive visual documentation were created using FARO SCENE. The virtual tour was exported from FARO SCENE to Scene2Go using the built-in 'Scene2Go App' in the software environment. The procedure consisted of selecting the "Create Scene2Go Data" option, setting up export options for gap-filling 3D data to achieve higher-quality visualisation (if required), and choosing between colour or grayscale presentations. Once all options were set, the Scene2Go data was exported and transferred using the Transfer Scene2Go Data feature. This process produced a standalone viewer package that includes an executable file and project data, accessible offline on Windows or macOS desktops, without the need to install FARO SCENE. Figure 8 shows the virtual tour interface developed on Scene2Go with (a) a floor plan of Muzium Sungai Lembing, (b) an immersive panoramic and 3D views within space. The visual tour offered an important aesthetic as well as spatial reference point for validating spatial and interpretative

solutions, supplementing the HBIM modelling process by facilitating continued crossover between geometric information and firsthand views.



(a)



(b)

Figure 8: Scene2Go virtual tour interface showing (a) overview map of Muzium Sungai Lembing and (b) immersive panorama and three-dimensional views used for spatial verification and interpretation

Source: The Authors

UAV Photogrammetry Data Processing

Although it offers features for point cloud filtering, editing, as well as analysis and evaluation processes, FARO SCENE is primarily intended to process and register point clouds from terrestrial laser scanners, but not as a means for creating them from UAV imagery. Hence, the imagery taken from the DJI Phantom 4 drone is processed separately using Pix4D photogrammetry software. All images taken by the UAV are initially aligned in the Pix4D environment to orient them spatially and ensure overlap. Following this, the registered images were post-processed to create a 3D point cloud and surface mesh model that describes the outer geometry of the building, with an emphasis on the roof lines. The focus of this dataset is to aid HBIM modelling for the above-ground parts of buildings, which are not appropriately captured by terrestrial scanning alone. Combining the photogrammetric results from UAV with TLS data could fill in all the gaps and be used to complement the documentation for HBIM modelling. The processing steps for TLS, UAV photogrammetry, and immersive visual

documentation are provided in Table 1. The table summarises the software platforms, processing steps, and output datasets supporting our Scan-to-HBIM workflow, as deployed in this work.

Table 1: Summary of data processing procedures for terrestrial laser scanning (TLS), UAV-based photogrammetry, and immersive visual documentation using Scene2Go within the Scan-to-HBIM workflow

Data Type	Input Data	Processing Software	Processing Steps	Output Data	Purpose in HBIM Workflow
TLS	Raw laser scan data from FARO Focus M70	FARO SCENE 2023	Noise filtering, scan registration, target-based and cloud-to-cloud alignment	Registered point cloud (~1.29 billion points)	Primary geometric reference for HBIM model development
TLS Panoramic Images	Panoramic images captured at scan stations	FARO SCENE 2023	Image panorama linking, processing, colorization support	Colorized point cloud and panoramic views	Visual reference and spatial verification
360-Degree Virtual Tour	Panoramic images from TLS scans	Scene2Go (via FARO SCENE)	Scene2Go data creation, gap filling, export and transfer	Offline virtual tour (executable + project data)	Immersive visualization and model interpretation
UAV Photogrammetry	Aerial photographs captured by DJI Phantom 4	Pix4D	Image alignment, dense point cloud generation, mesh creation	3D point cloud and surface mesh	Roof and upper façade modeling support

Source: The Authors

HBIM Model Development

According to previous research, LOD 300 is necessary to provide geometric accuracy that enables the visualisation and integration of information without the need for fabrication-level detailing (Alshawabkeh et al., 2024; Kandemir, 2025). The HBIM model produced in this paper complies with such a recommendation, focusing on spatial precision and documentation quality. The HBIM model was produced using Autodesk Revit and relied on point cloud data reduction as the primary geometric reference. The architectural elements, such as walls, floors, roofs and openings, have been modelled to denote the building's existing condition. Customised modelling approaches were devised, as heritage buildings feature irregular geometry and are not readily available with off-the-shelf elements. Non-geometric data, such as material and architectural information, were added to enrich the documentation of the HBIM model.

Workflow Documentation and Analysis

The construction of the HBIM model was created in Autodesk Revit, as it is a standard BIM software with accurate 3D modelling, point cloud integration, and an information storage and retrieval system. Since Autodesk Revit allows both geometric and non-geometric information to be included simultaneously, it can be used for heritage documentation. The registered 3D point cloud from TLS served as the basis for HBIM modelling. The point cloud data was

imported into the Revit environment, informing the precise modelling of architectural components. As shown in Fig. 9, when a TLS point cloud is input within the Revit interface, survey data can be aligned with the modelling workspace.

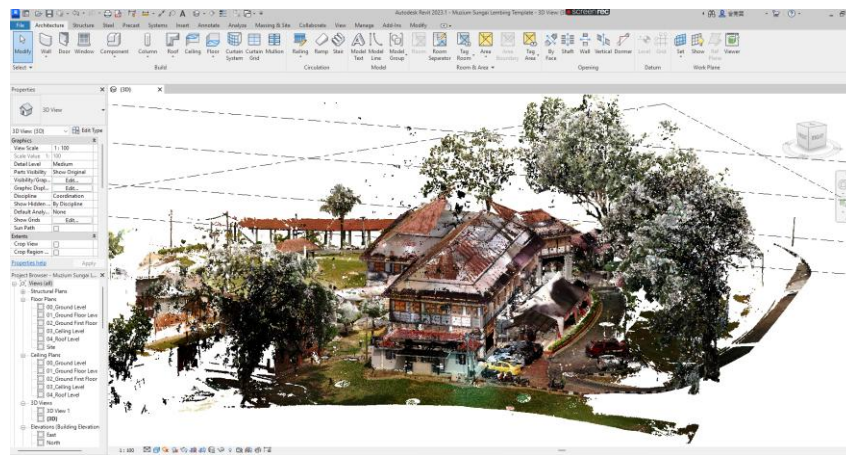


Figure 9: Autodesk Revit interface showing the imported and registered TLS point cloud used as the primary geometric reference for HBIM model development

Source: The Authors

We used additional reference materials to aid in model interpretation and verification, in addition to the TLS point cloud. These were the 360-degree virtual tours created with Scene2Go, UAV photos, and on-site photographic documentation. The addition of multiple reference sources was especially valuable in interpreting architectural details and building elements that were partially obscured or less well-defined in the point cloud data. The HBIM model was built to characterise the current state of the building, and includes architectural elements such as walls, slabs, roofs, columns, beams, doors and windows. Due to the irregularly shaped geometry and non-standard building construction common in heritage buildings, parametric families were developed where standard Revit libraries fell short. This method facilitated more realistic modelling of heritage-specific elements while navigating parametric control.

Used the LOD 300 LOD for heritage documentation in the HBIM model. At this level, building elements are modelled with the correct geometry (length and width), location, and orientation with respect to point clouds, spatially enabling them for analysis, visualisation, and information integration without extending to fabrication details. This level of detail is credible for modelling effort and geometrical accuracy in a Scan-to-HBIM implementation study. Non-geometric data is embedded in the HBIM model using an information schema that includes properties such as material specification, building element category, and descriptive notes on architectural features. This organised data will make the HBIM model more valuable as a digital collection by combining physical geometry with background information related to heritage documentation. Selected three-dimensional views from the HBIM model generated in Autodesk Revit are shown in Fig. 10, including (a) a 3D interior view with the display using TLS point cloud to illustrate geometric registration, and (b) a corresponding 3D interior view of pointing off for the HBIM model accomplishment. These viewpoints demonstrate how point cloud data supported the modelling activities and how the finalised HBIM model represents an understandable or interpretable digital replica of the heritage building.

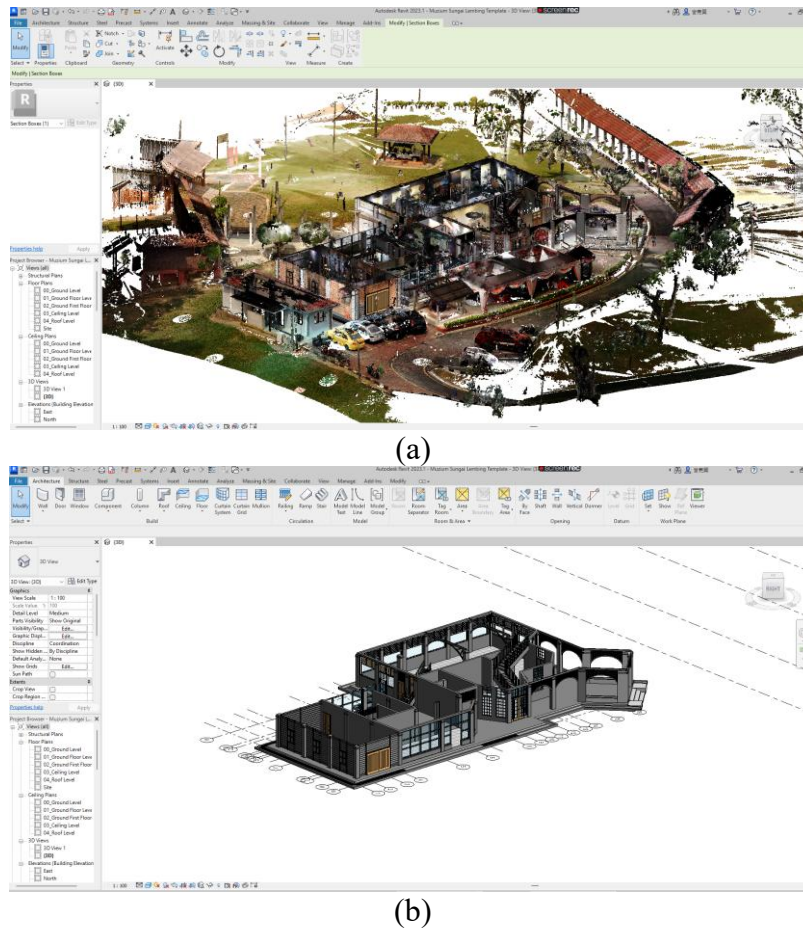


Figure 10: Three-dimensional views of the HBIM model developed in Autodesk Revit: (a) interior view with the TLS point cloud displayed for geometric reference, and (b) interior view with the TLS point cloud turned off, showing the completed HBIM model.
Source: The Authors

Discussion

This study showcases the application of a Scan-to-HBIM workflow for heritage building documentation through its case study, Muzium Sungai Lembing. The discussion also integrates the results and discusses the strong points of the applied workflow, potential improvements, lessons learned from application to practice, and its position in relation to other HBIM studies.

Strengths of the Scan-to-HBIM Implementation

One of the strengths of this workflow is that it brings together several digital documentation technologies to handle the complexity demanded by heritage building management. The use of terrestrial laser scanning (TLS) as the central methodology for geometric data ensured the precise acquisition of indoor/outdoor spaces. At the same time, UAV-based photogrammetry complemented it by capturing roof elements and the upper parts of facades that are not accessible by walking. The addition of immersive visual recording to enhance understanding and interpretation was found to enrich the HBIM modelling process.

Moreover, the Scan-to-HBIM process is structured and organised, which greatly helped in systematising data management from capture to processing and model generation. The distinct division of workflow stages enhanced data scalability and decreased incoherence between datasets. Such a methodical and systematic approach to documentation is beneficial in heritage documentation projects, where there may be an incomplete or fragmented record of the site, and challenges associated with limited on-site time typically make digital documentation difficult. A further methodological strength is the use of LOD 300 for implementing the HBIM model. At this stage, the model delivers good shape fidelity combined with rich information for documentation and visualisation, while not being carried through to fabrication-level detailing. Fast and accurate interactive 3D modelling methods are therefore crucial for heritage projects because such endeavours are often time-, budget-, and resource-limited.

Limitations of the Workflow

The introduced Scan-to-HBIM approach in this work presents promising advantages as well as some limitations. One of the most significant problems is the slow data processing and generation of HBIM models, particularly in cases involving dense point cloud data containing billions of points. Although TLS provides excellent geometric fidelity, manipulating and interpreting large datasets in this form are both computer resource and skill-intensive activities.

Another drawback concerns the manual workload required to model complex heritage parts. They had to be modelled as custom parametric families to realistically portray non-standard building elements, which led to additional modelling time and depended significantly on the modelling team's ability. This reflects a more general challenge in HBIM, where the automation of heritage-specific elements is currently incomplete. Moreover, although UAV photogrammetry could assist in modelling the roof structure, processing a multi-source dataset was more practical than using automatic methods. It is noted that this limitation echoes the reported difficulties in the HBIM literature, suggesting the use of more interoperable and automated data fusion methods for future research.

Lessons Learned and Practical Implications

There are several notable takeaways from the deployment of the Scan-to-HBIM methodology at Muzium Sungai Lembing. First, the early site inspection and workflow pre-planning are crucial for successful high-speed data acquisition, especially in heritage buildings with complicated space layouts. Transparent communication between team members during the planning process significantly contributed to efficient scanning and the completeness of data. Second, the study emphasises that it is crucial to set a documentation goal before developing a model. LOD 300 was chosen because the research team could concentrate on spatial correctness and information integration without excessive modelling. This is an essential lesson for heritage documentation projects that prioritise long-term digital archiving over construction-derived outputs.

Lastly, but not least, the results indicate that implementing HBIM should not be considered solely as a matter of technical modelling, but above all as a digital strategy based on processes.



The presented structured workflow for heritage documentation enables environmentally friendly data reuse, interdisciplinary cooperation, and further model extension.

Comparison with Existing HBIM Studies

Compared to current HBIM studies, the approach proposed in this paper not only aligns with established practice but also incorporates its own unique contextual contributions. In a previous study by Dore et al., (2015), terrestrial laser scanning has been endorsed as the primary means for data collection in HBIM generation, as it effectively represents complex historic geometries. This is because high-density point clouds provide detailed information related to datasets from which generic and specific architectural components can be produced. This is also the method adopted in the present study: TLS as a primary geometric database, yet one extended with UAV-borne photogrammetry and immersive visual documentation, which helps overcome issues of access while allowing for deeper spatial interpretation.

Additionally, a majority of HBIM research studies centre around European stone and masonry heritage buildings, while the Muzium Sungai Lembing case study presents an opportunity to demonstrate how Scan-to-HBIM workflows are applicable in Southeast Asian heritage settings that feature timber components, hybrid construction methods, and various additions. Unlike those who emphasise great detail in modelling strategies, the work has demonstrated that an LOD 300 HBIM model can deliver trustworthy documentation results and is more feasible for heritage projects with time and technology constraints. These results provide empirical evidence to complement the current HBIM literature, indicating that workflow flexibility and context-based modelling can underpin satisfactory heritage documentation.

Conclusion

This paper describes the implementation of the Scan-to-HBIM workflow for heritage building documentation, with Muzium Sungai Lembing in Malaysia serving as one of the case studies. Using terrestrial laser scanning (TLS), UAV photogrammetry, and immersive visualisation of digital heritage documentation, we demonstrated how diverse digital data can be seamlessly integrated to complement each other and provide accurate, full-scale 3D heritage documentation. The results verify that a formal scan of the HBIM process increases the completeness and reliability of documentation, specifically for heritage buildings with complex geometries and limited available information. The HBIM model at LOD 300 was formulated to meet the need for heritage documentation, which required medium-level geometric accuracy and rich information, yet remained manageable. Computer-assisted modelling in Autodesk Revit, augmented with the processed point cloud and visual data, provided an information-rich digital model for long-term documentation archives.

Meanwhile, the research also indicates that several issues arise with the practical application of HBIM, including time-consuming data processing, professional difficulties in modelling, and limited integrated implementation of multi-source datasets. These problems highlight the need for effective planning, optimising work, and professionalising the scope of HBIM in future projects. Ultimately, this research significantly enriched the empirical study in the HBIM research field through a highly detailed explanation of practical use in a real-world project. The recorded workflow and experience provide valuable insights for researchers and practitioners who wish to utilise Scan-to-HBIM solutions for heritage documentation in similar situations.



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DEVELOPING AN INQUIRY-BASED LEARNING TECHNOLOGY-INTEGRATED FRAMEWORK FOR ENHANCING TECHNOLOGICAL LITERACY IN MALAYSIAN VOCATIONAL COLLEGE STUDENTS

Muhammad Afif Ammar Muhammad Hijaz¹, Nur Hazirah Noh@Seth², Zi Jian Oh³

¹ Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia, Malaysia, (ammar1997@graduate.utm.my)

² Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia, Malaysia, (nurhazirah.n@utm.my)

³ Department of Business Management, Batu Lanchang Vocational College, Penang, Malaysia, (ohzijian@gmail.com)

Abstract: Industry Revolution 4.0 has intensified the demand for graduates who possess strong technological literacy and the ability to engage confidently with digital tools. In Malaysian Vocational Colleges, however, technological literacy remains an ongoing challenge due to lecturer centred practices, limited inquiry-oriented learning, and inconsistent use of technology during the Final Year Project. These issues reduce opportunities for students to investigate, analyse, and solve authentic problems using modern technologies. This conceptual paper proposes a technology integrated Inquiry Based Learning framework designed to strengthen technological literacy among Vocational College students. The framework is informed by constructivist principles, the Inquiry Based Learning model, and key elements of the Technology Acceptance Model to identify pedagogical and technological components that support meaningful inquiry. A review of current national TVET directions and recent empirical findings highlights gaps in project implementation, particularly the absence of structured inquiry processes and insufficient emphasis on reflective technological use. The proposed framework consists of five Inquiry Based Learning stages that embed purposeful technological engagement to support orientation, conceptualisation, investigation, conclusion, and reflection. This model offers structured guidance for educators to design richer learning environments that promote technological literacy and provide a foundation for future empirical validation.

Keywords: Inquiry Based Learning, Technological Literacy, Vocational Education, Technology Integration, Conceptual Framework

Introduction

The accelerated development of Industry Revolution 4.0 has transformed global expectations for workforce readiness and reinforced the importance of technological literacy across all economic sectors. Technologies such as artificial intelligence, the Internet of Things, automation, and data analytics increasingly shape industrial processes, requiring individuals to understand, evaluate, and apply technology with confidence. The World Economic Forum (2022) and Arifin, Sukarmin, Saputro, & Kamari (2025) identifies technological literacy as one of the most essential competencies for future employment, while recent analyses warn that workers without digital capability risk being displaced from technology driven fields Mohammad Hussain, Ahmat Zainuri, Mohd Zulkifli, & Abdul Rahman (2023). In Malaysia, national policy documents, including the Digital Economy Blueprint and the Industry Four



WRD Policy, further emphasise the need for a digitally competent workforce and position education institutions as key enablers of technological preparedness.

Within this national agenda, Malaysian Vocational Colleges carry a significant responsibility in preparing learners for technologically intensive environments. Yet, existing research shows that many Vocational College students still face challenges in achieving the level of technological literacy expected by industry. Studies reveal that learners struggle to use digital tools for data informed decision making and have limited exposure to simulation, design, and automation technologies that are relevant to their technical fields Salleh & Sulaiman (2021). Nurulwahida et al. (2024) found that learners in mechanical and manufacturing programmes face difficulties applying digital technologies during project tasks due to inadequate technological scaffolding. Similarly, Ariffin (2024) report that teaching practices in Technical and Vocational Education and Training remain dominated by lecturer centred instruction, which restricts opportunities for exploratory and technology supported learning.

The Final Year Project, designed as an authentic capstone assessment in Vocational Colleges, aims to enhance critical thinking, problem solving, and the application of technical knowledge. However, its current implementation often emphasises the final product rather than the investigative learning process that contributes to the development of technological literacy Luckin (2025). Evidence indicates that many students depend heavily on lecturer direction, conduct limited inquiry, and engage minimally with digital tools that support systematic investigation Rahman, Idris & Mahmud (2020). International studies similarly demonstrate that the absence of structured inquiry reduces learners' ability to integrate technology into complex problem solving Bekbayeva et al. (2021).

Inquiry Based Learning offers a promising approach to address these challenges because it promotes questioning, exploration, investigation, analysis, and reflection while using technology as a cognitive support tool. Recent research confirms that Inquiry Based Learning improves technological competence and higher order thinking when accompanied by meaningful digital integration Chen, Luo & Zhang (2024). Therefore, developing a technology integrated Inquiry Based Learning framework is essential to strengthen technological literacy among Malaysian Vocational College students and enhance the quality of learning in the Final Year Project.

Literature Review

The evolving demands of Industry Revolution 4.0 underscore the growing importance of integrating technological literacy as a fundamental learning outcome within education systems. Technological literacy encompasses the ability to understand, evaluate, use, and adapt technologies in informed and reflective ways. It goes beyond basic operational skills and includes the capacity to interpret data, solve digital problems, and analyse technological systems within authentic contexts. Research suggests that the future workforce must be able to interact meaningfully with artificial intelligence, automation, data analytics, and Internet of Things technologies, and must possess the ability to make informed decisions using these tools (Ghazali, Rahman & Ismail, 2020; World Economic Forum, 2022). In Malaysia, Ministry of Education reports highlight that many Vocational College students still demonstrate limited technological competence, particularly in tasks that require critical evaluation or the use of



technology supported reasoning. These challenges indicate the need for structured pedagogical strategies that can systematically cultivate technological literacy among learners (KPM, 2024).

Inquiry Based Learning has long been recognised for its ability to strengthen higher order thinking, promote self-directed exploration, and support deeper understanding of technological concepts. It positions learners as active investigators who develop knowledge by asking questions, exploring problems, gathering information, and engaging in reflective analysis Hmelo Silver, Duncan & Chinn (2008). Within Technical and Vocational Education and Training environments, Inquiry Based Learning has been shown to enhance learners' capacity to analyse problems, apply digital tools, and synthesise solutions grounded in evidence Mohammad Hussain et al. (2023). Recent research from Scopus indexed journals reports that Inquiry Based Learning also improves digital reasoning and complex problem solving when learners engage in structured inquiry phases supported by appropriate technological tools Nong et al. (2022). Bekbayeva et al. (2021) add that Inquiry Based Learning leads to notable gains in technological literacy when integrated with digital platforms that facilitate simulation, data collection, iterative experimentation, and evaluation.

Although Inquiry Based Learning offers strong potential for developing technological literacy, its implementation within Malaysian Vocational Colleges remains uneven and insufficiently structured. Many lecturers continue to adopt lecturer centred approaches that limit student engagement with exploratory inquiry and restrict the use of digital technologies during investigative tasks Salleh & Sulaiman (2021). This challenge mirrors international findings in vocational education, where project-based courses often emphasise product completion rather than the investigative and reflective processes necessary for technological skill development Abd Karim and Mustapha (2022). The same pattern is observed in Malaysia, where the Final Year Project guidelines in Vocational Colleges place substantial focus on documentation and end products, with limited emphasis on stages such as conceptualisation, investigation, and reflection that are essential for Inquiry Based Learning BPLTV PTA Guidelines (2023). Research indicates that when structured inquiry processes are absent, students receive limited opportunities for technological experimentation, data driven reasoning, and iterative problem solving, all of which are central to technological literacy Tikhonova & Raitskaya (2023).

The integration of the Technology Acceptance Model into this discussion adds an important psychological and behavioural dimension to understanding how learners adopt technology during inquiry activities. The model explains that perceived usefulness and perceived ease of use strongly influence learners' attitudes, motivation, and actual usage of technological tools Davis (1989). These factors shape whether learners are willing to engage with simulation tools, digital measurement devices, collaborative platforms, or automation software during their investigative processes. Studies in Technical and Vocational Education and Training show that when learners perceive digital tools as beneficial and manageable, they are more likely to integrate them meaningfully into their inquiry tasks, resulting in enhanced technological literacy (Venkatesh and Bala, 2008; Luo, Chen & Zhang, 2024). This suggests that efforts to embed technology into Inquiry Based Learning must also consider learners' perceptions, confidence, and readiness to use digital tools.

Taken together, the existing literature reveals significant gaps in current practice. Although technological literacy is increasingly recognised as a critical competency, and Inquiry Based Learning has demonstrated its value for technology supported learning, the implementation of



both elements in Malaysian Vocational Colleges remains inconsistent and insufficiently structured. Technology integration in project-based learning is often fragmented, limiting learners' exposure to authentic technological reasoning. Furthermore, there is no framework within the Malaysian Vocational College context that systematically combines Inquiry Based Learning with technological literacy development in the Final Year Project. These gaps highlight the need for a new and comprehensive framework that integrates theoretical, pedagogical, and technological perspectives to better support learners in developing the competencies required for Industry Revolution 4.0.

Conceptual Framework

The conceptual framework developed in this paper is grounded in three major theoretical foundations, namely constructivism, the Inquiry Based Learning model, and the Technology Acceptance Model. Constructivism provides the philosophical basis by explaining that learners construct knowledge through active engagement, interaction with the environment, and meaningful exploration of real-world experiences. Scholars such as Piaget (1970) and Vygotsky (1978) emphasise that learners develop understanding by connecting new information with prior knowledge, which makes learning more authentic, purposeful, and personally meaningful. In the context of Vocational Colleges, constructivism suggests that students must be provided with opportunities to explore technical problems, engage with technological tools, and build knowledge through hands on activities that mirror industry practices.

The Inquiry Based Learning model strengthens this theoretical foundation by offering a structured learning process that guides students through stages of orientation, conceptualisation, investigation, conclusion, and reflection Pedaste, Mäeots, & Siiman (2015). During the orientation stage, learners are introduced to authentic technical issues and encouraged to explore digital simulations or visualisation tools that stimulate curiosity. In the conceptualisation stage, learners generate questions, predictions, or hypotheses with support from online sources, digital concept mapping, or collaborative platforms. The investigation stage forms the core of technological literacy development because it allows learners to gather data, test ideas, and analyse information using simulation software, Internet of Things tools, digital measurement devices, or automation technologies. The conclusion stage involves synthesising findings with support from digital reporting or data analysis applications, and the reflection stage encourages learners to evaluate the effectiveness of the technological tools they used, identify challenges, and propose improvements for future inquiry activities. This sequence shows that Inquiry Based Learning provides a structured pathway through which learners can develop deeper understanding of technology supported problem solving.

The framework also incorporates the Technology Acceptance Model to address the psychological and behavioural aspects that influence technological engagement. The model explains that two key factors, namely perceived usefulness and perceived ease of use, influence whether learners accept and adopt technological tools during learning. Perceived usefulness refers to the degree to which students believe that technology supports their inquiry tasks or improves the quality of their project work, while perceived ease of use refers to the level of effort students believe they must invest in learning or using technological tools. These perceptions strongly influence students' confidence, motivation, and willingness to engage with digital platforms and tools during the inquiry process. Integrating these constructs into the

framework ensures that technological engagement is not solely a pedagogical requirement but also a supportive mechanism that enhances learners' comfort, readiness, and confidence when performing technology supported inquiry.

The Technology Integrated Inquiry Based Learning Framework therefore positions technology as a cognitive resource that supports each stage of inquiry and strengthens technological literacy. It connects the active learning principles of constructivism with the structured stages of Inquiry Based Learning and incorporates the behavioural insights of the Technology Acceptance Model. By doing so, the framework emphasises that technological literacy develops most effectively when learners actively investigate authentic problems using relevant digital tools while also experiencing motivation and confidence to engage with those tools. The combination of these theoretical perspectives results in a holistic model that can guide educators in designing Final Year Project learning environments that align with the technological demands of Industry Revolution 4.0 and the expectations of the national Technical and Vocational Education and Training system.

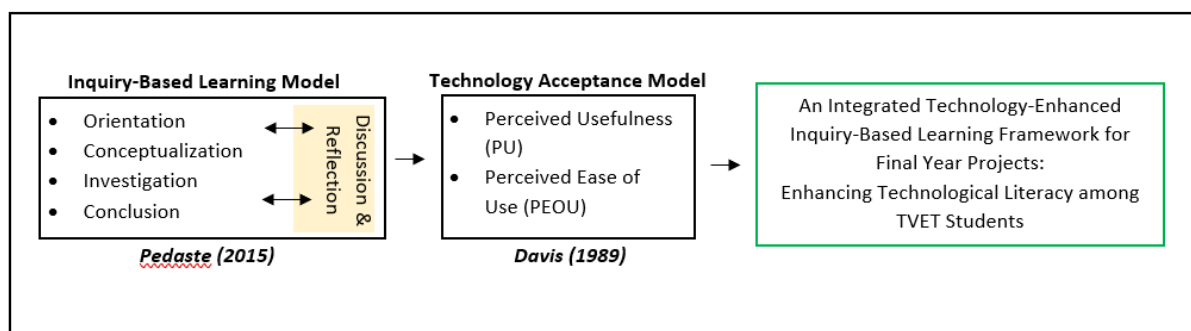


Figure 1: Technology Integrated Inquiry Based Learning Framework

Discussion

The synthesis of theoretical perspectives and current research highlights the need for a structured pedagogical approach to address persistent challenges related to technological literacy among Malaysian Vocational College students. Although national policies emphasise digital readiness and technological competence, learning environments in many Vocational Colleges still rely heavily on lecturer centred strategies that do not encourage active inquiry or sustained engagement with digital tools. The absence of structured inquiry in the Final Year Project limits opportunities for learners to conduct authentic investigation, evaluate data, or engage with technologies commonly used in industry.

The Technology Integrated Inquiry Based Learning Framework proposed in this paper responds to these challenges by integrating technology into each inquiry phase and positioning it as a cognitive support tool. By embedding digital tools into orientation, conceptualisation, investigation, conclusion, and reflection, learners engage in deeper and more authentic investigative activities. This approach aligns with global findings indicating that technology enriched inquiry leads to stronger cognitive transfer, improved technological confidence, and greater workplace readiness Tikhonova & Raitskaya (2023).

The inclusion of Technology Acceptance Model constructs strengthens the framework by acknowledging that learners' perceptions influence technological engagement. When students



perceive digital tools as useful and easy to use, they are more likely to adopt them during investigative tasks and reflective analysis. This is especially relevant in Vocational Colleges where learners come from diverse technological backgrounds and may require greater support to use unfamiliar tools confidently.

Overall, the discussion emphasises that technological literacy develops most effectively through structured inquiry supported by meaningful and motivational technological engagement. The proposed framework has the potential to transform Final Year Project practices by shifting emphasis from producing a final output to engaging in a technology supported investigative process.

Conclusion

The rapid transformation associated with Industry Revolution 4.0 underscores the need for Technical and Vocational Education and Training institutions to adopt pedagogical strategies that systematically strengthen technological literacy. Evidence indicates that many Malaysian Vocational College students face difficulties applying digital tools, conducting technology supported investigations, and reasoning with data during technical tasks. These challenges highlight a misalignment between traditional instructional practices and the competencies required by technology driven industries.

The Technology Integrated Inquiry Based Learning Framework introduced in this paper provides a structured and theoretically grounded approach to address these challenges. The framework integrates constructivist principles, structured inquiry processes, and key insights from the Technology Acceptance Model to position technology as a meaningful cognitive resource rather than a supplementary tool. Through purposeful integration of digital visualisation, simulation, data analytics, and reflective technologies, learners can develop deeper technological understanding and stronger problem-solving competence.

This conceptual contribution is specifically tailored to the Malaysian Vocational College context and aligns with national aspirations to prepare a digitally competent workforce. Future research should focus on empirically validating the framework through pilot studies, expert evaluation, and student feedback. Practical implementation guidelines should also be developed to ensure sustainable and consistent adoption across Vocational Colleges. With further refinement and application, the framework has the potential to enhance teaching practices, improve technological competence, and contribute to the national agenda of producing a future ready workforce.

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COLLABORATIVE KNOWLEDGE SHARING MODEL TO STRENGTHENING STAKEHOLDER ROLES IN KNOWLEDGE PORTAL FOR PADDY FARMING

Fadhilah Mat Yamin¹, Wan Hussain Wan Ishak², Noor Hidayah Abu³, Zakirah Othman⁴, Arif Imam Suroso⁵, Febriantina Dewi⁶, Lokita Rizky⁷, Khariyah Kamilla⁸, Hansen Tandra⁹

^{1,3,4}School of Technology Management & Logistics, Universiti Utara Malaysia (UUM), Malaysia, (fmy@uum.edu.my; dayah@uum.edu.my; zakirah@uum.edu.my)

²School of Computing, Universiti Utara Malaysia (UUM), Malaysia, (hussain@uum.edu.my)

^{5,6,7,8,9}Institut Pertanian Bogor Indonesia, Indonesia

Abstract: Knowledge sharing in paddy farming faces persistent challenges due to fragmented information, limited access, and weak stakeholder engagement. Although digital platforms exist, many are underutilized because they lack clear stakeholder roles and long-term collaboration mechanisms. This study proposes the Collaborative Knowledge Sharing Model (CKSM), a framework that integrates digital tools with active stakeholder participation to support inclusive knowledge exchange. Using the Design Science Research (DSR) approach, the study involved problem identification, literature review, field consultations, model design, and validation. Consultations with three key organizations in Kedah, Malaysia—Kedah Department of Agriculture, MADA, and LZNK—ensured real-world relevance. CKSM comprises three components: (1) the Central Knowledge Hub (CKH), a cloud-based repository; (2) the Stakeholder Collaboration Layer (SCL), which fosters communication and coordination; and (3) the Monitoring and Feedback Mechanism (MFM), which allows continuous improvement. The model defines clear roles for six stakeholder groups: farmers, agricultural agencies, research institutions, financial institutions, agri-tech providers, and NGOs or community organizations. Each group contributes to creating, validating, and sharing knowledge. CKSM not only centralizes information but also encourages collaboration and shared governance. It offers a flexible and scalable solution to enhance decision-making and productivity in paddy farming. Future work includes developing and testing a prototype based on this model.

Keywords: Knowledge Management, Stakeholder Engagement, Paddy Farming, Collaborative Model, Digital Agriculture

Introduction

Paddy farming remains a critical pillar of food security and rural livelihoods in Southeast Asia, yet persistent challenges continue to constrain its productivity and sustainability, particularly in the way agricultural knowledge is generated, shared, and applied. Many farmers still rely heavily on informal experience-based practices or fragmented advice from extension agents, with limited access to scientific research, financial instruments, and modern agricultural technologies (Ali, Man, & Muharam, 2019; Assefa et al., 2011). These gaps in accessible and actionable knowledge weaken farmers' decision-making capacity, contributing to inefficiencies and suboptimal farm performance.



The agricultural knowledge ecosystem is further complicated by institutional fragmentation, where information is dispersed across research institutions, government agencies, financial bodies, and non-governmental organizations that often operate in silos. Limited coordination among these actors restricts effective knowledge exchange, reuse, and contextualization, while valuable indigenous and experiential knowledge is frequently underrepresented in formal systems (Abbas, 2016; Ali & Avdic, 2015; Tumwebaze, Walsh, & Lannon, 2024). Although digital technologies such as mobile applications, cloud platforms, and data analytics offer significant potential to bridge these gaps and enable real-time, two-way communication, their impact remains constrained when implemented without clear governance structures, role definitions, and sustained stakeholder engagement (Petana & Rosa, 2020; Chatterjee & Samanta, 2022; Ahmad & Karim, 2019).

Addressing these limitations requires a shift toward collaborative knowledge sharing, where digital systems support interaction, trust, and shared ownership rather than serving solely as information repositories. Prior studies emphasize that effective knowledge management depends on meaningful stakeholder interaction, role clarity, and mutual benefit (Alavi & Leidner, 2001; Amayah, 2013). Building on this foundation, this article introduces the Collaborative Knowledge Sharing Model (CKSM), an extension of the Collaborative Knowledge Portal Model for Paddy Farming (Fadhilah et al., 2025). CKSM integrates clearly defined stakeholder roles with structured interaction mechanisms in a unified digital environment to support the co-creation, validation, exchange, and application of knowledge. By aligning human expertise with digital infrastructure, the model aims to enhance evidence-based decision-making, reduce redundancy in knowledge delivery, and promote inclusive and sustainable development in the paddy farming sector.

Literature Review

Recent literature increasingly emphasizes that effective agricultural knowledge systems must be grounded in stakeholder collaboration rather than one-way information dissemination. Studies highlight the value of involving farmers, extension agents, researchers, financial institutions, and technology providers in the co-creation and validation of knowledge. Bernardi et al. (2021) demonstrate that community-based and participatory knowledge practices can foster more sustainable agricultural behaviors by treating knowledge as a shared and collectively governed resource. This perspective aligns with broader arguments that inclusive governance structures are essential for sustaining engagement and ensuring that knowledge remains relevant to local agricultural contexts.

Digital platforms have been widely explored as enablers of multi-stakeholder knowledge sharing, particularly in rural and agricultural development. Ali and Avdic (2015) propose a knowledge management framework that integrates local knowledge and encourages community participation, underscoring the importance of adapting content to the needs of different actors. However, their work addresses rural development in general and does not fully capture the complex, interdependent nature of paddy farming systems. Similarly, Amayah (2013) identifies trust and role clarity as critical enablers of effective knowledge exchange within public organizations, insights that are highly applicable to agricultural settings where overlapping institutional mandates often impede collaboration. Together, these studies suggest that clearly defined roles and participatory mechanisms are central to improving coordination across diverse agricultural stakeholders.



Despite growing investments in digital transformation, several studies caution that technology-driven solutions alone are insufficient. Chatterjee and Samanta (2022) report that knowledge management systems lacking human coordination and participatory design are prone to low adoption and underutilization. Complementing this, Tumwebaze, Walsh, and Lannon (2024) find that many agricultural knowledge initiatives fail to support continuous feedback, real-time collaboration, or adaptive learning, as they primarily focus on information delivery rather than interaction. These limitations underscore the need for a dynamic, human-centered model such as CKSM, which integrates digital infrastructure with structured stakeholder engagement, continuous feedback, and evolving roles to support collaborative and adaptive agricultural knowledge management.

Methodology

This study employs a Design Science Research (DSR) methodology (Brocke et al., 2020) to develop and validate the Collaborative Knowledge Sharing Model (CKSM) for agricultural knowledge management, with a specific emphasis on paddy farming. The iterative nature of DSR enables systematic refinement through problem identification, stakeholder engagement, model design, and validation, ensuring both theoretical rigor and practical relevance. A comprehensive literature review was conducted to identify limitations in existing digital agricultural knowledge systems, particularly the lack of structured stakeholder roles, inclusive feedback mechanisms, and active knowledge flow. Findings from prior studies and earlier work highlighted persistent challenges such as weak stakeholder ownership, low adoption of digital tools, and limited community involvement, which informed the need for a more collaborative and role-defined model.

To ensure contextual relevance, field consultations were carried out with key stakeholders in Kedah, including the Kedah Department of Agriculture, Muda Agricultural Development Authority (MADA), and Lembaga Zakat Negeri Kedah (LZNK), using semi-structured interviews and group discussions to uncover operational challenges and knowledge gaps. Insights from these engagements guided the design of CKSM as a multi-layered model comprising a Central Knowledge Hub, a Stakeholder Collaboration Layer, and a Monitoring and Feedback Mechanism, supported by clearly defined roles for six stakeholder groups. The model was subsequently validated through follow-up sessions with the same stakeholders, where feedback on feasibility and alignment with real-world practices was gathered. This validation process enabled further refinement of the CKSM to ensure its suitability across granary, non-granary, and estet paddy farming contexts.

Proposed Model: Collaborative Knowledge Sharing Model (CKSM)

The development of CKSM is based on the understanding that effective knowledge management in agriculture involves more than just disseminating content, it requires active collaboration and shared responsibility among all actors in the paddy value chain. CKSM introduces a multi-layered framework that supports structured knowledge exchange, grounded in stakeholder participation, strengthened by digital infrastructure, and continuously refined through feedback mechanisms.



At the core of the model is a central digital platform (Knowledge Hub) that serves as a repository for validated information. Surrounding this hub are collaborative engagement spaces and moderation structures, which depend on the active involvement of key stakeholders, each with clearly defined roles and responsibilities.

CKSM defines six primary stakeholder groups with complementary roles that collectively support sustainable and inclusive knowledge sharing: farmers function as both users and contributors by applying validated information while sharing local knowledge and field experiences; agricultural extension agencies and government departments act as facilitators by translating research into practical guidance, supporting implementation, and moderating content; research institutions generate and validate knowledge while leveraging field feedback to enhance research relevance; financial institutions and cooperatives strengthen financial inclusion by providing education, digital tools, and data-driven financial services; agri-tech providers maintain and enhance the digital platform through usability improvements, real-time data integration, and technical support; and NGOs or community-based organizations promote inclusivity by addressing the digital divide, supporting marginalized groups, and fostering community trust. Collectively, these stakeholders form a collaborative ecosystem that enhances engagement, transparency, and continuous improvement, enabling the CKSM to promote shared knowledge ownership while remaining adaptable, scalable, and responsive to evolving agricultural conditions.

Figure 1 illustrates the proposed conceptual framework of a knowledge portal for paddy cultivation, which functions as a centralized knowledge hub (CKH) serving as a one-stop reference center for paddy-related information, while Figure 2 presents the CKSM that details stakeholder roles and interactions within this portal. The CKSM is structured around three integrated components aligned with clearly defined stakeholder responsibilities to ensure accountability and sustained participation: the Central Knowledge Hub (CKH), a cloud-based repository for validated resources such as scientific research, policy guidelines, financial tools, and user-generated content; the Stakeholder Collaboration Layer (SCL), which facilitates interaction, coordination, and co-creation of knowledge through forums, live sessions, and content review features; and the Monitoring and Feedback Mechanism (MFM), an analytical component that tracks engagement, captures stakeholder feedback, identifies knowledge gaps, and supports the continuous improvement of the model.

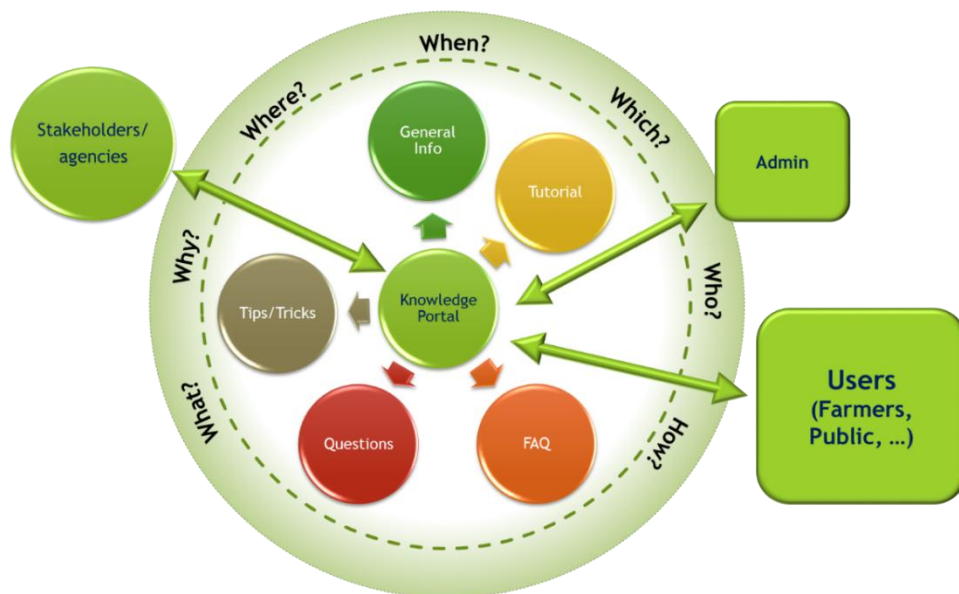


Figure 1: Conceptual Framework of Collaborative Knowledge Portal for Paddy Farming

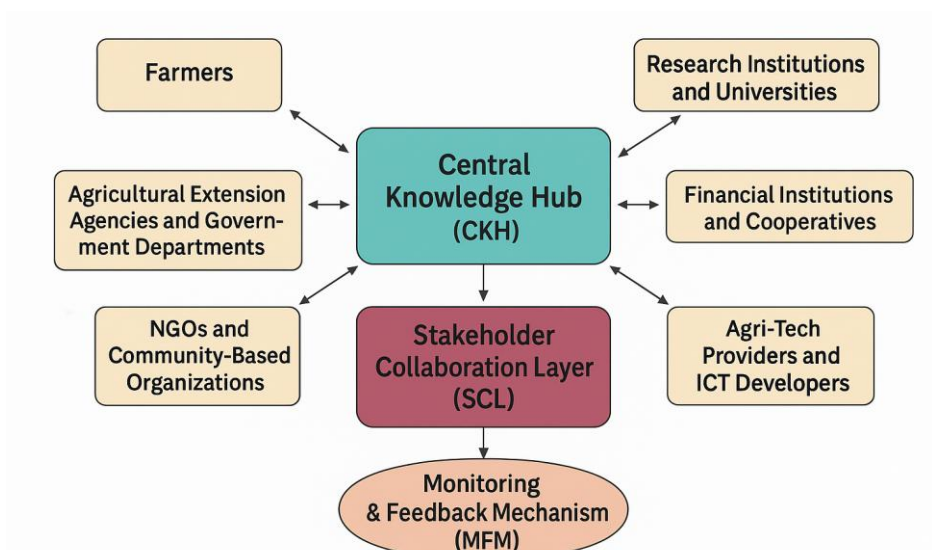


Figure 2: Collaborative Knowledge Sharing Model (CKSM)

Conclusion

The proposed CKSM addresses a fundamental limitation in existing agricultural knowledge systems, which often emphasize information centralization without sufficient stakeholder integration. Unlike earlier models that focused mainly on repository-based knowledge access, CKSM embeds clearly defined stakeholder roles, interaction mechanisms, and feedback processes to support co-creation, validation, and continuous refinement of knowledge. Its multi-layered structure that comprising the Central Knowledge Hub, Stakeholder Collaboration Layer, and Monitoring and Feedback Mechanism supports both reliable knowledge dissemination and active participation. By recognizing farmers as contributors rather than passive recipients and enabling two-way knowledge flows among agencies, researchers, and

service providers, the model aligns digital infrastructure with real-world agricultural practices and evolving environmental and market conditions.

Feedback from key stakeholders such as MADA, LZNK, and the Kedah Department of Agriculture confirms the model's practical relevance and alignment with existing workflows, particularly in improving coordination, reducing redundancy, and strengthening shared accountability. At the same time, the findings highlight persistent challenges related to digital inclusion, especially among marginalized farming communities with limited ICT access or skills. In this context, NGOs and community-based organizations play a critical bridging role by supporting access, contextualizing information, and fostering trust at the community level. By integrating technological capabilities with human and institutional coordination, CKSM responds to shortcomings identified in prior studies where digital platforms were underutilized due to weak participatory governance, thereby promoting inclusivity, adaptability, and resilience in agricultural knowledge systems.

In conclusion, CKSM advances agricultural knowledge management by shifting from one-way information dissemination toward a collaborative, governance-oriented ecosystem that emphasizes shared ownership and sustained engagement. By structurally integrating farmers, government agencies, research institutions, financial bodies, agri-tech providers, and NGOs, the model offers a scalable and adaptable framework to enhance productivity, sustainability, and decision-making in agriculture. Future work will focus on developing and piloting a CKSM-based digital platform within selected farming communities to empirically assess usability, impact, and adaptability, ensuring the model's long-term relevance and contribution to more equitable and effective agricultural knowledge ecosystems.

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SAFETY COMPLIANCE AMONG MALAYSIAN FOOD DELIVERY RIDERS: THE ROLE OF SAFETY KNOWLEDGE, MOTIVATION, AND WORK PRESSURE IN THE GIG ECONOMY

Nur Hannan Mohammad Sabri¹, Intan Suraya Noor Arzahan¹, Siti Hawa Harith¹

¹Department of Human Resource Management, School of Business Management, College of Business, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Malaysia

Abstract: *Ensuring safety compliance among food delivery riders is essential for minimizing workplace hazards and safeguarding their well-being. This study investigates the effects of safety knowledge, safety motivation, and perceived work pressure on safety compliance among p-hailing riders in Northern Region in Malaysia. A quantitative approach was employed using a cross-sectional design, with data collected through an online survey. The study targeted active food delivery riders from major platforms such as GrabFood and Foodpanda, utilizing convenience sampling techniques. Results showed that safety knowledge significantly predicted compliance ($\beta = .606, p < .001$), while perceived work pressure negatively influenced compliance ($\beta = -.371, p < .001$). Safety motivation, however, did not significantly predict compliance. This study extends Social Cognitive Theory by demonstrating that environmental constraints can weaken the translation of motivation into safe behaviour in gig work settings. Practically, the results offer valuable insights to policymakers, platform providers, and regulatory bodies, enabling the design of targeted interventions to improve rider safety and address job-related pressures.*

Keywords: *Safety compliance, Food delivery riders, Gig economy, P-hailing*

Introduction

The rapid growth of the gig economy has reshaped labour dynamics globally with no exception to Malaysia. Food delivery riders, commonly referred to as p-hailing workers, form a growing subset of this informal workforce. P-hailing is defined as services involving the delivery of food, drinks and parcels using motorcycles (Bernama, 2021). While their services provide convenience and contribute to local economies, their exposure to occupational hazards, particularly on the road, has become a pressing concern. P-hailing riders frequently encounter risks such as reckless road users, poor weather conditions, long working hours, and pressure to meet delivery timelines. This risk is closely linked to safety compliance among the riders. Safety compliance refers to adherence to laws, guidelines, and standard procedures that are designed to ensure safety at work. For food delivery riders, this includes the consistent use of helmets, adherence to traffic rules, and awareness of safety protocols.

Unfortunately, safety non-compliance remains prevalent in this sector. The Department of Occupational Safety and Health (DOSH) Malaysia reported there was a total of 1,242 accidents involving food delivery riders between 2018 and 2022, with 112 fatalities (Ibrahim et al., 2023). Such statistics highlight the urgent need to understand and improve safety behaviour in this workforce. Past studies have emphasized the role of safety knowledge and safety motivation in influencing the compliance behavior (Guo et al., 2016; Somoray et al., 2024).

Moreover, environmental pressures such as tight delivery schedules and incentive-based penalties may exacerbate unsafe behaviours (Saleem et al., 2022). Hence, this study aims to examine the influence of three specific factors: safety knowledge, safety motivation, and perceived work pressure, on safety compliance among Malaysian food delivery riders.

This study addresses four main gaps identified in the literature. First, a practical gap exists due to the limited empirical research focusing specifically on the safety behaviour of p-hailing riders. Second, there is an evidence gap, as past studies have produced conflicting results regarding the roles of safety motivation and work pressure in predicting compliance. Third, the methodological gap stems from previous reliance on qualitative or face-to-face methods, which this study addresses through a broader reaching online quantitative approach. Lastly, a population gap is evident in the literature's emphasis on traditional sectors like construction or healthcare, overlooking the distinct experiences of gig workers. Although previous research has shown that knowledge and motivation influence safety behavior, evidence among gig-based delivery workers is inconsistent. Some studies report strong motivation–compliance links, while others find motivation overridden by production pressure and incentive systems. This inconsistency suggests a unique behavioral mechanism in algorithm-driven gig work, warranting further investigation. By addressing these gaps, this research contributes meaningful insights that can inform policy, guide interventions, and support the development of safer work environments for food delivery riders in Malaysia.

Research Objectives

The objectives of this research are as follows:

1. To investigate the significant influence between safety knowledge and safety compliance.
2. To investigate the significant influence between safety motivation and safety compliance.
3. To investigate the significant influence between perceived work pressure and safety compliance.

Literature Review

The research uses Albert Bandura's Social Cognitive Theory (SCT) to study the factors affecting safety compliance among p-hailing riders, including safety knowledge, safety motivation, and perceived work pressure. This theory sets a framework that is useful in the understanding of the correlation between the variables. Utilizing SCT, the relationship between safety motivation (individual factor) and safety knowledge (individual factor), and perceived work pressure (environmental factor) are examined as they relate to safety compliance (behavior). Within SCT, safety knowledge reflects cognitive capability, safety motivation reflects self-regulatory and outcome expectancy processes, and perceived work pressure represents environmental influence. These elements interact reciprocally to shape safety compliance behavior among riders.

A research framework is formed into a figure, which describes the DV and IVs of the study and how they relate to one another. Figure 3.1 shows the framework of this study as follows:

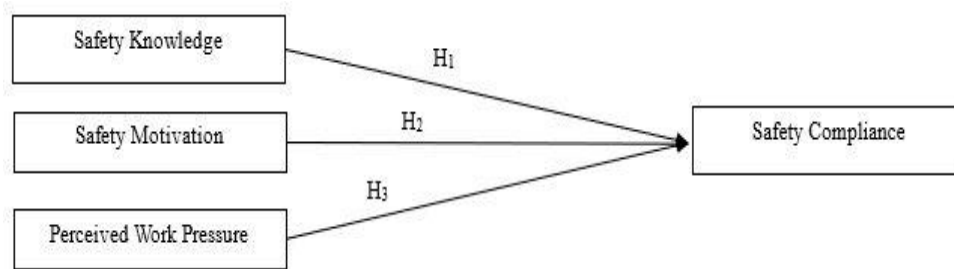


Figure1: Research Framework

Methodology

Instrumentation

A self-administered questionnaire is used as the research instrument. The questionnaire was developed by adapting items from previous studies. Specifically, the items measuring the independent variables which is safety knowledge and safety motivation, both were adapted from Guo et al. (2016), while perceived work pressure was adapted from Seo (2005). Meanwhile, the dependent variable, safety compliance, was assessed using items adapted from Vinodkumar and Bhasi (2010). The questionnaire utilized a five-point Likert scale (Likert, 1932) to measure responses, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The example of instrument items are as follows:

Table 1: Questionnaire items

Variable	Items
Safety compliance	1. I use hands-free kit, company-issued double barrel delivery bag, and helmet during delivery. 2. I deliver food in a safe manner. 3. I follow correct road safety rules and regulations while making delivery. 4. I ensure the highest levels of safety when I make delivery. 5. Occasionally due to lack of time, I deviate from correct road safety rules and regulations. 6. Occasionally due to over familiarity with making delivery, I deviate from correct road safety rules and regulations. 7. It is not always practical to follow all road safety rules and regulations while making delivery.
Safety knowledge	1) I know how to use the motorcycle safety equipment (helmet, hands-free kit, boots, etc.) in a safe manner. 2) I know how to maintain or improve health and safety while making delivery. 3) I know how to reduce the risk of accidents and incidents while making delivery. I know what are the hazards associated with my jobs and the necessary precautions to be taken while making delivery. 1) I enjoy working safely while making delivery. 2) Delivering order safely aligns with my personal values. 3) I feel bad about myself when I do not deliver order safely.

Perceived work pressure	I feel guilty when I do not deliver order safely.	
	1)	Timely delivery is given higher priority than safety.
	2)	I am often in such a hurry to complete deliveries that safety is temporarily overlooked.
	3)	I take short cuts when I need to get the order delivered in a timely manner.
	4)	I often do not have time to deliver order safely.
	5)	It is difficult to make delivery while following all of the road safety rules.
	6)	Short cuts and risk taking are common due to high number of orders.
There is a lot of pressure to complete deliveries quickly.		

The questionnaire items are translated into Bahasa Melayu through Cambridge Dictionary and back-to-back translation techniques was conducted with the linguistic expert from the university. The items in the questionnaire underwent a Content Validation process with a p-hailing expert and an academician who evaluate the items to determine their validity. Through this process, the average CVI value obtained was 0.86, which surpassed the acceptable cut-off standard of 0.80 for two experts (Davis, 1992, as cited in Yusoff, 2019). It is concluded that the questionnaire items prepared have strong content validity, indicating that they are fitting with the research's context.

Data Collection Procedure

The data collection for this study was conducted over a period of approximately three weeks. A non-probability purposive sampling technique was used to recruit participants. Active food delivery riders were identified through a p-hailing service provider operating in the Kubang Pasu district, ensuring that only riders currently engaged in delivery work were included. This sampling approach is appropriate for studies involving informal gig workers, where centralized population listings are not available. A total of 113 riders voluntarily completed the survey administered through an online platform. All participants were informed of the study purpose, assured of confidentiality and anonymity, and provided consent prior to participation. They were reminded that participation was voluntary, and respondents retained the right to withdraw at any point without consequence. A post hoc power analysis confirmed that the achieved power was 0.94, well above the 0.80 threshold to ensuring adequate statistical power to detect meaningful effects.

Results

Descriptive Analysis

As shown in Figure 2, the mean score for safety compliance is 4.00 (SD = 0.52), suggesting that respondents generally report moderately high adherence to safety measures. The mean score for safety knowledge is 4.38 (SD = 0.61), indicating that majority of respondents perceive themselves as well-informed about safety practices. Meanwhile, safety motivation has a mean of 4.16 (SD = 0.66), reflecting a high level of motivation of respondents to follow safety regulations. Conversely, perceived work pressure records a moderately low mean of 2.68 (SD = 0.70), yet the relatively higher standard deviation implies considerable variation among respondents' experiences of pressure.

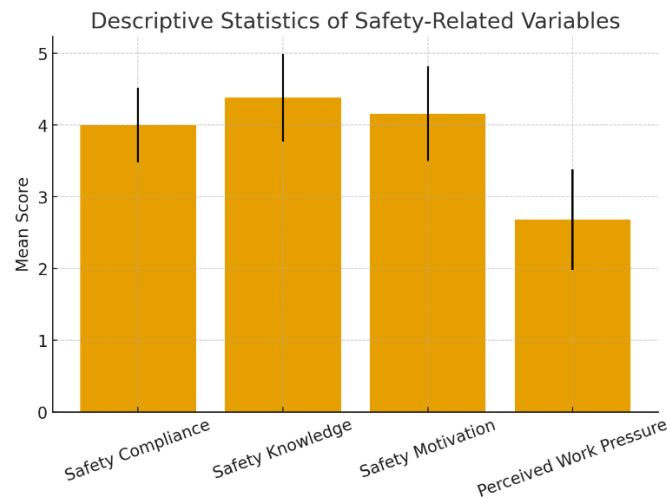


Figure 1: Descriptive Statistics (n = 113)

Correlation Analysis

A Pearson correlation analysis was conducted to examine the relationships between dependent variable and the independent variables. The results, presented in Table 2, indicate the strength and direction of these relationships. Safety knowledge was found to have a strong positive correlation with safety compliance, $r = 0.650$, $p < 0.001$, suggesting that higher safety knowledge is associated with higher safety compliance. Safety motivation showed a weak positive correlation with safety compliance, $r = 0.396$, $p < 0.001$, indicating a small but significant positive relationship. In contrast, perceived work pressure demonstrated a moderate negative correlation with safety compliance, $r = -0.446$, $p < 0.001$, meaning that as perceived work pressure increases, safety compliance tends to decrease.

Table 2: Correlation Between Variables (n = 113)

Variable	Safety Compliance	Safety Knowledge	Safety Motivation	Perceived Work Pressure
Safety Compliance	1	.650**	.396**	-.446**
Safety Knowledge	.650**	1	.617**	-.124
Safety Motivation	.396**	.617**	1	-.069
Perceived Work Pressure	-.446**	-.124	-.069	1

Note: **Correlation is significant at the 0.01 level (2-tailed), $p < 0.001$ for all correlations.

Regression Analysis

A multiple linear regression analysis was conducted to examine the extent to which safety knowledge, safety motivation, and perceived work pressure predicted safety compliance. The overall model was statistically significant, $R = .747$, $R^2 = .558$, Adjusted $R^2 = .546$, $F(3,109) = 45.87$, $p < .001$, indicating that the predictors collectively explained approximately 55.8% of the variance in safety compliance.

Table 3: Multiple Regression Results for Predictors of Safety Compliance (n = 113)

Predictor	B	SE	β	t	p
Constant	2.494	.295	—	8.45	< .001
Safety Knowledge	.513	.069	.606	7.45	< .001
Safety Motivation	-.003	.063	-.004	-0.05	.964
Perceived Work Pressure	-.272	.047	-.371	-5.78	< .001

Note: $R = .747$, $R^2 = .558$, Adjusted $R^2 = .546$, $F(3,109) = 45.87$, $p < .001$.

As shown in Table 3, safety knowledge emerged as a significant positive predictor of safety compliance ($\beta = .606$, $p < .001$), while perceived work pressure significantly and negatively predicted compliance ($\beta = -.371$, $p < .001$). In contrast, safety motivation did not significantly predict safety compliance ($\beta = -.004$, $p = .964$). These results suggest that knowledge strongly enhances safety behavior, whereas work pressure may force riders to compromise safety practices, even when motivation is present. Table 3

Discussion

Influence of Safety Knowledge on Safety Compliance

The analysis showed a strong positive correlation between safety knowledge and safety compliance, where $r = 0.650$ ($p < 0.001$). The finding obtained from this analysis serves as a supporting detail to the hypothesis that higher safety knowledge is associated with higher safety compliance. The finding is consistent with previous studies (Mai et al., 2023; Taylor et al., 2023). The regression analysis further confirmed this relationship. The result obtained from regression analysis proves that safety knowledge emerging as a significant positive predictor of safety compliance ($\beta = 0.606$, $p < 0.001$). According to Bandura's Social Cognitive Theory (SCT), behavior is shaped by the dynamic interaction between cognitive factors, personal experiences, and the environment. Safety knowledge, as a cognitive component, equips individuals with the necessary understanding to recognize hazards and make informed decisions in potentially risky situations. When riders are well-informed about safety protocols and understand their importance, they are more likely to act in ways that align with safe behavior, demonstrating SCT's principle of reciprocal determinism.

This suggests that as p-hailing riders possess greater knowledge of safety practices, they are more likely to adhere to safety protocols, such as wearing helmets, following road regulations, and using safety equipment. The critical role of safety education and training programs in improving compliance among riders are highlighted through the findings of this study. The demographic characteristics of the sample, particularly the riders' educational background and work experience, may also influence their level of safety knowledge, aligning with SCT's emphasis on the role of personal and contextual factors in behavioral outcomes. The higher percentage of respondents with a secondary school education (SPM) suggests that formal education may have a foundational impact on their understanding of safety concepts. With that being said, the ongoing training initiatives to enhance riders' understanding of safety measures should be prioritized by organizations and merchant platforms. The effect could directly contribute to reducing accidents and promoting safer delivery practices.

Influence of Safety Motivation on Safety Compliance

Safety motivation was positively correlated with safety compliance, where $r = 0.396$ ($p < 0.001$), but it was not a significant predictor of safety compliance ($\beta = -0.004$, $p = 0.964$) in the regression analysis. While riders may be motivated to adhere to safety protocols, such motivation may not result in profound safety compliance outcomes. While prior researches (Nguyen Phuoc et al., 2024; Tedone et al., 2022) pointed to the role of motivation in adhering to safety measures, the finding of this study suggests that motivation alone was not enough to provide satisfactory compliance to safety measures. Other factors, such as organizational support, work conditions, and regulatory enforcement, may also play a more substantial role in shaping compliance.

From the lens of SCT, motivation is recognized as an important internal factor influencing behavior. However, SCT emphasizes that behavior results from the interplay of personal cognitive factors (like motivation and beliefs), behavior, and environmental influences, a process known as reciprocal determinism. In this context, while riders may be intrinsically or extrinsically motivated to act safely, environmental constraints, such as time pressure, high workload, or lack of organizational safety support, can inhibit the translation of motivation into actual behavior. This aligns with SCT's assertion that even high motivation cannot lead to desired behavior if environmental facilitators or reinforcers are weak or negative.

The demographic analysis indicates that many riders work full-time (66.4 percent). This statistic suggests that it might be one of the factors that lead to increased pressure to meet delivery targets, which could potentially reducing the effectiveness of intrinsic safety motivation. Therefore, to effectively encourage safety compliance, it is essential not only to foster motivation but also to create a work environment that supports and reinforces safe behavior, consistent with SCT's emphasis on environmental determinants. Institutional interventions, such as consistent safety reminders, incentives for compliance, and manageable workloads, may strengthen the motivation-behavior link and enhance safety outcomes among riders.

Influence of Perceived Work Pressure on Safety Compliance

The relationship between perceived work pressure and safety compliance was statistically significant and had a negative correlation. Perceived work pressure negatively correlated with safety compliance ($r = -0.446$, $p < 0.001$). With increased pressure to deliver work the tendency is to cut corners leading to compromises in safety compliance. The regression analysis results validated perceived work pressure as a major negative predictor of safety compliance ($\beta = -0.371$, $p < 0.001$). This finding aligns with previous research (Wang et al., 2022; Segbedzi et al., 2023) that identified negative work pressure as having an adverse impact on safety compliance. The findings indicate that high delivery pressure may result in the p-hailing riders taking shortcuts, ignoring safety rules or engaging in risky behaviors like speeding, traffic rules violations, and so on.

From the perspective of SCT, perceived work pressure influences safety compliance through its impact on self-regulation and reciprocal determinism. SCT emphasizes the dynamic interaction between personal factors, behavior, and the environment. When riders are exposed to high work pressure, their cognitive capacity to self-monitor and prioritize safe behavior is weakened. This pressure interferes with the formation of positive outcome expectations, which are crucial for maintaining compliance under challenging conditions. Riders may perceive that



the rewards of faster delivery (e.g., more income or performance bonuses) outweigh the risks of violating safety procedures.

The demographic data contextualizes this finding, as neighbouring 71.7 percent of riders make more than 15 deliveries per day, which likely explains the high perceived work pressure. Additionally, the full-time workers, who make up the majority of the sample, are more likely to experience stress and time constraints, which could encourage risky behaviors as riders attempt to meet daily quotas. These results underscore the need for delivery platforms to address work pressure by adjusting delivery targets and offering sufficient time for safe practices. Reducing work pressure can help create a safer working environment, ultimately benefiting both the riders and the general public.

Conclusion

This study investigated the determinants of safety compliance among p-hailing riders in Kedah, focusing on safety knowledge, safety motivation, and perceived work pressure. The findings reveal that safety knowledge significantly predicts safety compliance, reinforcing the practical importance of consistent training and safety education for gig economy workers. Perceived work pressure negatively influenced safety compliance, suggesting that high job demands and time constraints can compromise adherence to safety protocols. Although safety motivation was positively correlated with compliance, it did not emerge as a significant predictor when considered alongside the other variables, indicating that motivation alone may not sufficiently explain safety behaviour in this context. From a practical perspective, the study offers actionable insights for policymakers, platform providers, and occupational safety practitioners. Emphasizing safety training and reducing work-related pressure can lead to improved compliance and a reduction in road accidents, especially among high-risk groups like p-hailing riders. Delivery platforms should redesign incentive structures to reduce speed-based pressure, integrate mandatory micro-safety training within rider apps, and collaborate with DOSH and municipal authorities to enforce safer road behaviors. This study contributes new evidence to gig-economy safety research by demonstrating that environmental work pressure can override safety motivation, highlighting the need to address platform-driven delivery expectations rather than relying solely on individual safety awareness campaigns.

Acknowledgement

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Disclosure and Declaration Statement

No funding was received for conducting this study. The authors declare that there is no conflict of interest regarding the publication of this paper.

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EXPLORING LEARNING DIVERSITY IN HIGHER EDUCATION: INSIGHTS FROM THE VARK MODEL

Khofizhoah Mohd Karim¹, Ani Munirah Mohamad², Mohd Rizal Safar³

¹School of Government, Universiti Utara Malaysia (UUM), Malaysia, (fizhoah@uum.edu.my)

²School of Law, Universiti Utara Malaysia (UUM), Malaysia, (animunirah@uum.edu.my)

³School of Government, Universiti Utara Malaysia (UUM), Malaysia, (rizal@uum.edu.my)

Abstract: *Learning diversity has become a central concern in contemporary higher education due to greater diversity in student bodies and a quick change in the modes of instructional delivery. This paper explores the learning preferences of undergraduate students enrolled in the Integrity and Anti-Corruption course, based on the visual, auditory, reading/writing, and kinesthetic (VARK) model, at a Malaysian institution of higher learning. The survey design that was used is a cross-sectional survey design that was done on 84 undergraduate students who were undertaking different academic programmes. The questionnaire was used to collect data based on a structured questionnaire consisting of VARK learning style preferences, preferred methods of learning and preferred learning times. Results show that there is a great dominance of visual learners (52.4%), then the reading/writing learners (29.8%), auditory learners (9.5%), and the kinesthetic learners (8.3%). The conditions of instruction that turned out to be most preferred were traditional face-to-face instruction and morning learning sessions. The results support the relevance of multimodal instructions design and give technological evidence in favour of inclusive pedagogies planning in the higher education. Discussed are implications of the teaching practice, curriculum design, and institutional policy.*

Keywords: *VARK Model, Learning Styles, Higher Education Institution, Learning Diversity*

Introduction

The acknowledgment of learning diversity has been an essential part of the modern educational theory and practice. Since colleges and universities have been receiving more and more diverse students with diverse backgrounds, abilities, and interests the information processing and retention in students has become a burning issue among educators and instructional designers (Vanegas et al., 2024; Silva et al., 2020). The dilemma of meeting the varied learning requirements and simultaneously upholding academic standards and delivering equal results has led to massive studies on learning style constructs and their application and implementation (Husmann & O'Loughlin, 2019; Valle-Escobedo et al., 2024).

The learning style model has been widely applied to the education field, creating numerous models of learning style in educational psychology; however, one model named VARK model created by Neil Fleming in the 1980s has gained a lot of followers in the higher education settings all over the world (Idowu, 2024; Ally et al., 2022). The acronym VARK is the four sensory modalities preferences which are visual (learning by means of graphs, charts, maps, and diagrams), auditory (learning by listening and speaking), reading/writing (learning by reading and analysing written text) and kinesthetic (Mishra et al, 2025; Dey et al., 2024). The simple classification and suitability of the VARK style of thinking have made it especially



appealing to classroom application and curriculum design compared to more complex models of cognitive style (Gangadharan et al, 2025; Zapalska & Brozik, 2006).

The VARK model is theoretical and is based on the assumption that people have the sensory mechanisms in which they best receive, process and remember information (Kannappan et al., 2025). Advocates present that when learning is delivered in ways that meet the learning preferences of students, engagement goes up, cognitive load goes down and learning outcomes go up (Vanegas et al., 2024; Özeke et al., 2025). It is this alignment hypothesis that has inspired many pedagogical interventions, including adaptive learning technologies up to multimodal course design strategies (Bazán-Perkins et al, 2024; Zahra et al., 2024). Nevertheless, the model too has not gone without criticism among researchers who doubt the empirical data on the based instruction using the learning style and is worried about possible simplification of the complicated cognitive processes (Husmann & O'Loughlin, 2019; Zapalska et al., 2007).

In spite of the current arguments regarding the theoretical soundness and practical usefulness of the learning style models, VARK model remains a popular tool in higher education institutions to assess students, develop their faculty and plan their instruction (Pincay et al, 2024; Limaico et al, 2024). In recent years, there have been reports of the use of VARK in a variety of fields, such as medical education (Mishra, 2025; Demberel et al, 2025), engineering, (Silva et al, 2020), business education (Zapalska & Brozik, 2006) and in online learning settings (Ally et al, 2022; David et al, 2024). The COVID-19 crisis further escalated the interest in learning preferences as institutions were quickly switching to remote and hybrid modes of instruction, which forced the researchers to pay even more attention to the ways students are interacting with various modes of delivery (Ally et al, 2022; Fikri et al, 2023).

Within the context of the Malaysian higher education, where this research is being conducted, learning diversity is especially relevant as a result of the multicultural nature of the student population as well as the constant adoption of technology-supportive learning practices (Nasir, et al, 2021). The Malaysian universities cater to the needs of diverse ethnic orientations of students with Malay, Chinese and Indian being the major ones, and they have diverse cultural orientations towards education and learning (Indriyani et al., 2025). Moreover, the quick growth of online and blended learning models in Malaysian higher education requires the evidence-based understanding of how the students with various learning behaviours react to various approaches to instructions (Othman & Amiruddin, 2010).

In this respect, this paper seeks to establish the proportion of VARK learning style preferences among the undergraduate students in the sample population, to investigate the connection between VARK preferences and the most preferred learning strategies of the students and to determine the learning preferences of students and how they might impact on the scheduling of classes and course design. The achievement of these goals will provide practical information to teachers, curriculum creators and administrators who want to build more inclusive and effective learning experiences and environments that are sensitive to the diverse needs and interests of students.

Learning and teaching are closely related in that when the two are well intertwined the students will learn better, comprehend concepts at a deeper level and have a greater interest in experimenting with new ideas. Learning strategies that are consistent with the way students learn will assist in the establishment of a safe and interactive atmosphere, where the learners



will be motivated to ask questions, be innovative and take the risk of trying something new (Mohd Karim & Darus@Mat Junus, 2025).

Literature Review

The VARK Model

VARK model took root in the work of Neil Fleming in the late 1980s, who gave a practical tool to identify the preferred sensory characteristics by students in learning. It outlines four major learning preferences: visual learners, who learn best when presented with information in a graphical, chart, diagram, and spatial form; auditory learners, who learn best when presented with information by way of listening to lectures, discussions and through verbal explanations; reading/writing learners who learn best when presented with information through textual medium and written assignments; and finally, the kinesthetic learners who learn best when presented with the information through hands-on experiences, experiments, and through the physical manipulation of materials (Fleming & Mills, 1992).

The VARK model is theorized based on the study of sensory processing and information encoding that has been done by numerous researchers in cognitive-psychology (Cowan, 2001). The framework by Fleming assumes that even though individuals can perceive the information in different modalities, they usually have a tendency to engage in certain sensory channels as they allow the individuals to learn more effectively. This preference-based view is in contrast to ability-based models, which focus on the principle of learning styles as preferred styles of interaction, as opposed to cognitive capabilities that cannot be changed (Kirschner & van Merriënboer, 2017).

Recent theoretical and empirical discussions have expanded the VARK model to emphasise multimodal learning preferences, whereby a substantial proportion of learners effectively employ combinations of learning modalities rather than relying on a single dominant style (Fleming & Mills, 1992; Fleming, 2001; Leite et al., 2010). This perspective is further supported by cognitive theories of multimedia learning, which highlight the benefits of integrating multiple representations in instructional design (Mayer, 2014).

Othman and Amiruddin (2010) argued that the VARK model should be interpreted flexibly, encompassing pedagogical, psychological, and practical perspectives, rather than being treated as a rigid classification system. This nuanced interpretation aligns with contemporary constructivist learning theories, which emphasise learning as a dynamic and context-dependent process (Piaget, 1976). Accordingly, teaching strategies should be aligned with students' learning styles in order to enhance engagement and academic performance (Mohamad et al., 2019).

Applications of VARK in Higher Education

The VARK model has found extensive application in the heterogeneous setting of higher-education particularly in health-sciences education. Several studies were conducted to determine VARK preferences in medical students with multiple distributions in institutions and across cultural contexts (Mishra et al., 2025; Kannappan et al., 2025). As an example, Mishra et al. (2025) evaluated the preferences of first-year MBBS students in their learning styles and tried to determine the correlations between learning style and academic outcomes in the



introductory medical courses. On the same note, Kannappan et al. (2025) used the VARK Model on first-year medical students, thus, informing the accumulating evidence base on the topic of learning preferences in medical education.

VARCK has also been used in engineering, business, and information-technology courses in addition to medical education. Silva et al. (2020) studied the use of VARK amongst undergraduate Systems Analysis and Development students by exploring how learning style awareness might be used to guide curriculum development in technology-oriented curricula. The study of Valle-Escobedo et al. (2024) focused on learning styles in the first trimester of students of a Mexican university, providing a perspective of the preferences of study participants in the most important period of the process of secondary to tertiary education.

The model has also been popular in distance and online learning, where knowledge on learning preferences is essential in the instructional design (Ally et al, 2022). Zapalska and Brozik (2006) explored the issue of learning styles in online educational settings and how preference of modalities can be applied in digital learning settings. In addition, Ally et al. (2022) investigated educational concerns in the COVID-19 pandemic and stressed the need to address multimodal preferences of students in emergency remote teaching settings.

Dey et al. (2024) centered the preferences of VARK on the Open and Distance Learning (ODL) students and cited the implications of individualized pedagogy and student achievement in the non-traditional environments. Their results emphasized the particular challenges and opportunities in terms of accommodating a variety of learning styles in the conditions where the face-to-face interaction is limited or excluded.

Some of the institutional uses of the VARK model have included student orientation programs, faculty development workshops, academic advising and learning-support services (Fleming & Mills, 1992). Other institutions have incorporated VARK tests as a part of first-year experience programmes to build metacognitive consciousness of learning styles, thus promoting the use of more effective learning styles (Kirschner & van Merriënboer, 2017).

Effectiveness Studies and Academic Performance

A substantial body of research has investigated the relationship between VARK learning preferences and academic performance, yielding mixed and sometimes contradictory findings. Several studies have reported positive correlations between learning style awareness and academic outcomes (Vanegas et al, 2024; Mishra et al, 2025; Özeke, 2025), while others have found weak or non-significant relationships (Husmann & O'Loughlin, 2019; Zapalska et al, 2007).

Mishra et al. (2025) examined the correlation between learning style preferences and academic performance in first-year MBBS subjects, finding that awareness of learning preferences was associated with improved study strategies, though direct effects on grades were modest. Gangadharan et al. (2025) compared the relationship between preferred learning styles and academic achievement among undergraduate health sciences students versus other disciplines



at a Middle Eastern university, revealing discipline-specific patterns in how learning preferences relate to performance outcomes.

Bazan-Perkins et al. (2024) investigated the relationship between learning gains and learning style preferences among students from the School of Medicine and Health Sciences, employing pre- and post-test designs to measure actual learning rather than relying solely on grade-based metrics. Their findings suggested that the relationship between learning styles and learning gains is complex and mediated by factors such as instructional quality, student motivation, and prior knowledge.

Indriyani et al. (2025) specifically examined VARK learning styles and their relationship to learning outcomes in an instructional media course, finding that alignment between instructional design and student preferences was associated with higher satisfaction and engagement, though not necessarily with higher test scores. This distinction between affective outcomes (satisfaction, motivation) and cognitive outcomes (knowledge acquisition, performance) has emerged as an important consideration in effectiveness research (Andrade-Arenas et al., 2023).

However, critical studies have challenged the effectiveness of learning style-based instruction. Husmann and O'Loughlin (2019) found disparities among undergraduate anatomy students' study strategies, class performance and reported VARK learning styles. Their research revealed that students who used study strategies aligned with their reported VARK preferences did not perform better than those who did not, raising fundamental questions about the practical utility of learning style-based pedagogical interventions.

Özeke et al. (2025) conducted a comprehensive study examining whether learning styles or study approaches better predict academic success in medical schools, concluding that study approaches were more predictive of performance than VARK preferences. This finding aligns with broader educational psychology research emphasizing the importance of learning strategies over learning styles (Septiani et al., 2024).

Methodology

The research design used was cross-sectional survey research on the topic of VARK learning-style preferences and related learning features on undergraduate student population. To allow the systematic data gathering of standardized information about the relatively large sample, the quantitative approach was chosen. Cross-sectional designs are quite suitable when faced with the descriptive research goals and have been applied extensively in research on learning-style research in higher education settings (Mishra et al., 2025; Kannappan et al., 2025; Demberel et al., 2025).

The research sample included 84 undergraduate students in one of the Malaysian government universities. The participants have been recruited using convenience sampling of different academic programs. The sample consisted of students of various levels of their undergraduate studies, which allowed getting a representative sample of the student body of the university.

Data were collected using a structured questionnaire consisting of three sections. The first section gathered demographic information, including gender, ethnicity, academic programme,

and year of study. The second section employed the VARK questionnaire to identify students' preferred learning methods. The third section categorised learning styles into Visual, Auditory, Reading or Writing and Kinesthetic modalities. Data analysis involved descriptive and inferential statistics. All 84 responses were complete and included in the analysis. Frequencies, percentages, and cross tabulations were used to examine VARK learning preferences, learning methods, and learning time preferences, as well as their associations.

Findings

VARK Learning Style Preferences

The study of the VARK learning style preferences of the 84 respondents showed that Visual learning preference was well dominant, closely followed by Reading/Writing preference, and Auditory and Kinesthetic preferences were found to be significantly less prevalent among the 84 respondents.

Table 1: VARK Learning Styles Preferences

Learning Style	Frequency (n)	Percentage (%)
Visual	44	52.4%
Reading/Writing	25	29.8%
Auditory	8	9.5%
Kinesthetic	7	8.3%
Total	84	100.0%

The sample was dominated by visual learners (52.4% or 44 individuals), which means that over half of the participants lean towards using graphs, charts, maps, diagrams, and other visual aids as the means of learning. The observation is consistent with a lot of literature in the higher education setting which has reported Visual Preference as the prevalent mode of learning between university students (Mishra et al., 2025; Gangadharan et al., 2025; Demberel et al., 2025).

Reading/writing learners were the second-largest cohort with 29.8% percentage (n=25) indicating that almost a third of students favoured the reading and analysis of written text. the percentage of the visual and reading/writing learners (82.2%) is rather high, so it is possible to state that an overwhelming majority of the students in this sample preferred the visual or text-based learning modalities.

Conversely, auditory learners were the fewest 9.5% of the sample and kinesthetic learners were the fewest 8.3% of the sample. The comparatively low scores in auditory or kinesthetic modalities among the student population can be attributed to trends in most studies on higher education, but the extent to which this difference manifests itself depends on context and subject (Bazán-Perkins et al., 2024; Kannappan et al., 2025; Demberel et al., 2025).

Learning Method Preferences

The preference of various learning approaches by students showed that there was a high tendency of students to use traditional face-to-face instruction, although there were significant minorities who preferred online and activity-based learning.

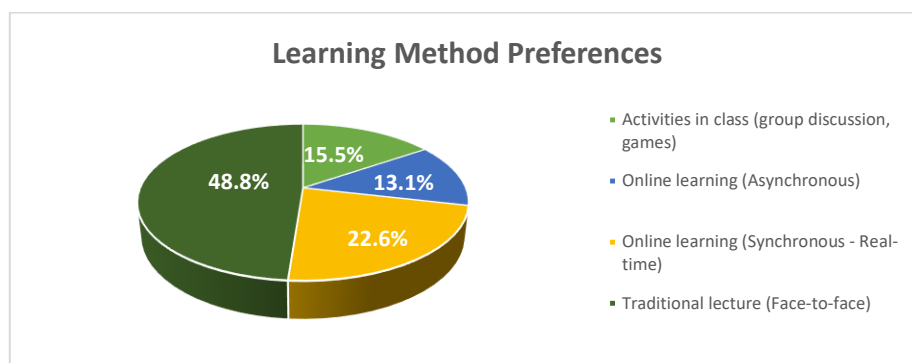


Figure 1: Learning Method Preferences

The most favoured learning method was the traditional face-to-face lectures, which were chosen by 48.8% of the students. This result implies that even in the face of the growing number of opportunities and advertisements on online learning programs, almost 50% of students still prefer traditional approaches to learning, where the classroom setting is adopted.

The second most preferred mode was online synchronous learning (real-time) 22.6% which means that one out of five students prefer live online learning where there is a time link between the instructors and students. Students favoured in-class tasks (group discussions, games, role-play) the most (15.5% of respondents), whereas online asynchronous learning (not real-time) was the least favourite (13.1% of respondents).

The overall preference of face-to-face approaches (traditional lecture and in-class activities) amounted to 64.3% and overall preference of online approaches (synchronous and asynchronous approaches) amounted to 35.7%. This distribution indicates that even though online learning has been accepted, physical classroom presence is still appreciated by most of the students in this sample.

Learning Time Preferences

The study of preferred time of learning indicated that morning classes were very popular with other timeframes being significantly less favoured.

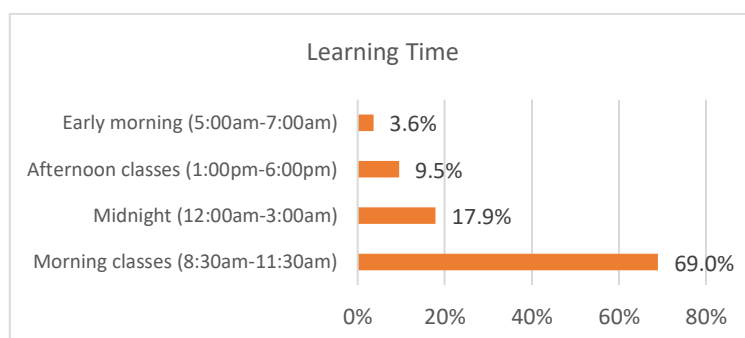


Figure 2: Learning Time Preferences

Classes in the morning (8:30 am to 11:30 am) were by far more popular with 69% of students having this time as their choice. This observation has significant implications on scheduling the classes and indicates the conventional morning schedule of classes fits well in the



chronobiology of students and daily habits. Interestingly, the second most popular time interval at 17.9% was midnight study (12:00 am -3:00 am) (which also means that the proportion of late-night students is quite significant). This trend could be an indication of students who labour during the day, their family commitments or even the circadian response that suits their brain to work during the later hours of the day. Only 9.5% of students preferred evening classes (1:00 pm-6:00 pm) indicating that the post-lunch time might not be the most suitable time to learn among most of the students, perhaps because of post prandial slumps in alertness or conflicting engagements. Learning very early in the morning (5:00 am to 7:00 am) was least preferred (3.6%) which means that not many students prefer learning before dawn.

Discussion

This paper shows that the visual learning preference is the most common among the university students and this is in line with the trends recorded in other studies conducted at higher institutions of learning. Recent studies have revealed that a typical population of students is between 40 and 65 percent of visual learners (Mishra et al., 2025; Gangadharan et al., 2025; Kannappan et al., 2025; Demberel et al., 2025; Mohd Karim et al., 2025; Mohamad et al., 2019). The example of this is that Gangadharan et al. (2025) found high visual dominance in undergraduate students of the health sciences at a university in the Middle East, and Kannappan et al. (2025) did the same with first year medical students in India. The presence of a high rate of visual learners can be attributed to a number of attributes to modern higher education. In most cases, much of academic content is presented visually (in the form of PowerPoint slides, diagrams, charts, graphs, and projected text) (Vanegas et al., 2024; Ally et al., 2022). Proficiently processing visual information students will thus be able to perform better in these environments and thus more visual learners will be represented in universities.

Moreover, the high adoption of digital technologies has exposed students to visual media earlier in life, and it could have boosted visual processing capability and tastes over time (David et al., 2024). It is also anticipated that the ratio of reading and writing students will be high since tertiary education is very much dependent on textbooks, journal articles, written work and exams (Zapalska and Brozik, 2006). Such needs can either benefit the student with great reading and writing inclinations or they can lead to the creation of such inclinations. Conversely, the smaller proportions of auditory and kinesthetic learners could indicate the drawbacks of the lecture-based teaching method, where the participants are usually passive listeners as opposed to active speakers (Husmann and O Loughlin, 2019; Othman and Amiruddin, 2010). Equally, the kinesthetic type of learning can also be underrepresented because of the abstractness of university education and the limitation of the VARK tool to reflect in practice (Husmann and O'Loughlin, 2019; Zapalska et al., 2007).

Conclusion

In this paper, learning preferences of VARK between 84 undergraduate students in a Malaysian university were studied and can inform about learning diversity at the higher education level. The visual learning style was the most common and Reading and Writing preferences were following it, whereas the less common preferences were Auditory and Kinesthetic. The tendency is in line with the information about trends that are observed in the institutions of higher learning around the globe. There was also a strong inclination towards face-to-face teaching with online synchronous learning and in class methods also being appreciated by the

students. Mornings classes and especially the classes between 8.30 am and 11.30 am were highly desired. These results have implications in practice to teachers and curriculum developers. As much as the visual and reading based approaches are common, the existence of all VARK modalities justifies the use of multimodal teaching strategies. The knowledge of learning styles can assist students in self-evaluating the habits of studying, yet a teacher must not categorise students strictly. This preference to face to face learning promotes the blended methods, whereas the popularity of morning classes proposes the close attention to the design of the timetable. In general, the research confirms the significance of inclusive and balanced pedagogies in higher education.

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EXPLORING TEACHERS' BELIEFS AND PEDAGOGICAL PRACTICES IN INTEGRATING ISLAMIC VALUES, ENGLISH LANGUAGE TEACHING, AND STEM EDUCATION

Fariha Diyana Awang Ali¹, Nadiah Hashim Radzi², Ahmad Salahuddin M Azizan³, Khairul Firdaus Ne'matullah⁴, Hafiza Ab Hamid⁵, Siti Amalina Ahmad Khairundin⁶

¹Faculty of Education, Open University Malaysia, Malaysia, (fariha_diyana@oum.edu.my)

²Faculty of Health Sciences, Nursing and Education, Mahsa University, Malaysia, (nadiyah.h@mahsa.edu.my)

³Faculty of Social Sciences & Humanities, Open University Malaysia, Malaysia

(salahuddin_azizan@oum.edu.my)

⁴Centre for General Studies and Languages MAIWP International University, Malaysia,

(khairulfirdaus@ucmi.edu.my)

⁵Faculty of Education and Social Sciences, Universiti Selangor, Malaysia, (hafiza@unisel.edu.my)

⁶Faculty of Education and Social Sciences, Universiti Selangor, Malaysia, (amalina@unisel.edu.my)

Abstract: *The integration of Islamic values, English language teaching (ELT), and STEM education reflects Malaysia's aspiration for holistic and values-driven education. Despite strong policy endorsement, limited empirical research has examined how teachers conceptualise and enact this three-domain integration in classroom practice. This qualitative study explores teachers' beliefs and pedagogical practices in integrating Islamic values, English, and STEM, with particular attention to conceptual understanding, instructional tensions, and adaptive strategies. Semi-structured interviews were conducted with six purposively selected teachers from values-oriented school contexts. Data were analysed using thematic analysis. Findings reveal fragmented conceptualisations of integration, tensions arising from curriculum and assessment demands, and teachers' adaptive yet largely implicit strategies for embedding values in ELT and STEM lessons. While teachers demonstrated strong commitment to holistic education, integration was often unsystematic and dependent on individual initiative. The study highlights the need for professional development that strengthens conceptual clarity, interdisciplinary pedagogy, and practical classroom enactment of integrated education.*

Keywords: *teacher beliefs, Islamic values, English language teaching, STEM education, integration*

Introduction

Malaysia's education system places increasing emphasis on holistic learner development that integrates intellectual, moral, spiritual, and social dimensions. Within this framework, the integration of Islamic values across subject areas is promoted alongside national priorities for English language proficiency and STEM competence. These priorities reflect the dual aim of producing ethically grounded individuals who are globally competitive and technologically literate.

Despite policy-level advocacy for integrated and values-driven education, classroom enactment remains complex. Teachers are expected to align disciplinary learning outcomes, ethical dimensions, and examination-driven curricula within limited instructional time.



Teachers' beliefs therefore play a critical mediating role in how integration is interpreted, prioritised, and enacted in practice.

Existing research on integrated curricula has largely focused on policy frameworks and conceptual models, with fewer empirical studies examining teachers' lived experiences of integrating Islamic values, ELT, and STEM. This study addresses this gap by exploring teachers' beliefs and pedagogical practices, foregrounding their voices and identifying implications for professional development.

Literature Review

Integrated and Holistic Education in the Malaysian Context

Holistic education emphasises the development of learners' cognitive, moral, spiritual, and social dimensions through meaningful connections across disciplines. In Malaysia, national education policies consistently promote values-based and integrated curricula as a means of nurturing ethically grounded and socially responsible learners alongside academic competence. However, research highlights a persistent gap between policy aspirations and classroom realities, particularly in examination-oriented systems where subject boundaries remain rigid (Drake & Reid, 2020; Wu et al., 2024).

Teachers play a central mediating role in translating integrated curriculum ideals into practice. Studies show that integration often depends on teachers' personal interpretations, pedagogical confidence, and institutional support, leading to uneven and fragmented enactment across classrooms (Wang et al., 2020; Da Silva Mendes, 2025). Without shared conceptual frameworks and coordinated planning structures, integration risks becoming superficial or symbolic rather than pedagogically coherent.

Conceptualising the Integration of Islamic Values in Education

Islamic values in formal education extend beyond moral instruction to encompass ethical reasoning, epistemological orientations, and responsibility towards God, humanity, and the environment. Scholars argue that Islamic values should function as foundational principles shaping cognition, emotion, and learning practices rather than as isolated moral content (Hidayat, Sutisna & Jaelani, 2025). Accordingly, values integration is conceptualised as the infusion of faith, knowledge, and morality across subject areas (Samsuriadi & Suardi, 2025).

The literature identifies several approaches to values integration. The infusion model embeds values within existing subject content by linking disciplinary concepts to ethical principles such as trust, justice, and responsibility (Hidayat, Sutisna & Jaelani, 2025). Embedded or implicit integration occurs through classroom interaction, teacher modelling, and learning culture, where values are enacted rather than explicitly taught (Samsuriadi & Suardi, 2025). While implicit approaches are often perceived as more natural, they pose challenges for planning, assessment, and empirical documentation.

Despite widespread endorsement of cross-curricular integration, studies report practical difficulties. Teachers frequently lack pedagogical clarity and professional preparation to integrate Islamic values meaningfully within non-religious subjects such as English and STEM,



resulting in partial or tokenistic practices (Utari, Soraya, & Wulandari, 2024). These challenges underscore the importance of examining teachers' beliefs and classroom practices.

Teacher Beliefs and Their Influence on Pedagogical Practice

Teacher beliefs are widely recognised as powerful determinants of instructional decision-making. Beliefs function as cognitive and affective filters that shape how teachers interpret curriculum demands, select instructional strategies, and prioritise learning outcomes (Leng et al., 2025). Research consistently demonstrates that beliefs influence not only what teachers' value but also what they enact in classrooms (Martinez, 2022).

Beliefs are multidimensional, encompassing cognitive understandings of learning, affective commitments to educational values, and experiential knowledge shaped by training and teaching history (Leng et al., 2025). Studies show that even when teachers strongly endorse values-based education, classroom enactment may remain limited due to time constraints, assessment pressures, and low self-efficacy for complex pedagogical practices (Kamanga, 2024).

Institutional culture further mediates the belief–practice relationship. School norms, leadership priorities, and assessment regimes can either enable or constrain teachers' ability to translate beliefs into practice (Bleukx et al., 2024). Consequently, alignment between beliefs and practices in integrated education is neither automatic nor stable but contingent upon professional support and contextual conditions (Chen et al., 2025).

Islamic Values in ELT and STEM Education

In ELT, integrating Islamic values is often justified on the grounds of identity formation, ethical communication, and intercultural competence. Common strategies include values-oriented text selection, moral discussions, and collaborative language tasks that promote respect and responsibility (Ag-Ahmad et al., 2025). However, empirical studies indicate that language teachers frequently prioritise linguistic outcomes, positioning values as implicit or secondary to grammar, vocabulary, and communication skills (Shiu, 2025).

Similarly, STEM education has traditionally been framed as value-neutral, although recent scholarship increasingly emphasises ethics, social responsibility, and sustainability within STEM learning (Joseph & Uzundu, 2024). While problem-based learning and real-world applications provide opportunities for ethical discussion, teachers often struggle to align scientific content with religious or moral dimensions without compromising disciplinary rigor (Mesutoglu & Akgündüz, 2025).

Three-Domain Integration and Professional Development

Three-domain integration; linking values, language, and STEM, has been promoted as essential for addressing complex real-world challenges and fostering 21st-century competencies. Nevertheless, empirical research on its classroom enactment remains limited and fragmented (Alvero, 2025; Drake & Reid, 2020). Teachers' conceptualisations of integration are often partial, shaped by disciplinary silos and constrained instructional contexts (Wu et al., 2024).



Professional development literature emphasises that effective integrated teaching requires conceptual clarity, interdisciplinary pedagogical models, and practical classroom strategies. Sustained, reflective, and context-sensitive professional learning is consistently shown to support teachers in aligning beliefs with integrated practices (Alvero, 2025; Drake & Reid, 2020). Without such support, integration initiatives risk remaining aspirational rather than transformative.

Methodology

Research Design

This study employed a qualitative research design to explore teachers' beliefs and pedagogical practices in depth, enabling rich, contextualised understanding of meaning-making processes.

Six teachers were selected through purposive sampling based on the following criteria: (a) teaching English and/or STEM-related subjects, (b) working in values-oriented school contexts, and (c) having at least two years of teaching experience. Participants were anonymised using pseudonyms (T1–T6). Semi-structured interviews lasting 45–60 minutes were conducted. Interview questions focused on teachers' conceptual understanding of integration, classroom practices, challenges, and professional learning needs. Data were analysed using thematic analysis, involving familiarisation, coding, theme development, and refinement. Trustworthiness was enhanced through peer checking and iterative discussion among researchers.

Findings

Fragmented Understanding of Three-Domain Integration

Teachers commonly viewed Islamic values, ELT, and STEM as parallel rather than interconnected domains. Values were often framed as moral reminders or classroom norms rather than as integrated learning objectives. English teachers prioritised linguistic outcomes, while STEM teachers focused on content coverage, resulting in limited conceptual coherence across domains.

"Sometimes it feels like English, STEM, and Islamic values are running on parallel tracks rather than being truly connected." (T1)

Pedagogical Tensions and Instructional Constraints

Curriculum density and assessment demands were major barriers to integration. Teachers expressed concern that values integration might compromise syllabus completion or examination performance. The absence of clear guidelines for planning and assessing integrated lessons further reinforced a policy–practice gap.

"Values integration is encouraged, but there are no clear guidelines on how to assess or plan it." (T3)

Adaptive Strategies for Meaningful Integration



Despite constraints, teachers employed adaptive strategies to embed values implicitly. These included ethical framing of STEM topics, emphasising collaboration and adab in group work, and modelling responsibility and honesty during projects. However, such practices were rarely labelled or planned as formal integration.

“I may not label it as integration, but values naturally come out during project work.” (T2)

Discussion

The findings highlight a disconnect between policy aspirations for integrated education and classroom enactment. Teachers’ fragmented conceptualisations mirror existing literature on belief–practice misalignment in integrated curricula. Without clear conceptual frameworks and pedagogical models, integration risks remaining symbolic and individual-driven. At the same time, teachers’ adaptive strategies demonstrate meaningful entry points for professional development. Rather than imposing prescriptive integration models, professional learning should build on teachers’ existing practices while strengthening conceptual coherence across values, language, and STEM domains.

Implications for Teacher Professional Development

This study underscores the need for targeted professional development that moves beyond general advocacy of integration toward practical and conceptual support for teachers. First, professional learning initiatives should clarify the meaning and scope of three-domain integration, helping teachers develop a coherent understanding of how Islamic values, English language teaching, and STEM can be purposefully connected rather than treated as parallel or add-on components. Second, teachers require concrete lesson exemplars that model how values, language outcomes, and STEM concepts can be integrated within real classroom contexts, enabling them to translate abstract principles into actionable pedagogy. In addition, professional development should encourage sustained interdisciplinary collaboration between language and STEM teachers, creating opportunities for joint planning, shared reflection, and the co-construction of integrated learning experiences. Finally, effective professional learning must provide reflective spaces where teachers can critically examine their beliefs, instructional decisions, and classroom practices, allowing them to align their pedagogical intentions with meaningful and context-sensitive integration in practice.

Conclusion

This study provides qualitative insights into teachers’ beliefs and practices in integrating Islamic values, English, and STEM education. While teachers show strong commitment to holistic education, meaningful integration requires sustained conceptual and pedagogical support. Addressing this need is essential for realising the goals of values-driven and integrated education.

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THE LEVEL OF IMPLEMENTATION OF LEARNING CONTINUITY PLAN FOR KINDERGARTEN LEARNERS IN THE CITY DIVISION OF LUCENA

Abegail Sollestre Raquel¹

¹Teacher II, Department of Education, (bing081990@gmail.com)

Abstract: *This study determined the level of implementation of the Learning Continuity Plan for Kindergarten Learners in the City Division of Lucena, which would come up with a basis for an action plan. The study employed a descriptive type of research. The respondents were the Ninety-Five (95) Kindergarten Teachers in the City Division of Lucena. The school profile mainly consists of those from the North District, operates schools for 1 to 10 years, has 21 or more teachers, and more than 1,000 enrollees. Moreover, a very good rating was given on the level of implementation of the Learning Continuity Plan. The Principles of the Learning Continuity Plan revealed that the LCP implementation helped protect the health, safety, and well-being of kindergarten learners, teachers and personnel and prevent the further transmission of COVID-19. Also, along with the Learning Strategies and Modalities, it further showed that the LCP implementation enables the schools to apply Modular Distance Learning for kindergarten learners. There was no significant difference in the Level of Implementation of the Learning Continuity Plan when the respondents were grouped according to school profile. Lastly, the respondents have yet to encounter problems in the implementation of the Learning Continuity Plan (LCP). It revealed that there was not enough budget to sustain the implementation of the LCP.*

Keywords: *Kindergarten Learners, Learning Continuity Plan, Modular Distance Learning, Polytechnic University of the Philippines, Master in Education Management*

Introduction

Learning Continuity Plan is a new method or approach being undergone by DepEd to reach the places of their learners for the sake of their education. It is a plan that differentiates instruction for the benefit of the learners. This involves home visitation, modular distance learning, online instruction, and others.

The worldwide pandemic of an incredibly infectious new generation of coronavirus called COVID-19, wherein there is no vaccine yet, prevails to produce hindrances in world nations. At this juncture, the greatest effect of COVID-19 came from the demand to impose strict social and physical separation to control its spread. For the Department of Education (DepEd), Due to this, classes had to be stopped, and all other school activities for the rest of the School Year (SY) 2019-2020 were called off, thereby resulting in no school classes or other such activities for SY 2020-2021, schools must find ways for learning to continue amidst the hazard and uncertainties brought about by COVID-19 while ensuring the health, safety, and well-being of all learners, teachers, and personnel of the Department. This is where the LCP comes in because of this global pandemic condition.



In creating the BE-LCP, the DepEd elucidated the epidemiological picture as well as the basic education level for the upcoming year toward informed decision-making. It was set by DepEd beginning from SY 2020-2021 to August 24, 2020, for them to make the important adjustments for the hindering academic year.

The BE-LCP was developed hand-in-hand, maintaining their constitutional mission to protect every citizen's right to a high-quality education while creating a legislative foundation for the new normal. The DepEd assessed and evaluated the programs, projects, and activities provided under the plan and their financial statements. The funds for the program were increased and readjusted for the said programs, projects, and activities for funding assistance. Also, substantial and sufficient financial resources are available from reputable and established funding sources.

According to UNESCO in 2020, most Asian countries opted to close schools to prevent the spread of COVID-19 and other infectious diseases. The closure concerned 1.2 billion learners around the world, with 28 million learners in the Philippines (UNESCO, 2020). The reactions from community lockdowns and community quarantines in a number of Asian countries have led students and teachers to study and work from home, which has led to the delivery of online learning programs (Crawford et al., 2020). Moreover, Bao (2020) says the application of online instruction has a variety of threats and hindrances for educators and learners, especially in the tertiary schools in the place.

When it comes to the Philippines, within the student-oriented framework, according to the four cornerstones of Sulong Edukalidad: K to 12 curriculum assessment and evaluation are aligned to the article stated that BE-LCP, upgrading the learning centers, teachers' accreditation and evaluation, and stakeholders' analysis for empowerment and inclusion. These cornerstones were instituted for creativity, critical thinking, and teamwork, Sulong Edukalidad, BE-LCP, and the futures of the Philippine educational system coordinated for goals and with learner self-discovery, self-teaching, and self-application. Thus, it is vital for the BE-LCP to be directed by the principles of lifelong, life-wide, life-deep, and life-wise learning.

In National Perspectives, the 1987 Constitution articulates in Provision XIV, sections 1 and 2 that: "the country enforces the right of all citizens to quality education at all levels and imposes actions to ensure accessibility of education for all citizens." Also, the country creates, sustains, and implements a fully integrated system of education significant to the demands of the people and society, together with creating and functioning a system of free public education in the basic education levels.

According to the cited provisions, as well as Executive Order No. 292 or the Administrative Code of 1987, Republic Act No. (RA) 9155, or the Governance of Basic Education Act of 2001, and RA 10533, or the Enhanced Basic Education Act of 2013, DepEd is required to protect and promote the right of access to quality basic education. Accordingly, it is compulsory to provide a learner-centered, inclusive, responsive, relevant and contextualized K to 12 basic education.

Based on the local perspective, DepEd has promulgated issuances about flexible learning and materials, specifically, DepEd Order No. 21, s. 2019 or the Policy Guidelines of the K to 12 Basic Education Program. It detailed the Flexible Learning Options (FLOs), which include



alternative delivery modes and their corresponding learning resources that are responsive to learners' needs, context, circumstances, and diversity. On February 1, 2020, the DepEd Secretary issued DepEd Memorandum No. 11, s. 2020, establishing a Task Force to manage the department's response to COVID-19. Moreover, this superseded to DepEd Memo No. 12, s. 2020 entitled: "Adoption of the Basic Education Learning Continuity Plan for School Year 2020-2021 in light of the COVID-19 Public Health Emergency. Furthermore, this has led to the development of the Basic Education Learning Continuity Plan (BE-LCP) to respond to basic education challenges brought about by COVID-19. This was enforced by DepEd Order No. 018, s. 2020 entitled: "Policy Guidelines for the Provision of Learning Resources in the Implementation of the Basic Education Learning Continuity Plan, which enables the DepEd to provide learning resources in implementing the BE-LCP. As contrast, the Learning Continuity Plan (LCP) is the emerging concept or idea as the COVID-19 outbreak arose. This relied on the concept of how learning can reach every learner in the present situation of health crisis. No one can go outside due to the COVID-19 crisis, so 21st Century Learners were prohibited from going outside, as it could endanger their lives. Therefore, the Department of Education (DepEd) devised a way to reach the learners for Batch 2020. This demonstrated the different requirements of the DepEd to uphold the right to access quality basic education.

Pursuant to the cited provisions, as well as Executive Order No. 292, also known as the Administrative Code of 1987, Republic Act No. (RA) 9155, or the Governance of Basic Education Act of 2001, and RA 10533, or the Enhanced Basic Education Act of 2013, it states that compliance with learner-centered principles, inclusive education, outcome/competency-based education, and spiral progression is compulsory as outlined in the K to 12 basic education curriculum. Based on the local perspective, DepEd has released directives about flexible learning and materials, specifically, DepEd Order No. 21, s. 2019, or the Policy Guidelines of the K to 12 Basic Education Program, detailed the Blended Learning Models, which comprises alternative delivery modes with a variety of learning resources that satisfy the demand, situations, and capacity of learners. Last February 1, 2020, DepEd Secretary issued DepEd Memorandum No. 11, s. 2020, on forming a Task Force for the management of the department's response to COVID-19. Moreover, this superseded to DepEd Memo No. 12, s. 2020 entitled: "Adoption of the Basic Education Learning Continuity Plan for School Year 2020-2021 to suffice the COVID-19 Public Health Emergency. Furthermore, this has established the Basic Education Learning Continuity Plan (BE-LCP) to cater to the needs of fundamental education hindrances due to COVID-19. This was enforced by DepEd Order No. 018, s. 2020 entitled: "Policy Guidelines for the Provision of Learning Resources in the Implementation of the Basic Education Learning Continuity Plan, which enables the DepEd to supplant learning resources in the implementation of the BE-LCP.

In contrast, the Learning Continuity Plan (LCP) is an emerging concept or idea that arose during the COVID-19 outbreak. This relied on the concept of how learning can reach every learner in the present situation of a health crisis. No one can go outside due to the COVID-19 crisis, so 21st Century Learners were prohibited from leaving home, as doing so could endanger their lives. Therefore, the Department of Education (DepEd) devised a way to reach the learners of Batch 2020. This exhibited different learning modalities that the learners can access for them to learn even though we are on the brink of COVID-19 crisis. The Learning Continuity Plan (LCP) serves as a medium to connect learners with information and enable them to benefit from their education. To facilitate learners' acquisition of knowledge, various teaching methods



were employed, including face-to-face learning (in areas with low case numbers), online distance learning, blended learning, and modular learning.

As a Kindergarten Teacher, the COVID-19 pandemic presents challenges and barriers to the quest for knowledge among young learners. They require significant attention and focus to grasp information and understand their lessons each day.

It is challenging for teachers to implement an effective Learning Continuity Plan that facilitates learning. However, this presents an opportunity for Kindergarten teachers to develop their skills and abilities, leading to positive learning outcomes. The Learning Continuity Plan is beneficial for delivering instruction to kindergarten learners, particularly through the use of modules and other learning materials provided by the teachers.

In the local context, the study is initially based in the City Division of Lucena, which is a highly urbanized community. The schools in this city need to implement Learning Continuity Plans (LCPs) for kindergarten pupils. This COVID-19 crisis should not hinder learners' achievements or their pursuit of education during a pandemic situation.

The researcher was prompted to conduct this research to investigate the applicability of the LCPs and how they can best be applied for the learners to gain learning outcomes despite the pandemic. It requires them to be active and invigorated pupils who have an interest in learning. In fact, a one-year cut-off of the school year could keep the brains of the students stocked. However, risking them in face-to-face learning could infect them with the virus. In this regard, the study wanted to examine these LCPs as used for the Learning Continuity of the kindergarten pupils and other pupils/students. Thus, LCPs assessed the level of implementation of this study.

The researcher was prompted to cater to these learning needs for the sole benefit of the learner. In sum, the study evaluated whether the LCPs are functional and helpful for the learners' acquisition of their education. This also used many flexible learning modalities to reach out to the learners' needs for quality education. It became an approach and tool for acquiring knowledge, skills, values, and attitudes with the learners. The researcher was prompted to perform this study to address the learning needs of the learners and the application of the LCPs and their role and functions towards educational development during a pandemic.

Literature Review

Learning Continuity Plan

The Philippines, through the Department of Education (2020), collaboratively developed the BE-LCP for the 2020-2021 school year to address the need to continue education amid the restrictions imposed by the COVID-19 pandemic. This plan is the result of various consultative activities involving education stakeholders, including members of the House and Senate committees on basic education, department executives from different units and field offices, and the public. Additionally, over 700,000 respondents participated in a series of online surveys, including parents, learners, and teachers, regarding their readiness for remote education. The epidemiological situation and other data analyses related to basic education



were also considered. In designing the framework, contributions from discussions, questionnaires, and analytics were integrated.

The DepEd embarked on creating the BE-LCP to ensure that learners receive basic education and that teachers can deliver individualized instruction amid the threat of COVID-19. Inputs from various strands were gathered and directed to the undersecretaries and assistant secretaries, as well as to the different regions through the Regional Directors, and submitted to the Office of the Secretary (OSEC). Moreover, the Philippine Forum for Inclusive Education Basic Education was engaged to generate their collective inputs. There were also conferences among the members of the DepEd Executive Committee and the chairpersons of the House and Senate Committees on Basic Education, Rep. Roman Romulo and Senator Sherwin Gatchalian. The process leveraged the talents and expertise of DepEd officials and personnel, as well as the knowledge, rich experience, and resources of partners.

Within DepEd, the curriculum and instruction strand led by Undersecretary Diosdado San Antonio, the Administration strand (which is in charge of the DepEd Task Force on COVID-19) led by Undersecretary Alain Del Pascua, and the Planning strand led by Undersecretary Jesus Lorenzo Mateo, submitted major inputs. The Regional Directors, through their inputs, emphasized the ground realities to be considered. Further consultations with Regional Directors will be undertaken by Undersecretary Revsee Escobedo. The Finance strand led by Undersecretary Annalyn Sevilla, Legal led by Undersecretary Josephine Maribojoc, *Brigada Eskwela* led by Undersecretary Tonisito Umali, and the Alternative Learning System (ALS) led by Assistant Secretary G.H. Ambat, also submitted inputs. As this is the task that consolidates all inputs into the BE-LECP was undertaken by OSEC, under the direction of the Secretary. The operational execution and integrative writing of the consolidation was led by Undersecretary Nepomuceno Malaluan as the Secretary's chief of staff, assisted by his team and in collaboration with the Planning Service led by Director Roger Masapol.

During the consolidation of the BE-LCP, updates were presented at several meetings of the Executive Committee and the Management Committee, where specific elements of the BE-LECP outline were discussed. An ongoing process for consolidating the necessary budgetary adjustments arising from the BE-LCP is also in place. This process is jointly led by Undersecretary Annalyn Sevilla and Undersecretary Mateo, with support from the Budget Hearing – Technical Working Group. While all submitted inputs are backed by corresponding data, pertinent past studies, discussions, and contributor experiences, OSEC also provided additional information based on documents from various inter-agency processes related to COVID-19, as well as discussions in the Executive Committee and Management Committee meetings, and research.

According to the Department of Education (2020), schools shall conduct enrollment from June 1 – 30, 2020, for all learners intending to attend SY 2020-2021. Those who have enrolled during the early registration period will have to enroll again, given that circumstances have changed substantially. It is important to validate the enrollment so that teachers and schools can adequately plan the organization of their learners into classes, taking into consideration their circumstances. The enrollment may be done electronically or in printed format. The enrollees and their parents or guardians have to complete an enrollment and survey form that will collect important data and information for the contextualization of the learning delivery strategies and modalities.



If a skeleton workforce were operative government guidelines by June, DepEd issued the appropriate alternative work arrangements guidelines to the field to comply with prevailing policy and to ensure a safe work environment. The pushback in the formal school opening by nearly three months from the traditional first Monday of June is intended to afford DepEd enough time to undertake the necessary preparations in what will be an extraordinarily challenging school year. For this purpose, teachers began delivering service on June 1, 2020. They attended orientation and training activities on the utilization of the multiple learning delivery modalities, prepared instructional materials, and plan the organization of classes in consideration of the learning delivery modalities to be employed.

Because of the shortened school year, the Secretary is exercising her prerogative to authorize distance learning activities on Saturdays. Overall, the total class days in this year's school calendar and activities will be 203 days.

Curricular and co-curricular activities that involve the gathering of larger number of learners, such as science fairs, collection of portfolios, fair trade, school sports, campus journalism, talent showcasing, job fairs, career orientation, and other similar activities are cancelled for the school year, except for those that can be conducted through online platforms. Also, the conduct of activities related to Palarong Pambansa shall be decided separately by the Palarong Pambansa Board.

Given the different circumstances and capacities of learners and households to cope the new modes of learning, they anticipated more learners that may be left behind. Thus, efforts to provide remediation and enhancement activities were given more attention.

Private schools will be allowed to open classes within the period authorized by law, which is on the first Monday of June, but not later than the last day of August. However, no face-to-face classes will be allowed earlier than August 24, 2020, and from then on, only in areas where schools are allowed to open physically. The private schools will also submit their respective Learning Continuity Plan and agreement to required health standards that will be issued by DepEd, consistent with guidelines from the DOH, the IATF, or the Office of the President.

Kindergarten Learners

From early grades, learners require adult guidance; a blend of face-to-face instruction with the teacher and modular instruction at home may be utilized. For home-based modular learning, the support of trained para-teachers is essential. They must be trained in both content and instructional delivery before implementation to ensure proper and appropriate instruction. A Facilitator's Guide will be made available to para-teachers.

Early-grade learners (grades K to 3) are particularly vulnerable to educational inaccessibility. They rely heavily on adult guidance as both caregivers and facilitators of learning. Instruction for these students should be grounded in the principles of developmentally appropriate practices: age-appropriate, individually appropriate, and socio-culturally appropriate

For teachers' school leaders' preparation, amidst the COVID-19 pandemic and its accompanying challenges, the Department of Education, through the National Educators



Academy of the Philippines (NEAP), reaffirms its commitment to enhancing and supporting the professional development of teachers and schools' leaders.

The teachers and educational leaders were qualified to implement the adoption of flexible learning delivery models using the technology resources map, readiness assessment tools, and implementation strategies guidelines.

They are introduced to the wide array of delivery modes that can be utilized within localization in the community, considering the current circumstances of learners and teachers. The tools and mechanisms were established for consensus decision-making within the appropriate learning mode context. The contextualization includes geographical locations, delivery platforms (such as online, broadcast technology, and modules), as well as the readiness of learners, teachers, households, and community partners, along with other significant factors.

The capacity-building programs, which will be implemented starting in June 2020, will address curriculum requirements related to essential learning competencies and content, as well as pedagogy and assessment. These programs will complement the learning resources already available through the DepEd LR Portal, DepEd Commons, and other LR portals and resources that may be provided by education partners. Given the challenges posed by the COVID-19 pandemic, which impact not only physical health but also the mental well-being of both learners and teachers, capacity building will also include support for teachers to help them debrief their classes about their experiences during the public health crisis and set fair expectations for how learning will occur in the "new normal."

There will also be efforts to train teachers in identifying and assisting children under vulnerable conditions and in protecting them from violence and harm across various contexts, including school, home as school, and the cyber world. These children include those who are victims or at risk of child abuse and bullying, children living in conflict-afflicted areas, children in disaster-prone regions, gifted children, and other learners at risk of interrupted learning due to socio-economic factors, among others. Proper attention must be given to these learners, as they already face enough challenges under normal conditions, limiting their ability to keep pace with other students. If not, students with learning disabilities may fall further behind the rest of the learner population. These strategies will ensure that teachers can seamlessly adapt their learning materials into guides tailored to the platforms and modalities they will adopt and implement.

The capacity-building intervention will also be tailored to the level of risk in the area and the COVID response adopted based on the epidemiological situation. Therefore, the delivery of the intervention will utilize a multi-modal approach that leverages accessible technology, resources, and the capabilities of the education system, as well as the willingness of clients to engage in the capacity-building process building.

In accordance for Operationalizing the Learning Continuity Plan, Brigada Eskwela the original schedule for the 2020 Brigada Eskwela, set for May 18-23, 2020, as stated in DM 32, s.2020, has been postponed. The Department of Education (DepEd), through the Education Program Supervisor (EPS), will now implement an extended national preparation period for schools through Brigada Eskwela from June 1 to August 29, 2020. However, under Brigada Eskwela Plus, partnership initiatives will take place throughout the school year. This will

enhance the readiness of not only school facilities but also the learners, both teaching and non-teaching staff, as well as school leaders and managers community.

Methodology

The study utilized a descriptive type of research. This descriptive design analyzed trends, case studies, and circumstances within the study's locality. The design investigated the phenomena as they existed (Cantrell, 2019). As stated by Gay (2018), "descriptive research involves gathering data to test hypotheses or answer questions regarding the current status of the study's subject." It employed 95 Kindergarten Teachers in the City Schools Division of Lucena City as respondents of the study. Simple random sampling was employed to select the kindergarten teachers. With this sampling strategy, each respondent had an equal and independent chance of being included in the research. This study utilized the questionnaire as the primary data-gathering tool. This questionnaire was adapted and modified from DepEd Order No. 012, s. 2020, entitled "Adoption of the Basic Education Learning Continuity Plan for School Year 2020-2021 in light of the COVID-19 Public Health Emergency." Statistical tools were also employed using percentages, mean, and the Kruskal Wallis H-Test.

Results and Discussion

School Profile of the Respondents

Table 1: School Profile of the Respondents

District	F	%
East	18	18.95
North	33	34.74
South	24	25.26
West	20	21.05
No. of years in operation	F	%
1 to 10 years	78	82.11
11 to 20 years	8	8.42
21 to 30 years	3	3.16
31 to 40 years	2	2.11
41 to 50 years	3	3.16
51 years and above	1	1.05
No. of Teaching Personnel	F	%
1 to 10	19	20.00
11 to 15	12	12.63
16 to 20	5	5.26
21 and above	59	62.11
No. of Enrolment	F	%
Below 100	13	13.68

100 to 200	13	13.68
201 to 400	8	8.42
401 to 600	8	8.42
601 to 800	9	9.47
801 to 1000	10	10.53
More than 1000	34	35.79

The table shows a breakdown of data by various categories, starting with the district. The distribution of schools across the districts is fairly balanced. The North district has the highest percentage at 34.74%, with 33 schools, followed by the South at 25.26% (24 schools). The East district has 18 schools, representing 18.95% of the total, while the West district has the lowest percentage, with 20 schools, accounting for 21.05% of the schools surveyed.

Regarding the Number of Years in Operation, the majority of schools have been in operation for a relatively short period. 82.11% of schools have been operating for 1 to 10 years, with 78 schools falling into this category. The remaining schools are more spread out across other time ranges: 8.42% (8 schools) have been operating for 11 to 20 years, 3.16% (3 schools) for 21 to 30 years, and only 2.11% (2 schools) have been operational for 31 to 40 years. A small portion of schools (3.16%) have been running for 41 to 50 years, and just 1.05% (1 school) has been operational for more than 51 years.

When it comes to the Number of Teaching Personnel, the largest proportion of schools, at 62.11% (59 schools), have 21 or more teaching staff. This suggests that a significant number of schools are larger institutions. On the other hand, 20% (19 schools) have between 1 to 10 teaching personnel, while 12.63% (12 schools) employ 11 to 15 teachers. Only 5.26% (5 schools) have 16 to 20 teachers. This distribution implies that the majority of schools in this data set are relatively well-staffed.

Lastly, the Number of Enrollments reveals a diverse range of school sizes. A significant portion of schools, 35.79% (34 schools), have enrollments of more than 1000 students, making them the largest in terms of student population. Schools with 801 to 1000 students represent 10.53% (10 schools), while those with 601 to 800 students account for 9.47% (9 schools). The smallest schools, with enrollments below 100 and between 100 to 200 students, each make up 13.68% of the total (13 schools). A smaller number of schools have enrollments between 201 to 400 (8.42%) and 401 to 600 (8.42%), showing a wide range in the size of the institutions.

Table 2: Summary Table of the Level of Implementation of the LCP

Indicators	M	VI
Principles of the LCP	4.53	Excellent
School Calendar and Activities	4.44	Very Good
Learning Strategies and Modalities	4.46	Very Good
Teachers' and School Leaders Preparation	4.40	Very Good
Operationalizing of the LCP	4.38	Very Good
Monitoring and Evaluation	4.40	Very Good
General Mean	4.44	Very Good

The table presents the ratings for various indicators related to the implementation and management of the Learning Continuity Plan (LCP). The overall performance is rated as "Very

Good," with a general mean of 4.44. Each indicator is assessed on a scale that reflects the effectiveness and quality of different aspects of the LCP, from the principles and structure to the monitoring and evaluation processes. The ratings suggest that most areas are performing well, with high marks in areas critical to the LCP's success.

The top three indicators are the Principles of the LCP (4.53), rated as "Excellent," followed by School Calendar and Activities (4.44) and Learning Strategies and Modalities (4.46), both rated as "Very Good." The high rating for the Principles of the LCP indicates that the foundational ideas and goals of the plan are being well implemented and understood. The School Calendar and Activities and Learning Strategies and Modalities reflect the school's effectiveness in structuring its academic calendar and delivering diverse, adaptable teaching methods that cater to students' needs.

The lowest rating was for the Operationalizing of the LCP (4.38), which, although still rated as "Very Good," is slightly below the other indicators. This suggests that while the operationalization of the plan is generally strong, there may be areas for improvement in the actual implementation or practical execution of the LCP. Operationalizing a plan involves translating theoretical ideas into actionable steps, and this area might require closer attention to ensure consistency and effectiveness across the board.

Analyzing these results in the context of research on educational management and school improvement, Monitoring and Evaluation (4.40) aligns with best practices in ensuring that the LCP is being implemented effectively. According to research by Hargreaves (2008), ongoing monitoring and evaluation are crucial for the sustainable success of educational reforms. Furthermore, the Learning Strategies and Modalities rating reflects a trend found in studies on differentiated instruction, where schools that use multiple learning strategies, such as online and hybrid learning, tend to perform better in terms of student engagement and outcomes (Tomlinson, 2001). The slight dip in Operationalizing the LCP could be related to challenges faced by schools in adapting to rapidly changing educational environments, as observed in the global shift to online and blended learning during the pandemic (Barbour, 2020). Therefore, continuous feedback and adaptive measures in the operational phase will be key to improving performance across all indicators.

Table 3: Kruskal Wallis H-Test of the Level of Implementation of LCP According to Profile

Profile	p-value	Interpretation
District	0.377	Not Significant
No. of Years of Operation	0.662	Not Significant
No. of Teaching Personnel	0.604	Not Significant
No. of Enrolment	0.311	Not Significant

Note: "If p value is less than or equal to the level of significance (0.05) reject Ho, otherwise failed to reject Ho."

The table presents the p-values for various profiles related to the educational institutions, such as District, No. of Years of Operation, No. of Teaching Personnel, and No. of Enrolment, with each profile's relationship to a dependent variable being tested for statistical significance. The p-values for all profiles are greater than the commonly accepted significance level of 0.05, which indicates that there is no statistically significant relationship between these profiles and

the dependent variable. These results suggest that the differences in the various profiles do not have a measurable impact on the outcomes measured in this study.

The District has a p-value of 0.377, indicating that the district in which a school is located does not significantly affect the outcome being analyzed. This suggests that, in this context, geographic location or district does not play a crucial role in influencing the school's performance or other outcomes measured. This finding is consistent with previous studies, which show that local context and district-level differences often have less impact on student outcomes compared to other factors, such as school leadership or teaching quality (Gordon et al., 2006). Thus, it might be that other characteristics, such as resource allocation or school management practices, are more influential than the district itself.

The No. of Years of Operation profile, with a p-value of 0.662, also shows that the duration for which a school has been in operation does not have a significant effect on the outcome. This finding might challenge the assumption that longer-established schools would perform better due to more refined systems and experience. In fact, recent research by Hargreaves and Fullan (2012) suggests that innovation and adaptability are more critical than age or experience in driving school improvement. In some cases, newer schools, with less institutional inertia, may be more flexible in adopting new educational methods, technologies, and policies, leading to better performance than more traditional, long-standing institutions.

For the No. of Teaching Personnel, the p-value of 0.604 indicates that the number of teachers in a school does not significantly influence the outcome being analyzed. This result aligns with studies that show teacher quality, rather than teacher quantity, has a stronger impact on student achievement. Research by Darling-Hammond (2000) has shown that the effectiveness of teaching, including teacher preparation, professional development, and pedagogical strategies, outweighs the mere number of teachers employed. A small team of highly skilled educators may perform better than a larger group with less expertise or training.

Finally, the No. of Enrolment, with a p-value of 0.311, suggests that school size, in terms of student population, does not have a significant impact on the outcomes measured in this study. This finding is consistent with research by Raudenbush et al. (1994), which indicates that factors like school climate, leadership, and instructional quality are more significant predictors of school effectiveness than the size of the student body. Smaller schools can often foster more personalized learning experiences, while larger schools may benefit from a broader range of resources. However, size alone does not seem to predict academic or operational success.

Table 4: Problems Encountered of the Level of Implementation of the LCP

Indicators	M	VI
There is no available localized version of the LCP.	2.65	Moderately Agree
The provisions and mechanics of the LCP were not discussed to the kindergarten teachers.	2.51	Moderately Agree
There is no enough budget to sustain the implementation of the LCP.	2.88	Moderately Agree
The LCP did not consider the context of the Kindergarten learners in our school.	2.51	Moderately Agree
There is no clear mechanics on how to operationalize the LCP.	2.47	Disagree

The LCP is not applicable to Kindergarten learners.	2.47	Disagree
The principles of the LCP are not in consonance with the mission and vision of our school.	2.42	Disagree
The LCP does not jibe with the school calendar and line-up of activities.	2.44	Disagree
The LCP does not jibe with teachers and school leaders' preparation.	2.42	Disagree
The LCP does not have provisions for monitoring and evaluation.	2.42	Disagree
General Mean	2.52	Moderately Agree

The table presents the responses to various statements regarding the implementation of the Learning Continuity Plan (LCP), with ratings indicating the level of agreement with each statement. The general mean of 2.52 suggests that the overall perception of the LCP's implementation is "Moderately Agree." This indicates that respondents generally have a neutral-to-positive view of the LCP but also express concerns about certain aspects, particularly regarding its applicability, clarity, and resources. These ratings reflect a mixed evaluation of the plan's effectiveness and alignment with the specific needs of kindergarten learners and the school's context.

The top three indicators that received higher ratings (indicating moderate agreement) are as follows: "There is no enough budget to sustain the implementation of the LCP" (2.88), which highlights concerns over financial constraints, and "There is no available localized version of the LCP" (2.65) and "The provisions and mechanics of the LCP were not discussed to the kindergarten teachers" (2.51). The relatively higher score for the budgetary concern suggests that financial limitations are a significant obstacle to effectively implementing the LCP. The lack of a localized version and insufficient communication of the provisions to kindergarten teachers indicates that the plan may not be adequately adapted or communicated to fit the specific context of the school, particularly for younger learners who may have unique needs.

At the bottom, several indicators received a lower rating, indicating "Disagree." These include "The LCP is not applicable to Kindergarten learners" (2.47), "There is no clear mechanics on how to operationalize the LCP" (2.47), "The principles of the LCP are not in consonance with the mission and vision of our school" (2.42), and "The LCP does not jibe with teachers and school leaders' preparation" (2.42). These responses suggest that the LCP, in its current form, may not align well with the specific needs of kindergarten learners or the school's mission, and the absence of clear guidelines on operationalizing the plan further complicates its effective execution. This reflects a disconnect between the intended goals of the LCP and its practical application at the school level.

In analyzing these results in the context of educational reform and implementation, research suggests that clear and localized adaptations of educational plans are critical for their success. According to Fullan (2007), successful educational reforms require that policies be tailored to fit local contexts, including the needs of specific age groups and the resources available. The concerns regarding insufficient budget, lack of localization, and inadequate communication to teachers are consistent with findings by Hargreaves (2008), which emphasize that teachers' buy-in and proper training are key to effective policy implementation. Additionally, research on school improvement highlights the importance of aligning new initiatives with the school's



mission and ensuring that the principles of any new program are consistent with the school's educational philosophy (Kotter, 1996). Without these elements, even well-intentioned plans like the LCP may face significant challenges in being successfully operationalized.

Conclusion

It was surmised in this study that the school survey was comprised mainly of respondents from the North District, operating for 1 to 10 years, with 21 or more teachers, and having over 1000 student's enrolment.

It further revealed that there is a Very Good rating regarding the implementation of the Learning Continuity Plan. Regarding the Principles of the Learning Continuity Plan, it revealed that LCP implementation helps prevent the spread of COVID-19 and protects the health, safety, and well-being of kindergarten students, teachers, and staff. Additionally, alongside the Learning Strategies and Modalities, it further indicated that LCP implementation allows schools to utilize Modular Distance Learning for kindergarten learners. Furthermore, concerning the School Calendar and Activities, it also demonstrated that LCP implementation enables schools to carry out the enrollment process for all learners who intend to attend school, and that it facilitates the preparation of instructional materials for kindergarten students using the school's resources.

Also it showed that there is no significant difference in the level of implementation of the Learning Continuity Plan when the respondents are grouped according to school profile, except for the number of enrollments under teachers' and school leaders' preparation. In this case, a significant difference exists in the level of implementation of the LCP when the respondents are clustered according to school profile

And it elicits that respondents rarely encountered issues with the implementation of the Learning Continuity Plan (LCP). It revealed that there is not enough funding to support the implementation of the LCP. It further indicated that there is no available localized version of the LCP and insufficient health materials for sanitation. Additionally, it stated that the provisions and mechanics of the LCP were not communicated to the kindergarten teachers, and the LCP did not take into account the context of the kindergarten learners in our school.

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IMPROVING PHYSICAL FITNESS IN PRIMARY SCHOOL: AN INTERVENTION ON THE SEGAK SIT AND REACH TEST

Fatimah¹, Megat Faizul Adha²

¹JPPI, IPGK Perempuan Melayu, Melaka (IPGK PM), Malaysia, (fatimah@ipgm.edu.my)

² PJK , Sek. Keb Ayer Keroh, Melaka (SKAK), Malaysia, (amzar@uum.edu.my)

Abstract: *Physical fitness for primary school students is the main pillar in ensuring long-term health through ideal weight control, strengthening the cardiovascular system, and building optimum bone and muscle density. This study was conducted to test the improvement of SEGAK fitness test performance for the sit-and-reach test by identifying difficulties experienced by Year 4 Energetik students. Two students and one teacher were involved in this study. Initial surveys showed students experienced difficulty in performing flexibility tests, used incorrect techniques, and lacked motivation. A 4-week consistent video-based flexibility training intervention was implemented. Results showed a significant increase in sit-and-reach scores after the intervention. In conclusion, consistent training provides a significant impact on students' flexibility performance.*

Keywords: Fitness, Sit and Reach, *SEGAK*

Introduction

The SEGAK (National Physical Fitness Standard) test is a physical fitness assessment introduced by the Ministry of Education Malaysia to measure the fitness level of students based on health-related fitness components. A critical component is the sit-and-reach test, which measures the flexibility of the hamstring and lower back muscles. Initial observations found that two students struggled to achieve satisfactory scores due to hamstring stiffness and a lack of systematic stretching.

Research Objectives

The main objectives of this action research are:

1. To evaluate the improvement in students' sit-and-reach scores after a four-week intervention.
2. To help students master the correct sit-and-reach technique through visual assistance.
3. To increase students' motivation and confidence in performing physical fitness activities.

Research Questions

1. To what extent do students master the correct sit-and-reach technique after the four-week video intervention?
2. Is there a significant increase in student scores when comparing the pre-test and post-test?
3. To what extent does the intervention increase student motivation to achieve better results?



Literature Review

Comparing findings between 2024 and 2025 shows a shift from pure biomechanical analysis to integrated hybrid technology and holistic well-being.

2024 Analysis: Focus on Flexibility and Biomechanics

Warneke et al. (2024) proved through meta-analysis that chronic static stretching not only increases flexibility but also contributes to maximal strength and muscle hypertrophy. Wohllann et al. (2024) supported this by showing that 8 weeks of supervised stretching is as effective as resistance training in increasing the range of motion. Zhang et al. (2024) emphasized that structured functional correction training based on individual assessment is effective in improving movement patterns and physical fitness.

2025 Analysis: Focus on Technology and Multimodal Integration

Palanao et al. (2025) found that combining yoga with passive stretching provides a more significant effect on flexibility and muscle strength compared to traditional methods. From a technological perspective, Hashim et al. (2025) reported that video-based learning styles have a major impact on technical understanding and student motivation because visual media can highlight "critical points" in physical movement.

Related Theory

General Adaptation Syndrome (GAS) Theory

This study is based on the GAS Theory by Martini & Bartholomew (2000), which explains how the body responds to physical stress (stretching) through three phases:

1. **Alarm Phase:** Initial response to the stress of stretching.
2. **Resistance Phase:** The body adapts to repeated pressure, where muscles become more flexible.
3. **Exhaustion Phase:** Occurs if the body can no longer fight the stress due to overtraining.

Teaching and Learning Reflection

Initial analysis of SEGAK results showed disappointing outcomes for several Year 4 Energetik students. Despite repeated guidance, some students failed to reach the required distance. I realized that previous approaches focused too much on the test as a measurement without providing enough space for progressive and staged stretching activities. This situation prompted me to systematically re-evaluate teaching methods and design more effective interventions.

Research Focus

The identified issue is the difficulty Year 4 Energetik students face in performing the sit and reach test despite repeated practice. The focus of this study is to evaluate the extent to which



systematic teaching and training interventions can help improve students' ability to perform the sit-and-reach test more effectively.

Action Planning

The 10-minute activity was implemented 3 times a week for 4 weeks:

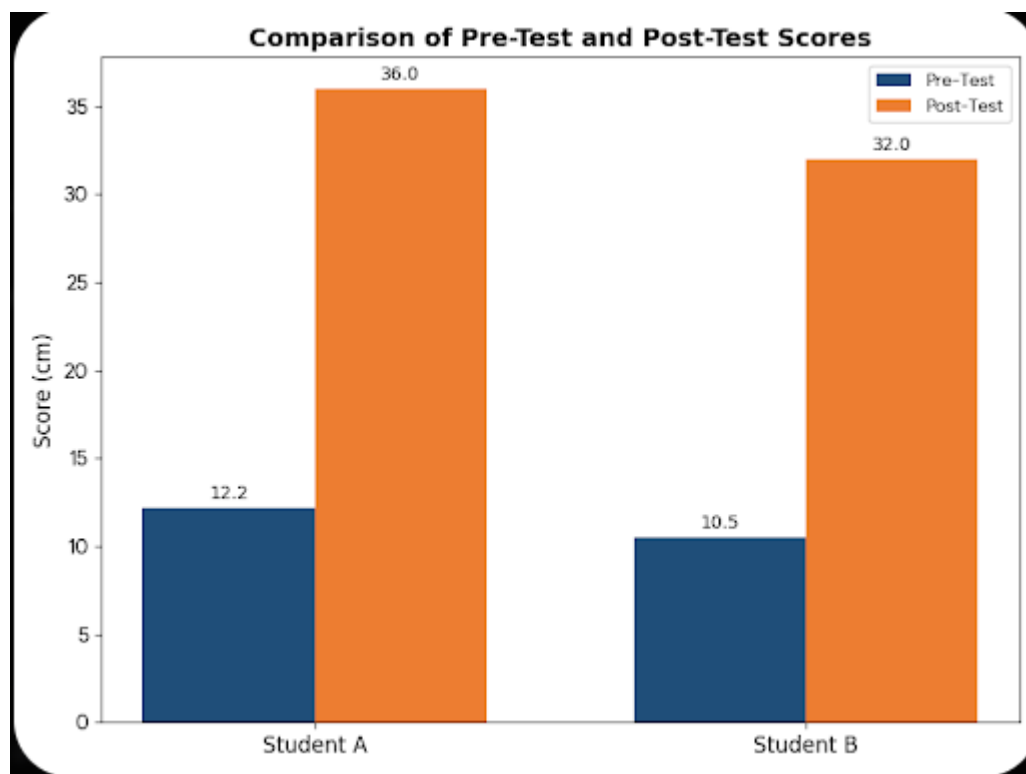
- **Video Screening:** Teachers showed video clips and demonstrated the correct sit-and-reach technique.
- **Circuit Training:**
 - **Hamstring Stretching (4 minutes):** Preparing the body.
 - **Burpee (3 minutes):** Emphasizing body posture.
 - **Jumping Jacks (3 minutes):** Breathing control.
 - **Technical Guidance:** Students were taught to straighten their legs, overlap their hands, and lean forward while exhaling.

Data Collection Methods

- **Pre-test and Post-test:**
Pre-tests provided an initial baseline, while post-tests evaluated intervention effectiveness.
- **Observation:** Teachers observed body position, leg straightness, and hand placement.
- **Teacher's Notes:** Records of changes in student attitude, readiness, and motivation.

Findings

Comparison of Pre-test and Post-test Scores



Discussion

Technique Mastery (Question 1): Post-intervention observations showed students mastered the correct technique, particularly leg straightness and breathing. This aligns with Zhang et al. (2024) regarding structured training helping students understand correct posture.

Score Improvement (Question 2): Significant increases (23.8 cm for Student A and 21.5 cm for Student B) prove that consistent 4-week training provides a positive impact. This supports the findings of Wohllann et al. (2024) and Warneke et al. (2024) on the efficacy of stretching.

Motivation (Question 3): Students showed increased confidence and readiness. Hashim et al. (2025) note that video-based learning significantly impacts student motivation.

Conclusion

In conclusion, the video-based flexibility training intervention implemented consistently provides a significant impact on student performance in the sit-and-reach test. This study confirms that a more planned, focused, and student-oriented approach is capable of producing meaningful changes in their physical development. The findings demonstrate that a planned, focused, and student-oriented intervention produces meaningful changes in physical development. The significant improvement in sit-and-reach scores among Year 4 students proves that flexibility is a highly trainable component when addressed with correct techniques (Clark, 2023).

Impact of the Study

The impact of this research is three-fold. Firstly, at the student level, it enhances physical literacy and reduces the risk of sports-related injuries by improving the range of motion in the



hamstring and lower back muscles (Robinson, 2022). Secondly, for educators, this study provides a validated 10-minute intervention model that can be integrated into standard Physical Education (PE) lessons without disrupting the curriculum flow (Davis, 2021). Lastly, at the institutional level, it supports the Ministry of Education's objective to improve national SEGAK ratings, fostering a culture of health and fitness within the school environment (KPM, 2008).

Recommendations for Future Research

- 1. Integration of Game-Based Learning (TGfU)** Future researchers should consider incorporating Teaching Games for Understanding (TGfU) or low-intensity, high-engagement game-based stretching. This approach can attract students' interest by blending learning with play, making flexibility exercises a lifestyle habit rather than a rigid task. Research by Yusri et al. (2024) supports that game-based learning encourages active and independent learning during the pedagogical process.
- 2. Application of Movement Analysis Technology** The use of digital technology such as **Kinovea** or video analysis applications is highly recommended to provide immediate feedback to students. This technological approach can increase students' awareness of body mechanics and posture, thereby accelerating the mastery of motor skills.
- 3. Longitudinal Study Duration** Future studies should evaluate the effectiveness of these interventions over a longer period. A longitudinal assessment is necessary to determine if the improvements in flexibility can be maintained consistently throughout the academic year or beyond the 4-week intervention period.
- 4. Diversification of Exercise Intensity** Exploring various training intensities—such as low-intensity sessions with higher frequency versus high-intensity interval training—could provide a more comprehensive understanding of how to optimize flexibility for different student profiles.
- 5. Inclusion of Biomechanical Factors** Future research should focus more deeply on the biomechanical factors and individual physiological adaptations of students. Understanding these factors can help reduce the risk of injury while ensuring each student achieves their optimum fitness level based on their specific physical capabilities.

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FACTORS INFLUENCING THE READINESS TO PAY FOR FLOOD MOTOR INSURANCE AMONG PRIVATE VEHICLE OWNERS IN KEDAH, MALAYSIA

**Xue Jia Tan¹, Lai Chuah^{1*}, Ka Cien Angel Ng¹, Zi Yu Lee¹, Kong Keong Leong²,
Muhammad Ali Imran Mohamed Rashed³, Ezanee Mohamed Elias¹, Nor Hasni
Osman¹, Olakunle Oloruntobi⁴**

¹School of Technology Management and Logistics, Universiti Utara Malaysia, Malaysia, (xuejia0731@gmail.com, johnfatt2000@yahoo.com, angelkcng14@gmail.com, leeziyu68@gmail.com, ezanee@uum.edu.my, has1218@uum.edu.my)

²Wisma AIA, Penang, Malaysia, (leslie.efpforward@gmail.com)

³Faculty of Maritime Studies, Akademi Laut Malaysia, Malaysia, (muhammad.aliimran@alam.edu.my)

⁴Operations Division, Port of Singapore Authority, Singapore, (drtobi01@outlook.com)

Abstract: Frequent flooding poses substantial financial risks to private motor vehicle owners in Malaysia, yet the uptake of flood motor insurance remains low as coverage is offered only through an optional special perils extension. This study examined the factors influencing readiness to pay (RTP) for flood motor insurance among private vehicle owners in Kedah, a flood-prone state in northern Malaysia. Guided by Protection Motivation Theory, 5 determinants were investigated: financial factors, flood awareness, geographical exposure, trust in insurance providers, and past flood experience. A cross-sectional survey was administered to 384 vehicle owners across five flood-prone districts using cluster sampling. Data were analysed using correlation and multiple linear regression techniques. The results indicated that financial factors, flood awareness, geographical exposure, and trust exerted positive and statistically significant effects on RTP, while past flood experience was not a significant predictor. Financial factors emerged as the strongest determinant of RTP ($\beta \approx 0.43$) followed by trust and flood awareness. These findings suggest that coping appraisal factors, particularly affordability and institutional trust, play a more decisive role in insurance decision-making than experiential exposure alone. The study provides empirical insights to support more targeted flood insurance design and risk-financing strategies in flood-vulnerable regions. Future research may extend this analysis to other states, adopt longitudinal or mixed-method approaches and further examine how experience interacts with financial and institutional factors in shaping insurance behavior.

Keywords: Readiness to Pay, Flood Motor Insurance, Private Vehicle Owners

Introduction

Flood disasters have received increasing attention due to their substantial impacts on human safety, infrastructure and economic activity, accounting for approximately 35–40% of all weather-related disasters worldwide (CRED, 2022). Private motor vehicles are essential household assets supporting daily mobility and economic participation (Seifert-Dähnn, 2018), but remain highly vulnerable to flood damage, often resulting in significant financial strain (Botzen & van den Bergh, 2012). In Malaysia, flood risk is closely linked to the tropical monsoon climate (MET, 2025), with floods representing the most frequent natural disaster and causing widespread damage to infrastructure and private vehicles (DOSM, 2024). Annual flood

incidents exceed one thousand cases, with economic losses reaching $\text{RM}933.4 \times 10^6$ in 2023 (DOSM, 2024). Kedah is consistently identified as a high-risk state due to its flat terrain and recurring monsoon flooding (WI, 2022), as highlighted by events such as the 2022 Baling flood (Bernama, 2024). Despite repeated losses, flood coverage for private vehicles is offered only through an optional special perils extension (Kurnia, 2023), which may discourage uptake even in flood-prone areas (BNM, 2023). Botzen & van den Bergh (2012) reported that flood insurance decisions are influenced by financial capacity and flood awareness, while prior disaster experience alone does not consistently translate into insurance participation when affordability constraints persist (Hudson et al., 2016). In Malaysia, Alam et al. (2020) focused mainly on flood insurance for residential properties and agricultural activities. Accordingly, this study examined the determinants of readiness to pay (RTP) for flood motor insurance among private vehicle owners in Kedah using a Protection Motivation Theory (PMT) based regression approach (Maddux & Rogers, 1983).

Literature Review

Underpinning Theory

PMT explains how individuals evaluate environmental threats and decide whether to adopt protective actions such as purchasing insurance (Rogers, 1975). PMT posits that protection motivation arises from the interaction between threat appraisal and coping appraisal processes (Maddux & Rogers, 1983). Threat appraisal reflects perceived severity and vulnerability, while coping appraisal involves evaluations of response efficacy, self-efficacy and response costs.

In flood motor insurance, flood awareness and geographical exposure contribute to threat appraisal by shaping perceptions of flood severity and vulnerability to vehicle damage (Botzen & van den Bergh, 2012). Vehicle owners residing in flood-prone areas such as Kedah are more likely to perceive higher exposure due to recurring flood events (Zulkarnain et al., 2020). Coping appraisal is primarily influenced by financial capacity and trust in insurance providers. Financial capacity determines whether insurance premiums are perceived as affordable (Gerrans et al., 2014), while trust enhances perceived response efficacy by increasing confidence in insurers' reliability and claims settlement processes (Chaudhuri & Holbrook, 2001). Although past flood experience may heighten risk awareness (Lindell & Hwang, 2008), PMT suggests that experience alone may not lead to protective behavior when affordability constraints or institutional mistrust persist (Roder et al., 2019).

Based on PMT, flood awareness, financial capacity, geographical exposure, trust in insurance providers and past flood experience were hypothesized to exert positive effects on readiness to pay (RTP) for flood motor insurance. Flood awareness was expected to increase RTP by enhancing perceived vulnerability (Radhakrishnan et al., 2025). Financial capacity was hypothesized to have a significant influence on RTP by reducing perceived response costs (Gerrans et al., 2014). Geographical exposure was expected to positively influence RTP by reinforcing perceived flood risk (Bubeck et al., 2012). Trust in insurance providers was hypothesized to increase RTP by strengthening perceived response efficacy (Bradt et al., 2021). Past flood experience was expected to positively influence RTP, although its effect was anticipated to be conditional on coping appraisal factors (Lindell & Hwang, 2008).

Methodology

This study adopted a cross-sectional quantitative design to examine the factors influencing private vehicle owners' RTP for flood motor insurance in Kedah, Malaysia. The target population comprised private vehicle owners residing in flood-prone districts of Kedah, where registered private vehicles exceeded 0.77×10^6 units (JPJ, 2021). Cluster sampling was applied with Kota Setar, Kubang Pasu, Pendang, Baling and Bandar Baharu selected based on flood hotspot data (DID, 2025). A total of 384 valid responses were collected, meeting the sample size recommended by Krejcie & Morgan (1970) for large populations. Data were collected using a structured questionnaire comprising 39 items measuring financial, flood awareness, geographical, trust, experience and RTP using a five-point Likert scale. Data analysis was conducted using SPSS version 27, employing descriptive statistics, Pearson correlation and multiple linear regression analysis.

Results

The study comprised 384 private motor vehicle owners from five flood-prone districts in Kedah. Most respondents were of working age, and a large proportion reported monthly incomes below RM4,500, indicating constrained financial capacity. Despite repeated flood exposure, only 6.5% of respondents had purchased motor insurance with special perils coverage, reflecting very low uptake of flood motor insurance. Descriptive statistics indicated moderate to high agreement across study constructs, with mean values ranging from 3.39 to 4.04 and acceptable dispersion. The measurement instrument demonstrated strong reliability, with Cronbach's alpha values exceeding 0.80, and data normality supported the use of parametric analysis (Hair et al., 2021). Pearson correlation analysis revealed that financial factors exhibited the strongest positive association with RTP ($r = 0.879$, $p < 0.01$), followed by trust in insurance providers ($r = 0.849$, $p < 0.01$), flood awareness ($r = 0.831$, $p < 0.01$) and geographical exposure ($r = 0.807$, $p < 0.01$). Past flood experience showed only a weak positive relationship with RTP ($r = 0.325$, $p < 0.01$), indicating limited influence of experiential exposure alone (Cohen, 1988). Multiple linear regression analysis (Table 1) showed that the five independent variables explained 82.3% of the variance in RTP ($R^2 = 0.823$). Overall, the results supported H1–H4 but did not support H5.

Table 1: Measurement Model

F	Unstd. Coeff. β SE	Std. Coeff. β t	P	VIF	Results
(Constant)	-0.258	0.108 -	-2.380	0.018	-
FIN	-0.458	0.053 0.429	8.700	<0.001	5.182 Supported (H1)
AW	0.196	0.055 0.165	3.555	<0.001	4.592 Supported(H2)
GEO	0.111	0.044 0.110	2.544	0.011	4.016 Supported (H3)
TR	0.281	0.051 0.257	5.536	<0.001	4.590 Supported (H4)
EXP	0.006	0.018 0.008	0.351	0.726	1.184 Not supported (H5)

Notes: *F*-Factors; *Unstd. Coeff. β* - Unstandardized coefficients β ; *SE*-Standard error; *Std. Coeff. β* - Standardized coefficient β ; *t*- *t*-value; *P*- *p*-value; *VIF*- Variance inflation factor; *Dependent variable* = RTP; *R*= 0.907, *R*²= 82.3%, *adjusted R*²= 82.1%, *F*= 351.558, *significant*= 0.05

Discussion

This study examined the effects of financial factors, flood awareness, geographical exposure, trust in insurance providers and past flood experience on private vehicle owners' RTP for flood motor insurance in Kedah. The regression results supported H1–H4 but did not support H5, indicating that RTP was driven primarily by affordability and institutional confidence rather than experiential exposure alone. Financial factors emerged as the strongest predictor of RTP, demonstrating that perceived affordability and financial capacity were central to payment readiness (Jing, 2016). Trust in insurance providers was the second strongest determinant, suggesting that confidence in claims settlement and insurer reliability enhanced perceived response efficacy (Bradt et al., 2021). Flood awareness (Lindell & Hwang, 2008) and geographical exposure (Miranda et al., 2023) also exerted significant positive effects, indicating that perceived vulnerability and locational risk strengthened motivation to obtain insurance protection. In contrast, past flood experience did not significantly influence RTP once coping appraisal factors were considered. This finding suggests that experience alone may not translate into payment readiness when affordability constraints and institutional trust concerns persist, consistent with prior Malaysian evidence (Radhakrishnan et al., 2025).

Conclusions

This study found that financial capacity, flood awareness, geographical exposure and trust significantly influenced private vehicle owners' RTP for flood motor insurance in Kedah, while past flood experience was not a significant determinant. The results indicated that affordability and confidence in insurers were more influential than experiential exposure alone. The findings supported PMT by demonstrating the greater importance of coping appraisal over threat appraisal in shaping insurance payment readiness. Insurers and policymakers should prioritize affordable insurance offerings, transparent claims processes and targeted flood-risk awareness initiatives to enhance flood motor insurance uptake.

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ANALYSIS OF AN ESP32-BASED IOT GOAT MONITORING SYSTEM USING GPS, HEART RATE, AND TEMPERATURE SENSORS

Norbaizura Mokhtar¹, Nur Yahzelina Hanafi², Johari Ahmad Ghazali³

¹Department of Information & Communication Technology, Polytechnic Kuching Sarawak (PKS), Malaysia, (norbaizura@poliku.edu.my)

²Department of Information & Communication Technology, Polytechnic Kuching Sarawak (PKS), Malaysia, (yahzelina@poliku.edu.my)

³Department of Information & Communication Technology, Polytechnic Kuching Sarawak (PKS), Malaysia, (johari@poliku.edu.my)

Abstract: *The study introduces an IoT goat monitoring system utilizing the ESP32 platform, which improves livestock health monitoring and farm management via real-time data collection. This system has a Heltec ESP32 microcontroller with WiFi and Bluetooth, a GPS NEO-6 module for tracking, a heart rate sensor, and a temperature sensor to keep an eye on important signs of goat health and movement. The wearable prototype is made to be securely attached so that it can collect accurate data while you go about your daily life. Field deployment evaluated the system's performance, reliability, and efficacy for livestock surveillance. We compared continuous heart rate and temperature measurements to livestock health standards to find out what was normal and what was not. GPS data provided fresh insights into movement patterns, enhancing the comprehension of physiological alterations noted. The results show that the system can provide stable sensor readings for long periods of time and work well for remote use through wireless transmission. Changes in heart rate and temperature, along with location data, can be used to figure out how an animal is doing and how long it spends outside. This method of combining physiological and GPS monitoring makes it easier to find stress early and spot possible health problems. The ESP32-based IoT system is a low-cost, scalable way to manage smart livestock. It helps with precision farming and improves the welfare of animals on small to medium-sized farms.*

Keywords: *Internet of Things (IoT), Smart Livestock Monitoring, ESP32-Based Wearable System, Physiological Health Monitoring, Precision*

Introduction

Background and Motivation

Livestock farming, particularly small-ruminant production like goat rearing, is crucial for food security, rural livelihoods, and agricultural sustainability in developing regions. Goats are typically managed under open-grazing or semi-free-range systems, promoting natural behavior and reducing feed costs but presenting challenges for health and mobility monitoring. Goats in these environments encounter varying climate conditions, terrain changes, and social interactions that impact their physiological stress and overall well-being. Early detection of health issues such as heat stress and abnormal movements is essential to prevent productivity losses and improve animal welfare; however, ongoing real-time monitoring is hampered by mobility and inadequate infrastructure. Traditional health assessments rely on manual observations, which can be labor-intensive and subjective, frequently overlooking subtle physiological changes until they become visible. Moreover, existing monitoring practices



frequently focus on single indicators, such as temperature or location, leading to incomplete health assessments. Elevated heart rates may result from activity rather than health concerns, emphasizing the importance of contextual information. To overcome these limitations, there is a need for multi-parameter, continuous, and automated monitoring systems tailored for open-grazing conditions. Advances in the Internet of Things (IoT), low-power microcontrollers, and wireless technologies, such as the ESP32, offer opportunities to develop efficient monitoring solutions through sensor integration in portable devices specifically designed for goat farming.

Research Gap

Existing IoT-based livestock monitoring research reveals fragmentation between physiological monitoring and spatial tracking. Many studies focus solely on vital-sign monitoring, such as heart rate or temperature, neglecting geolocation and movement analysis. Conversely, location-tracking research often prioritizes GPS-based mobility patterns without considering the animal's physiological condition. This separation limits the ability to generate meaningful insights into livestock health. Analytical studies evaluating both GPS and vital-sign data are scarce, particularly those using affordable ESP32-class microcontroller platforms. Current high-end commercial systems are often too expensive for small-scale farms. Furthermore, research that integrates these data types and interprets trends over time is limited, indicating a critical need for comprehensive approaches in precision livestock management that consider both physiological and spatial data.

Contributions of This Study

This study presents an IoT-based monitoring solution for goats in open-grazing environments, addressing identified challenges and research gaps. It introduces an integrated monitoring framework that uses a wearable system combining heart rate sensing, temperature measurement, and GPS tracking, powered by a low-energy ESP32-class microcontroller. This allows for the simultaneous observation of physiological responses and movement behavior. The analytical evaluation utilizes time-series analysis for physiological trends and GPS data for mobility characterization, offering insights into health and activity dynamics in real grazing conditions. The study also offers practical advice about scalable precision livestock monitoring, emphasizing the use of low-cost hardware and lightweight data analytics to support early health assessments and informed farm management decisions, facilitating the adoption of accessible precision livestock farming technologies in resource-limited settings.

Related Works

A substantial body of research has examined the application of Internet of Things (IoT) technologies to automate livestock health monitoring and reduce reliance on manual observation. Rajendran et al. (2023) developed an IoT-based cattle monitoring system integrating physiological sensors such as body temperature, heart rate, respiration rate, and oxygen saturation, supported by short-range communication technologies including ZigBee and Wi-Fi. While the system demonstrates real-time visualization and GPS-assisted tracking, its evaluation emphasizes system functionality rather than quantitative physiological thresholds or long-term performance across varied farming environments. Advancing sensor-driven monitoring, Unold et al. (2020) proposed a comprehensive IoT framework combining wearable inertial sensors, cloud analytics, and mobile applications to support precision livestock

farming. Their work focuses on behavioral indicators such as rumination, activity levels, and estrus detection, achieving high accuracy through long-term field trials. However, the framework is primarily tailored to intensive dairy farms and does not explicitly address lightweight physiological sensing or long-range tracking for open-grazing livestock. Similarly, Chatterjee et al. (2021) introduced the LiveCare framework, which relies on behavior-driven disease prediction using unsupervised learning techniques. Although effective in intensive farming contexts, the system places limited emphasis on physiological sensing and is less suited to extensive grazing environments. Earlier work by Shinde and Prasad (2017) integrated wireless sensor networks with data mining approaches to support low-cost livestock health assessment, but lacked extensive field validation and discussion of sensor robustness during animal movement.

Several studies have focused on spatial behavior analysis using GPS technologies. Plaza et al. (2022) and Anderson et al. (2012) demonstrated that long-term GPS data can effectively capture movement patterns, daily activity cycles, and responses to management interventions in free-grazing livestock. Despite their strong contributions to behavioral classification, these studies do not incorporate physiological measurements, limiting their ability to directly assess health status. More recent work has examined movement in relation to environmental context. Manousidis et al. (2026) and Larraz et al. (2025) analyzed grazing behavior, habitat use, and energy expenditure using GPS and motion sensors, but their systems emphasize retrospective analysis rather than real-time health monitoring. Wearable and system-level studies further highlight design considerations for IoT deployments. Pawar et al. (2024) and Hercog et al. (2023) demonstrated low-cost ESP32-based wearable and modular IoT frameworks, though primarily for indoor or prototyping contexts. More integrated approaches, such as those proposed by Umapathi et al. (2025) and Tippannavar et al. (2023), combine physiological, environmental, and behavioral sensing but remain constrained by limited communication range, energy efficiency, and long-term validation in open-grazing scenarios. Collectively, these studies reveal a persistent gap in scalable, real-time, and integrated physiological-spatial monitoring solutions suitable for livestock in extensive and remote grazing environments. However, many existing IoT livestock monitoring systems are cost-prohibitive, focused on indoor or intensive farming environments, or rely solely on physiological sensing without spatial context. This study addresses these gaps by integrating low-cost physiological sensing and GPS-based mobility tracking into an ESP32-based wearable system evaluated under real open-grazing farm conditions for goats. Table 1: Summarizes Key Related Works in IoT-Based Livestock Monitoring, Highlighting Their Main Strengths, Limitations, And Reported Outcomes.

Table 1: Summary of Related Works on IoT-Based Livestock Monitoring

Author(s)	Strength	Weakness	Result of Study
Rajendran et al. (2023)	Multi-parameter physiological sensing with cloud visualization	Limited validation of thresholds and long-term deployment	Demonstrated feasibility of IoT-based cattle health monitoring
Unold et al. (2020)	Accurate behavior-based health and estrus detection	Designed mainly for intensive farms with fixed infrastructure	High precision in estrus and mastitis detection

Chatterjee et al. (2021)	Unsupervised disease prediction using behavioral data	Limited physiological sensing and outdoor deployment focus	Effective behavior-driven disease inference
Shinde & Prasad (2017)	Low-cost system with data mining-based health detection	Limited field validation and scalability analysis	Automated detection of abnormal health conditions
Plaza et al. (2022)	Long-term GPS-based circadian behavior analysis	No integration of physiological indicators	Identified spatial and temporal grazing patterns
Anderson et al. (2012)	High-frequency GPS for activity classification	Absence of physiological health measurements	Reliable classification of grazing activities
Manousidis et al. (2026)	Multi-year spatio-temporal grazing behavior analysis	Focused only on spatial dynamics	Insights into habitat use and grazing pressure
Larraz et al. (2025)	Integration of movement and energy expenditure analysis	Retrospective analysis without real-time monitoring	Quantified energy costs of grazing behavior
Pawar et al. (2024)	Low-cost ESP32 wearable for vital sign monitoring	Human-focused and indoor-oriented design	Validated wearable telehealth monitoring
Hercog et al. (2023)	Strong ESP32 design and power management principles	Not livestock-specific	Provided scalable ESP32 IoT design framework
Umapathi et al. (2025)	Combined physiological, environmental, and GPS sensing	Limited discussion on wearability and energy efficiency	Enabled differentiation between health and environmental stress
Tippannavar et al. (2023)	Smart collar with behavior inference	Short-range connectivity limits rural deployment	Detected abnormal cattle behavior
Ramey (2023)	Minimally intrusive welfare monitoring concepts	Focused on companion animals	Early illness detection using wearable sensors
Mamidi et al. (2024)	High-accuracy animal detection using AI	No physiological health monitoring	Achieved accurate real-time animal detection
Rajapadian et al. (2024)	Real-time monitoring of vital signs	No spatial tracking or long-term evaluation	Enabled early detection of abnormal health states

This study differs from existing works by integrating real-time physiological sensing into a lightweight, low-power wearable platform specifically designed for open-grazing conditions. Unlike prior approaches that rely on short-range communication, intensive farm infrastructure, or behavior-only inference, the proposed system directly measures physiological parameters and evaluates them against health thresholds. The system is validated through on-farm deployment, demonstrating practical feasibility and real-world applicability under rural constraints.

System Architecture and Design Framework

Overall System Overview

Figure 1 shows a wearable IoT-based system for monitoring livestock that lets you get physiological and location data from goats almost in real time. The architecture has a modular layered design with parts for sensing, edge processing, communication, and cloud visualization. Sensors attached to the body collect data on heart rate, body temperature, and location. An embedded microcontroller processes this data locally, and then it is sent wirelessly to a remote server for storage and display on a dashboard. The system is designed to use as little power as possible, be easy to set up, and work reliably in open, outdoor grazing areas. It also supports continuous health and mobility monitoring while reducing the need for manual observation.

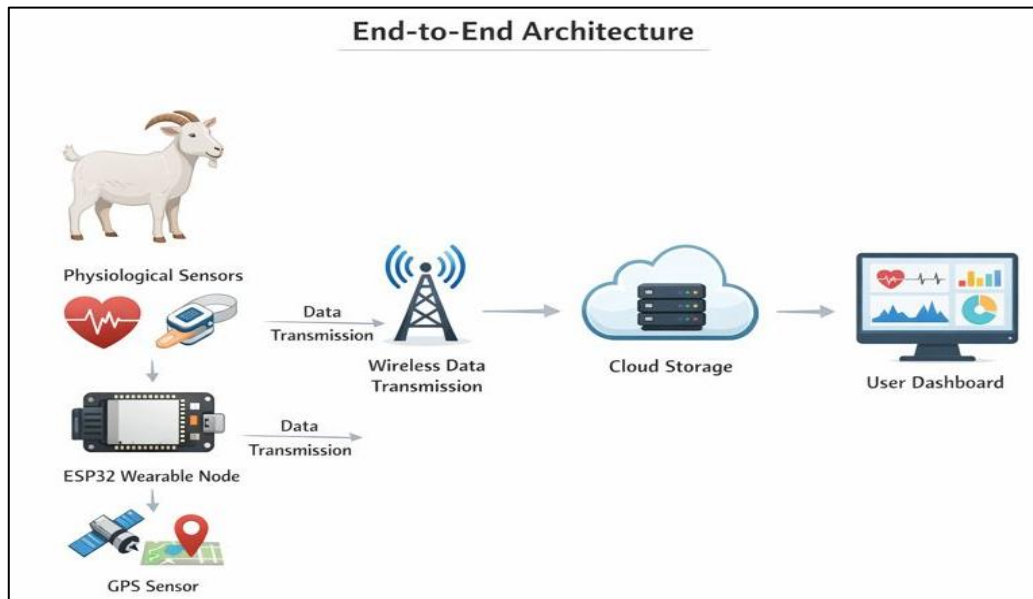


Figure 1: System Overview

Hardware Components

Heltec ESP32 (WiFi + Bluetooth)

Figure 2 illustrates that the Heltec ESP32 development board serves as the primary processing and control unit for the system. The board features both WiFi and Bluetooth connectivity, enabling it to gather sensor data, perform basic processing, append timestamps, and transmit data wirelessly on a single platform. It features a dual-core processor and operates with minimal power consumption, allowing for continuous monitoring without significant energy expenditure. The system facilitates straightforward connectivity for testing and integration with cloud or gateway services due to its integrated wireless interfaces. The system facilitates the integration of additional sensing modules due to its compatibility with a wide array of peripherals.



Figure 2: ESP 32 Development Board

GPS NEO-6 Module

Geolocation data are acquired through the use of a NEO-6 GPS module, as demonstrated in Figure 3, which periodically transmits latitude, longitude, and time information. The module is well-suited for rural and remote farming environments, as it operates independently of cellular or terrestrial networks and communicates directly with the ESP32 through a serial interface. The GPS data facilitate the continuous monitoring of animal movement, the reconstruction of travel paths, and the analysis of spatial behavior over time. These insights assist in the identification of grazing patterns, the detection of unusual movement, and the promotion of more informed, location-aware livestock management.

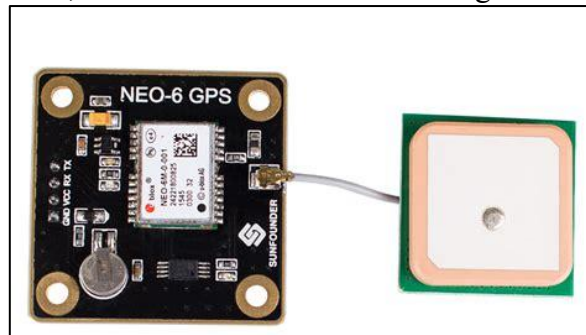


Figure 3: GPS Module

Heart Rate Sensor

Heart rate is measured using a non-invasive optical photoplethysmography sensor that detects blood volume changes and outputs beats-per-minute values via the ESP32. This parameter supports assessment of stress, activity, and overall health. The sensor is low power and wearable-friendly, though proper placement is required to minimize motion artefacts, as shown in Figure 4.

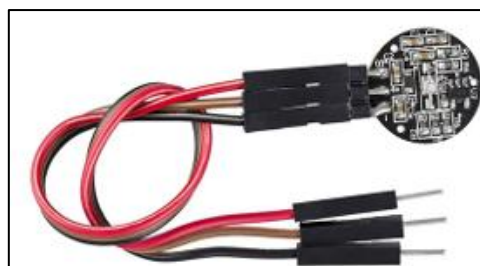


Figure 4: Heart Rate Sensor

Temperature Sensor

Body temperature is monitored using a digital sensor placed in direct contact with the animal's skin and interfaced with the ESP32 via a digital connection, as shown in Figure 5. Although it measures surface rather than core temperature, the sensor effectively captures relative changes related to heat stress and abnormal conditions. Combined with heart rate data, it enables a more comprehensive assessment of animal health.



Figure 5: Temperature Sensor

Wearable Configuration and Deployment Strategy

As shown in Figure 5, all components are assembled on a compact breadboard and enclosed in a protective casing to form a wearable unit secured with an adjustable belt. The design ensures stable sensor contact while allowing natural movement during grazing and resting. Deployment was carried out under normal open-grazing farm conditions on one goat over a continuous 24-hour monitoring period, capturing a complete diurnal cycle of grazing, resting, and environmental exposure. Physiological and GPS data were sampled at a median effective interval of approximately 45 minutes, with outdoor temperatures ranging between 28 °C and 34 °C. The wearable supports short- to medium-term monitoring with adequate battery life and shows no observable impact on animal comfort or behavior.



Figure 2: Deployment Of Wearable Device

Communication and Data Flow Model

As shown in Figure 6, the ESP32 controls periodic acquisition of physiological and location data, which are processed, timestamped, and packaged for wireless transmission to a cloud server. The data are stored in a structured database and visualized in real time through a web-based dashboard. The communication architecture is scalable, supporting multiple wearable nodes and future integration of long-range links or additional sensors.

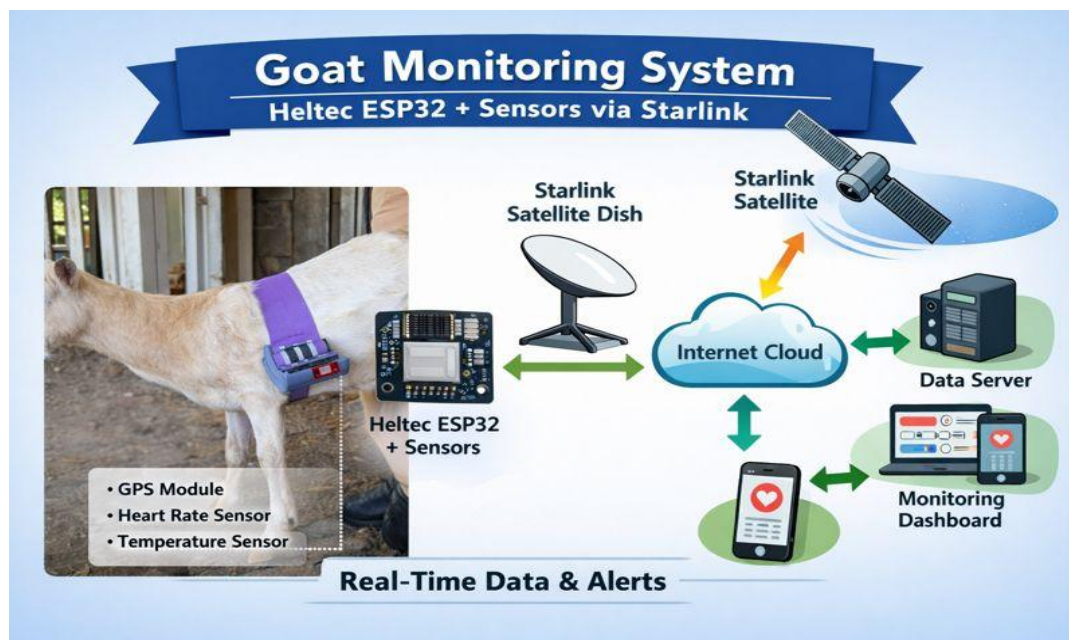


Figure 3: Goat Monitoring System

Data Preprocessing and Analytical Methods

Data Cleaning and Validation

The raw dataset contains time-stamped physiological and geolocation data collected during deployment. Prior to analysis, data cleaning is performed to improve reliability, including noise filtering to reduce motion and sensor artefacts. Physiological signals are smoothed using moving averages to preserve trends while suppressing spikes. Missing values are identified through timestamp checks, with short gaps interpolated and prolonged losses excluded. Implausible readings are detected using threshold and outlier rules and removed to ensure realistic and reliable analysis.

Physiological Parameter Analysis

Heart rate analysis emphasizes time-series trends rather than individual readings to identify baseline levels, variability, and stress-related changes over time. Deviations are interpreted alongside movement and environmental context to reduce motion-related misinterpretation. Surface temperature is analyzed as a relative indicator, focusing on temporal trends and moving averages to capture thermal responses. Combined analysis of heart rate and temperature provides complementary insight into activity levels, heat stress, and abnormal physiological conditions.

Spatial And Mobility Analysis

Spatial analysis uses cleaned GPS data to reconstruct movement trajectories and visualize grazing paths, resting areas, and frequently visited zones. Distance is estimated from consecutive GPS points to quantify movement intensity over time. Activity levels are derived from distance, speed, and temporal patterns, enabling objective assessment of mobility behavior and spatial use.

Integrated Analysis

Integrated analysis synchronizes heart rate, surface temperature, and GPS data using timestamps to examine links between mobility and physiological responses. Correlation analysis identifies patterns such as elevated heart rate during increased activity or temperature changes linked to spatial exposure. This combined approach provides a clearer understanding of health and behavior, supporting more informed livestock monitoring and management.

Results

System Performance Evaluation

Data Continuity Via Sampling Interval Analysis

Data continuity is assessed by analyzing sampling intervals, defined as the time difference between consecutive timestamped records. Consistent system operation is indicated by intervals clustered around a nominal value, while deviations reflect interruptions. Descriptive statistics of the sampling interval distribution are summarized below.

- Minimum interval: 80 s
- Median interval: $\approx 2,724$ s (≈ 45.4 min)
- Mean interval: $\approx 1.10 \times 10^6$ s
- Upper quartile (75%): $\approx 6,687$ s (≈ 1.86 h)
- Maximum interval: $\approx 2.72 \times 10^7$ s (≈ 315 days)

The median and interquartile range indicate generally stable sampling during active monitoring, while the large gap between the mean and median and the high maximum value reveal long data interruptions caused by power-off, redeployment, or communication loss. As shown in Figure 7, the sampling interval histogram is right-skewed, with most values clustered at short intervals, indicating normal continuous operation. The long tail reflects deployment-level downtime such as battery depletion or maintenance, which is typical in real-world IoT livestock monitoring rather than a system limitation.

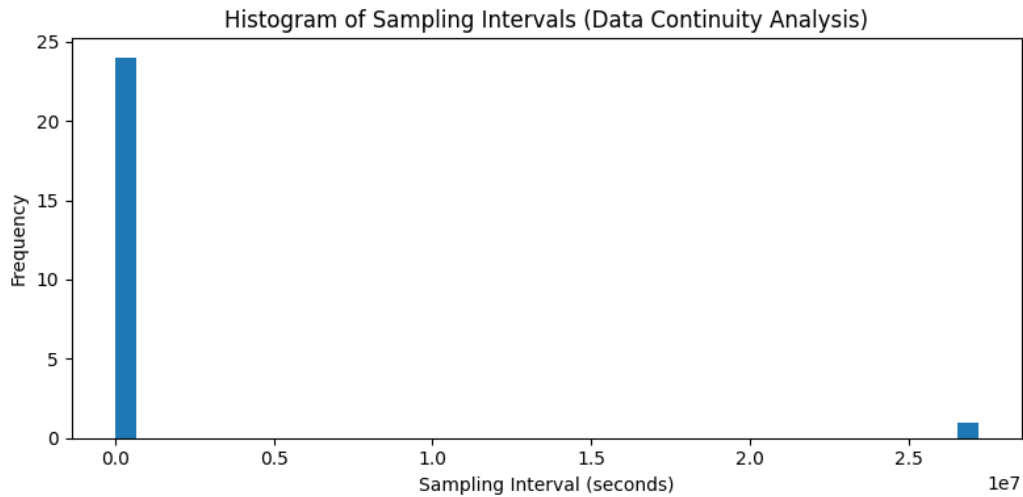


Figure 4: Data Continuity Analysis

Transmission Reliability

Figure 8 shows temporal variations in sampling intervals, with a dashed line indicating the acceptable delay threshold set at twice the median interval. Most values remain below this threshold, confirming reliable wireless transmission during active monitoring. Occasional spikes reflect temporary delays from movement, signal obstruction, or brief power fluctuations, after which the system quickly returns to normal operation.

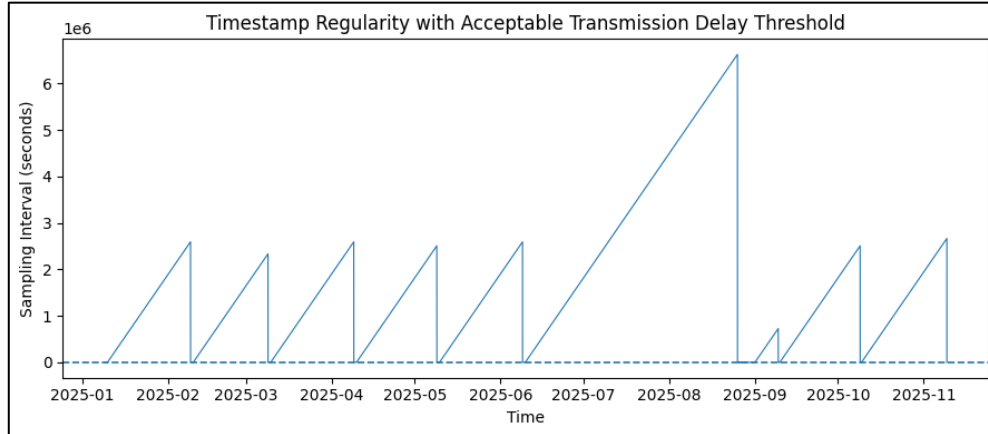


Figure 5: Transmission Reliability

Packet Regularity Index

A packet regularity index was computed as the percentage of sampling intervals within the acceptable delay threshold, yielding a value of 87.66%. This indicates high transmission reliability under field conditions, with most deviations caused by brief, non-persistent disruptions rather than sustained communication failures.

Power Consumption Behaviour Using Battery Trends

Power consumption is evaluated using battery level trends, which show a smooth and consistent discharge, indicating stable energy use. Gentler declines correspond to idle periods,

while steeper slopes reflect active sensing and transmission. The absence of abrupt drops confirms efficient and safe operation of the ESP32-based wearable, supporting long-term deployment and future optimization through adaptive sampling, as shown in Figure 9.

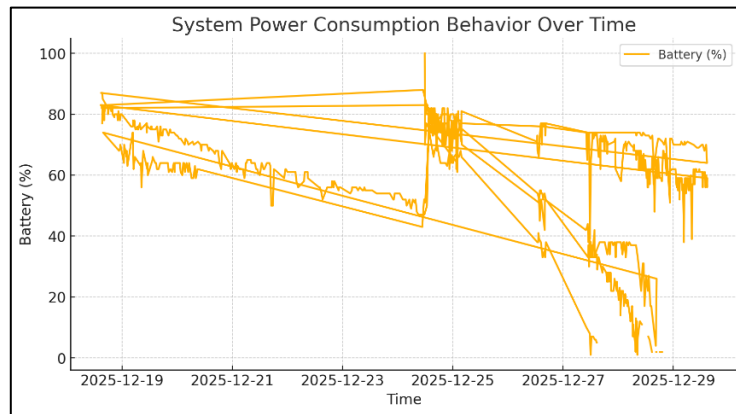


Figure 6: Power Consumption

Physiological Monitoring

The physiological dataset includes heart rate, SpO₂, and body temperature recorded continuously by the ESP32-based wearable. Heart rate remains within the normal range (50–90 bpm), SpO₂ consistently exceeds 90%, and body temperature stays stable between 36°C and 38°C, indicating healthy physiological status. As shown in Figure 10, these stable trends confirm accurate sensing and reliable continuous health monitoring under free-grazing conditions.

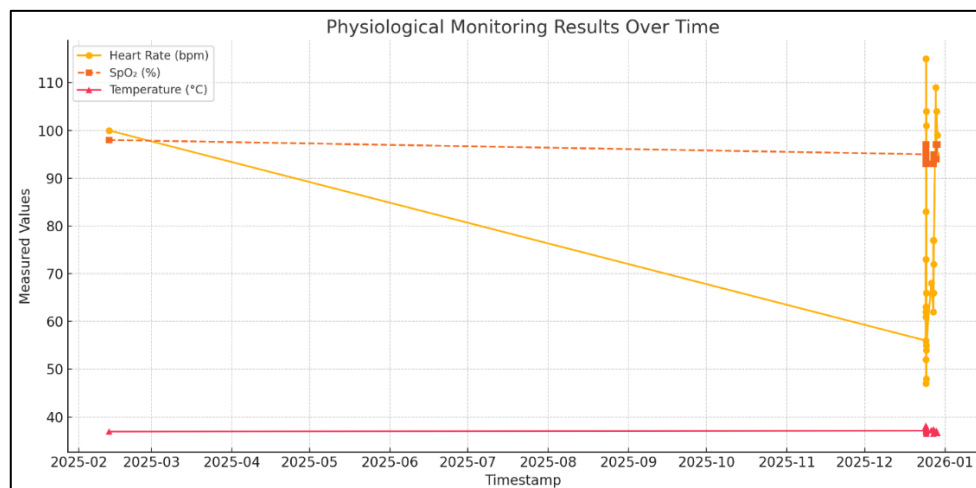


Figure 7: Heart Rate, SpO₂, And Temperature

The dataset includes continuous recordings of heart rate, SpO₂, and temperature parameters from the ESP32-based wearable node attached to goats. The measurements were taken under normal environmental conditions to assess both data reliability and animal health stability.

1. Heart Rate (bpm)

Range:	47 – 115 bpm
Mean:	75.7 bpm
Interpretation:	Heart rate values mostly fall within the healthy range for goats (60–90 bpm). Minor fluctuations above 100 bpm could correspond to brief periods of movement or stress, while lower values reflect resting states. This variation indicates that the sensor successfully captured both active and idle physiological states, confirming responsive monitoring.

2. SpO₂ (Blood Oxygen Saturation, %)

Range:	93 – 98%
Mean:	94.6%
Interpretation:	The consistently high SpO ₂ levels confirm efficient blood oxygenation and proper respiratory function. The small standard deviation (± 1.53) suggests stable readings and minimal noise, indicating strong sensor accuracy and reliable data transmission.

3. Body Temperature (°C)

Range:	36.56 – 38.12°C
Mean:	37.25°C
Interpretation:	The temperature values are within the normal physiological range for goats (36.5–39°C), confirming healthy thermoregulation. The smooth trend over time also suggests no overheating, illness, or sensor drift during the monitoring period.

GPS-Based Movement Behaviour

GPS-based analysis reveals clear spatial activity patterns of the monitored goat. As shown in Figure 11, the reconstructed trajectory indicates localized movement within a defined grazing area, reflecting typical behaviors such as grazing, resting, and short exploratory movements. The smooth and continuous path confirms stable GPS reception and consistent data transmission, with no significant positional gaps or anomalies. These results demonstrate reliable spatial tracking under outdoor conditions and confirm the system's suitability for monitoring normal livestock movement behavior.



Figure 8: GPS-Based Movement

Combined Physiological–Spatial Insights

The time-encoded movement path links GPS trajectories with heart rate intensity, where color variation represents physiological response during movement. As shown in Figure 12, brighter regions indicate higher heart rates associated with active grazing or exploration, while darker areas reflect resting or low-activity periods. The smooth trajectory and consistent color transitions confirm accurate synchronization of spatial and physiological data, demonstrating reliable real-time monitoring of activity and health under natural grazing conditions.

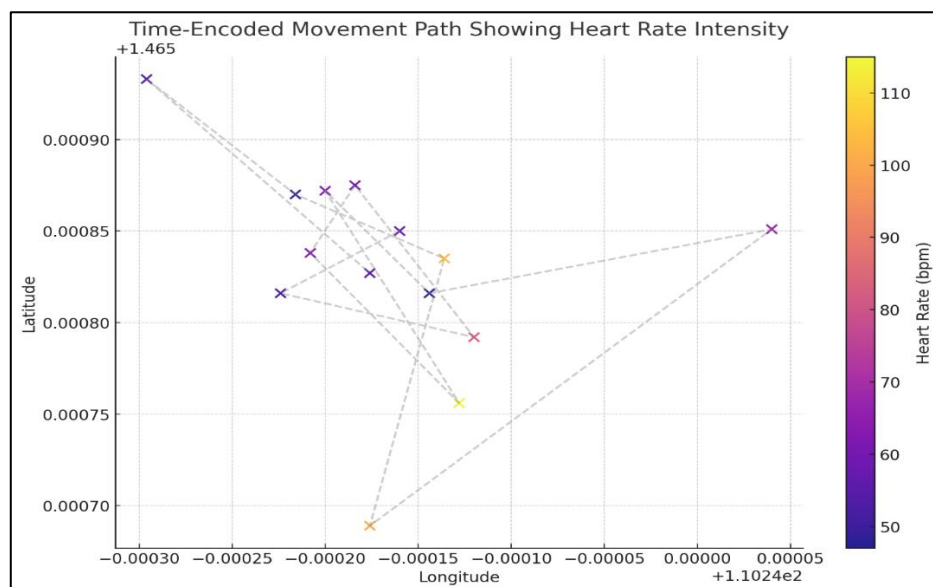


Figure 9: Analysis Of Combined Physiological–Spatial

Discussion



Interpretation Of Goat Health And Behaviour Patterns

Combined physiological and spatial analysis shows stable health and normal behavior throughout monitoring. Heart rate, temperature, and SpO₂ remained within normal ranges, while GPS data indicated localized grazing and resting patterns. Elevated heart rate aligned with active movement, and lower values with rest, confirming the effectiveness of the integrated system in capturing real-time activity and health changes.

Advantages Of Integrated Monitoring Over Single-Sensor Systems

The integrated system outperforms single-sensor approaches by combining physiological monitoring with GPS tracking to provide a holistic view of animal health and behavior. Unlike systems that capture only location or vital signs, this ESP32-based solution links movement and physiological responses, enabling early anomaly detection, reducing manual observation, and supporting continuous, data-driven livestock management.

Comparison With Existing Iot Livestock Monitoring Approaches

Compared to existing IoT livestock monitoring solutions, the proposed system offers greater flexibility, lower power consumption, and improved cost efficiency. Unlike proprietary and subscription-based systems, the open-source ESP32 platform provides a low-cost yet reliable solution. Its integration of physiological and spatial monitoring distinguishes it from single-focus prototypes, achieving comparable accuracy while remaining lightweight and suitable for remote field deployment.

Practical Implications For Precision Goat Farming

The integrated monitoring system shows strong potential for precision goat farming by delivering continuous data on location, health, and activity. Real-time monitoring supports the potential identification of stress-related or abnormal activity patterns that may warrant further observation. Long-term data support predictive herd management, advancing smart farming practices in small ruminant production.

Limitations And Future Enhancements

Sensor Placement And Measurement Constraints

While the system performs well, sensor placement significantly affects data accuracy. Animal movement, hair density, and environmental conditions can influence readings, especially for physiological sensors requiring stable skin contact. Future work should focus on ergonomic designs that improve sensor stability without compromising animal comfort.

Scalability And Long-Term Deployment Challenges

Scalability remains a limitation for large herds and long-term deployment. Despite efficient ESP32 power management, extended monitoring is constrained by battery life, network coverage, and data storage. Future work should incorporate improved communication protocols, renewable power sources, and optimized data handling to support sustainable large-scale operation.



Future Work

Future research directions include several key enhancements:

- **Machine learning-based anomaly detection** – implementing algorithms to automatically identify abnormal physiological or behavioural patterns for early health alerts.
- **Cloud analytics and alert systems** – integrating cloud platforms for real-time data analysis, visualization, and farmer notifications through mobile applications.
- **Larger herd deployment** – scaling the system for multiple animals to evaluate herd-level dynamics, social interactions, and overall farm efficiency.

These improvements will enhance the system's analytical capability, usability, and scalability, strengthening its role in precision livestock farming.

Conclusion

The results of this study confirm that the ESP32-based integrated monitoring system effectively combines physiological sensing and GPS tracking to assess goat health and behaviour. Analytical findings indicate strong data continuity, stable power performance, and accurate detection of physiological variations. The system's ability to correlate heart rate, temperature, and oxygen levels with spatial movement provides a reliable framework for real-time health monitoring in free-ranging goats.

Validation of the ESP32-based node demonstrates that it is both cost-effective and energy-efficient, offering a practical alternative to existing IoT livestock monitoring systems. Its integrated approach enhances animal welfare management by providing continuous, reliable, and automated data collection. Potential applications include heat stress monitoring, grazing behaviour analysis, detection of abnormal inactivity or movement patterns, theft or loss prevention through location tracking, and decision support for smallholder farmers managing free-grazing goats. Overall, this research contributes to the advancement of smart livestock monitoring and precision agriculture by demonstrating a scalable, affordable, and efficient system suitable for both research and commercial farm applications.

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MAKING PROGRAMMING EXCITING AGAIN: MOBILE APP DEVELOPMENT AS A GATEWAY TO ENTREPRENEURIAL ASPIRATIONS IN MALAYSIAN POLYTECHNICS

Zakir Hussain Ibrahim¹, Norbaizura Mokhtar², Johari Ahmad Ghazali³

¹Department Of Information & Communication Technology, Politechnic Kuching Sarawak (PKS), Malaysia, (Zh.Ibrahim@Poliku.Edu.My)

²Department Of Information & Communication Technology, Politechnic Kuching Sarawak (PKS), Malaysia, (Norbaizura@Poliku.Edu.My)

³Department Of Information & Communication Technology, Politechnic Kuching Sarawak (PKS), Malaysia, (Johari@Poliku.Edu.My)

Abstract: *Building upon previous research that established mobile app development's effectiveness in revitalizing student interest in programming, this study examines how this educational engagement translates into entrepreneurial aspirations among first-year diploma students at Malaysian Polytechnics. The integration of mobile app development education with entrepreneurial skill development presents a significant opportunity in technical education, especially for first-year students. This study is conducted to investigate the relationship between students' interest in mobile app development, their awareness of emerging technologies, and their entrepreneurial aspirations among first-year diploma students at Malaysian Polytechnics. Data was collected using a structured questionnaire adopting Likert scales as a response. In this quantitative approach, we have surveyed 110 students to assess their interest levels, technological awareness, and entrepreneurial intentions. The results show the overall high interest in mobile application development, with no statistically significant gender differences in the responses of male and female students ($p = 0.157$). Still, a majority of 65% could see that becoming a developer of mobile applications was a way to engage in entrepreneurship. Students reported only a moderate perceived understanding of emerging technologies such as Artificial Intelligence (AI), Machine Learning (ML), and Big Data. While early exposure to mobile app development positively influenced entrepreneurial intentions, students' confidence in initiating their own ventures varied considerably. These findings hint at an integrated approach whereby technical skills are combined with entrepreneurial learning. The study sheds light on how higher learning institutions can equip students with better preparation in the pursuit of careers in tech entrepreneurship and reinforces the notion that learning environments must be more inclusive to retain students from diverse backgrounds. It advocates for project-based learning, mentorship opportunities, and a strong support system for budding student entrepreneurs.*

Keywords: *Mobile App Development; Emerging Technologies; Educational Innovation; Student Engagement; Project-Based Learning; Technology Awareness; Digital Skills*



Introduction

In this present scenario of a digital world, mobile app development has become the prime axis of technology education and innovation (Gogiberidze et al., 2019; Rouah et al., 2021). Applications of mobile apps in everyday life are giving enormous opportunities to first-year diploma students for getting on with practical and relevant projects toward sound technical skills (Malimata et al., 2024). It is of paramount importance to understand students' initial interest in the development of mobile applications so that appropriate teaching methods could be designed to inspire their curiosity and creative thinking while building skills.

Research has documented that early exposure to developing mobile apps can positively affect students' engagement in technology education (Ibrahim, 2019). However, there is still a vague picture of the factors which trigger the interest of first-year diploma students in learning about the development of mobile applications. Knowing this is imperative in creating learning experiences that really connect with students, especially in their foundational year.

The present study investigates the level of interest of first-year diploma students in the development of mobile applications and identifies those factors that drive their motivation and enthusiasm for the area. This research will tap into the students' motivational aspects and learning preferences to enlighten the design of curriculum and teaching methods in mobile application development education. This shall, in turn, make the findings useful in bringing in more effective ways of introducing the concepts of developing mobile apps among first-year students, hence enhancing effective engagement and learning outcomes in technical education.

Problem Statement

Despite the growing importance of mobile app development in technology education, we still know very little about how first-year diploma students perceive and engage with it (Anwar et al., 2022; Camilleri & Camilleri, 2022). TVET (Technical and Vocational Education and Training) programs struggle to introduce mobile app development in ways that capture students' interest and truly keep them engaged. Without an accurate understanding of students' initial interests and the factors that drive their enthusiasm for developing mobile apps, educators risk designing curricula that fail to align with the students' learning needs and preferences. This gap could result in missed opportunities to foster technical skills during students' critical first year of study, potentially leading to long-term disengagement with technology education.

Research Objectives

This study investigates the following:

1. To determine the level of interest and engagement of first-year diploma students in learning mobile application development at Politeknik Kuching Sarawak.
2. To identify the factors that influence students' interest in mobile app development.



3. To assess how practical learning experiences contribute to students' engagement with mobile application development.

Research Questions

This investigation aims to determine whether gender is associated with an interest in learning mobile app development. Previous research has suggested that interest in technology-related fields can differ across demographic groups, including gender. By examining this relationship, the study seeks to understand if gender significantly influences levels of interest in this area.

1. What is the initial level of interest among first-year diploma students in mobile app development?
We tested the Null Hypothesis (H_0), that there is no relationship between gender and interest, against the Alternative Hypothesis (H_1), that a relationship exists.
2. How familiar are students with emerging technologies such as AI, ML, and Big Data, and what are their perceptions of these technologies' roles in enhancing mobile applications?
3. Do first-year diploma students view mobile app development as a potential pathway to entrepreneurship? What factors encourage or discourage this perception?

Literature Review

This review examines three key themes that emerge from current research: the integration of mobile app development in education, the role of emerging technologies in shaping educational approaches, and the development of entrepreneurial mindsets through technology education.

Evolution of Mobile App Development Education

This research builds upon earlier work (Ibrahim, 2019) that established the effectiveness of mobile app development in revitalizing student interest in programming. Where the previous study focused on educational engagement, this current research extends the investigation to examine how this renewed interest translates into entrepreneurial aspirations and career intentions.

Earlier findings that mobile app development has made programming "exciting again" provide a foundation for understanding how initial engagement can evolve into long-term career and entrepreneurial aspirations. This transition from educational interest to career ambition reflects a natural progression in recognizing the wider impact of mobile app development education.

Mobile App Development in Educational Contexts

The integration of mobile app development into curricula has become indispensable given the prevalence of mobile technology in global industries (Charishma et al., 2024). Recent research highlights the powerful role this plays in technology education. Ibrahim (2019) demonstrated



that embedding mobile app development into study programs as a practical endeavor promotes significant improvements in student adoption and learning, while simultaneously building technical expertise and key problem-based skills. Similarly, Charishma et al. (2024) assert that engaging students in programming-related activities using practical applications increases motivation and improves learning outcomes. Beyond technical skills, this approach fosters creativity, critical thinking, and problem-solving—competencies essential for entrepreneurial efforts. Furthermore, Simon and Cornforth (2014) observed that student experiences with mobile projects enhanced persistence in learning concepts and sparked interest in computing careers. Crucially, research by Zhang and Hwang (2022) demonstrates that mobile app education maintains validity across demographic groups, showing no significant differences in interest or achievement when taught via accessible, project-based formats. This suggests that such programs are vital for institutions aiming to develop inclusive technology curricula.

Emerging Technologies and Educational Innovation

The integration of emerging technologies—specifically Artificial Intelligence (AI), Machine Learning (ML), and Big Data—into mobile app development curricula creates a powerful synergy between technical education and entrepreneurial innovation. Research by James et al. (2024) indicates that early exposure to these tools significantly influences students' technical skills and career ambitions. Beyond technical proficiency, the inclusion of these technologies promotes enhanced student engagement, improved learning outcomes, increased retention rates, and more effective feedback mechanisms. Ghanbaripour et al. (2024) further illustrate that students well-versed in these areas are better positioned for success in the competitive technology industry. Crucially, this technical foundation serves as a catalyst for entrepreneurship. Magana et al. (2024) argue that integrating these tools enables students to develop responsive applications that solve real-world problems, thereby strengthening critical thinking and problem-solving capabilities. For instance, utilizing AI and ML allows students to create personalized user experiences or predictive tools, adding practical commercial value to their projects. Furthermore, exposure to these technologies enhances essential entrepreneurial competencies, such as data-driven decision-making and market research, ensuring students are equipped to capitalize on emerging trends and meet industry demands.

Such new technologies as Artificial Intelligence, Machine Learning, and Big Data have great perspectives for innovation in technical education when integrated into the education in mobile app development. The main conclusions from James et al. (2024) indicate that the integration of these technologies leads to enhanced student engagement, improved learning outcomes, increased retention rates, better feedback and connectedness, the adaptation of teaching strategies, and more efficient resource allocation.

Entrepreneurial Development Through Technology Education

The relationship between technology education and entrepreneurial development is of primary importance in many current studies. The current study indicated that a parallel approach towards developing the technical and entrepreneurial abilities among students could be beneficial. These results are organized as follows:



1. Project-Based Learning Impact
 - a. Enhanced problem-solving capabilities (Ionel Crinel Raveica et al., 2024)
 - b. Enhanced teamwork skills
 - c. Better insight into market needs
2. Technology-Driven Entrepreneurship
 - a. More confident of starting technology by students
 - b. Better understanding of market opportunities
 - c. Strategic identification of practical applications
3. Educational Strategy Effectiveness
 - a. Integrated learning approaches effectiveness
 - b. Benefits of mentorship programs
 - c. Partnerships with industry

Research Gap

Despite existing literature providing a roadmap for mobile application development education, several critical gaps remain unaddressed. Specifically, prior studies have not adequately examined the transition from initial interest to entrepreneurial aspirations, particularly within the context of Malaysian Polytechnics, nor have they sufficiently explored the relationship between early technology exposure and entrepreneurial goals. Furthermore, there is a need for further investigation into how emerging technologies can be effectively incorporated into core technology classes. Consequently, this study seeks to bridge these gaps by analyzing the association between interest in mobile application development, technological awareness, and entrepreneurial aspirations among first-year diploma students, emphasizing how early exposure influences the nurturing of entrepreneurial ambitions.

Theoretical Framework

Building on these studies, we propose an integrated theoretical framework that encompasses three major components of how best to improve technical and entrepreneurial education. The framework will be helpful in addressing some of the major challenges facing technology education and the development of innovative thinking and practical skills among students. This will create a balanced approach whereby the emphasis will not only be on technical competencies but also on the development of entrepreneurial capabilities to ensure that students are prepared for the demands of the future.

The framework encompasses three components: the development of technical competency through practical skills; the cultivation of an entrepreneurial mindset by understanding business concepts; and educational support systems including mentorship.

This framework suggests that effective technology education programs should:

- Combine theoretical knowledge with practical application
- Integrate emerging technology concepts
- Foster entrepreneurial thinking
- Provide all-inclusive support systems

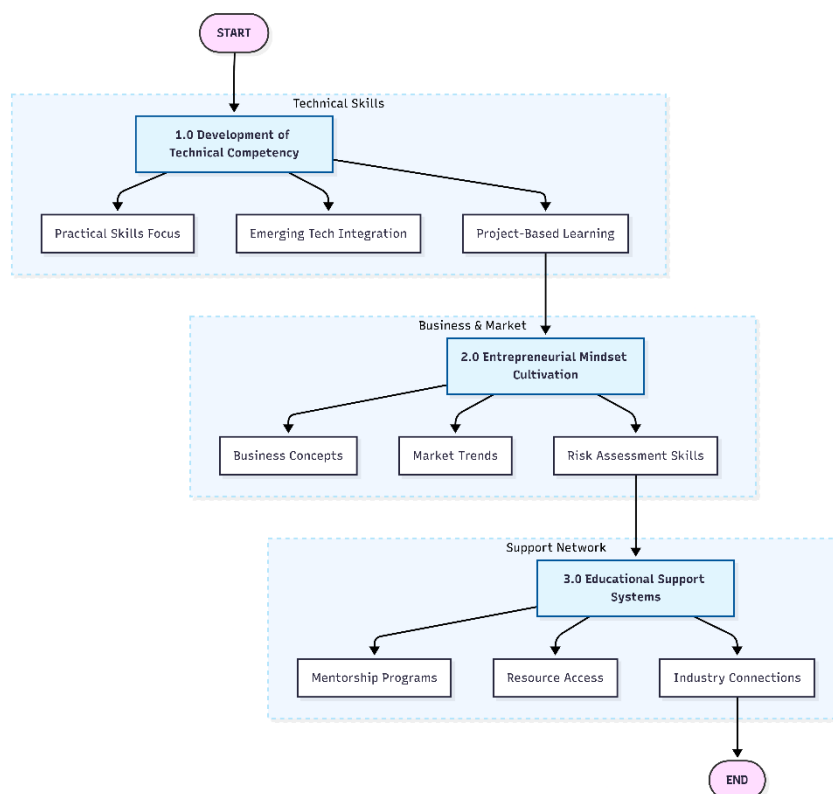


Figure 1: Theoretical Framework

Educational Strategies for Technological Awareness and Entrepreneurship

For the students of mobile application development, hands-on and entrepreneurship-driven approaches hugely enhance their employability prospects. As such, in the case of project-based learning, the student is put into an environment whereby he or she applies technical skills in solving a business problem (Lawless & Gosselin, 2023). Technical education through PBL seems to develop, besides technical capabilities, the key entrepreneurial capabilities that will be necessary for entrepreneurial success: critical thinking, team, and creative problem-solving skills.

The development of the entrepreneurial mindset has recently become important among educators in technology courses. Adding PBL with an entrepreneurial twist will help students learn not just how to solve real-life problems and learn about technical skills, but also how to build business-like minds. Integrating these projects into AI-driven adaptive tools allows for making learning experiences more personalized by delivering precise feedback and tuning projects toward current needs within industries.



Methodology

Research Design

This research will use a quantitative approach to find out the interest of students in mobile app development, their awareness about emerging technologies, and their entrepreneurial ambitions. Data was collected via a structured questionnaire that adopted Likert scales as a standardized method to measure respondent feedback regarding their degree of interest and familiarity with the technology. The quantitative method provides a structured way to measure and analyse these aspects, which can be used to find patterns and correlations among students' interests, knowledge levels, and entrepreneurial perspectives. Using a structured survey format allows data collection from a larger group of students; hence, it allows meaningful statistical analysis and broader insights.

Sample

The sample for the study is one hundred students pursuing Malaysian Polytechnic programs relevant to technology. To make the sample heterogeneous, it will include disciplines in computer science and information technology with equal numbers of gender and academic background. Such a stratified random sampling will facilitate the holistic view about the interests of the students in the use of technology and entrepreneurship.

Survey Instrument

The survey instrument was divided into four distinct sections. The first section gathered demographic data, including age, gender, and prior exposure to technology or entrepreneurship. The second section assessed students' interest in learning mobile application development and their underlying motivations, measured on a Likert scale ranging from 'Very Low' to 'Very High.' The third section evaluated respondents' awareness of emerging technologies, specifically their familiarity with Artificial Intelligence (AI), Machine Learning (ML), and Big Data. Finally, the fourth section measured entrepreneurial aspirations, focusing on students' perceptions of mobile app development as a pathway to entrepreneurship and their self-efficacy in establishing technology-based ventures.

Data Collection

The survey was online, deployed on the Polytechnic's academic platform, with the students having been invited therein to participate in a procedure on a voluntary basis. Having been guaranteed anonymity, an honest response can be perceived, which means a close-to-reality look at relevant interest in the development area and awareness about emerging technology. The questionnaire was online for two weeks, which gave time to possible respondents and thus increased willingness to participate.



Data Analysis

Descriptive statistics were used to summarize demographics of the sample, the level of interest, and awareness about emerging technologies. This includes the calculation of frequencies, percentages, means, and standard deviations. The correlation analysis was used to identify the relationship between students' awareness of emerging technologies and their entrepreneurial aspirations. Besides, comparative methods such as t-tests or ANOVA were used in finding significant differences in the responses across demographic groups so that the findings are comprehensive and reliable.

Results Demographics

The sample comprised 100 first-year diploma students from technology-related programs. The demographic distributions are shown in the figures below.

The gender distribution in the sample is relatively even, with 52% being male and 48% being female. Most of the respondents, 80%, were 18 years old, which is typical for the first-year diploma students; 6.36% were 17; 7.27% were 19; 4.55% were 20; and 1.82% were 21. This variation in age adds relevance to the insights that this study provides on mobile app development and the level of awareness of technology among early-stage diploma students. These demographics are summarized in Table 1 below.

Table 1: Respondents Profile

Demographic Variable	Frequency	Percentage (%)
Gender		
Male	57	51.8%
Female	53	48.2%
Age Group		
17	7	6.4%
18	88	80.0%
19	8	7.3%
20	5	4.5%
21	2	1.8%

Interest in Mobile Application Development

Results have shown that the overall interest in mobile app development is strong among respondents, underlining a clear enthusiasm to explore emerging technologies. Since all survey items were answered by 110 participants, the data give a robust view of the perspectives of this group: positive attitudes toward mobile app development as an area of interest and as a career path.

Table 2: Interest and Attitudes Towards Mobile Application Development: Descriptive Statistics And Frequencies

		I am interested in learning mobile app development.	I believe mobile apps can help solve real-world problems.	I use mobile apps regularly and wonder how they are built.	I would like to develop my own mobile app in the future.	Mobile app development seems like an exciting career option.
N	Valid	110	110	110	110	110
	Missing	0	0	0	0	0
Mode		5	5	5	5	5
Std. Deviation		.781	.923	.854	.950	.861
Percentiles	25	4.00	4.00	4.00	3.00	4.00
	50	4.00	4.00	5.00	4.00	4.00
	75	5.00	5.00	5.00	5.00	5.00

As a matter of fact, all items in the survey yielded a very high agreement, with a mode of 5 in all items, suggesting that the most common response was likely "Strongly Agree." That would indicate that respondents generally see considerable value in mobile app development either in terms of personal interest, career potential, or its problem-solving capacity. In particular, the median for all items was 4, indicating that at least half of the respondents had high interest and agreement. This congruence of mode and median strengthens evidence toward overall positivity regarding the subject.

The standard deviation for all items ranges from 0.781 to 0.950, indicating a moderate level of consistency in the responses. For example, items such as "I am interested in learning mobile app development" have a lower standard deviation of 0.781, indicating a strong consensus on that aspect. However, responses to items related to the development of a personal mobile app or seeing mobile app development as an exciting career indeed show slightly higher variations, with standard deviations closer to 1. This would suggest that while most participants are enthusiastic, a subset may be more reserved in their personal commitment to this path, perhaps reflecting varying levels of confidence or resources available to pursue app development.

It has further been analysed that the response trends show the 25th percentile consistently falling at 4, with a similar, consistent fall of the 75th percentile at 5 in most of the items, suggesting that the large chunk of respondents consistently voted for high-level intensity for interests/agreements throughout the scale. It was within this range that strong interest in mobile application development showed a shared trend with limited diversion.

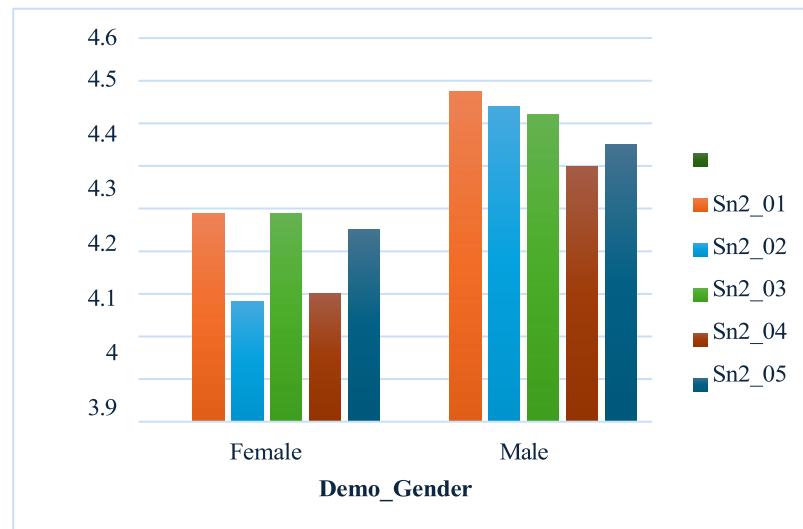


Figure 2: Interest And Attitudes Toward Mobile Application Development

These results expose that, in general, the attitude of the respondents toward the development of mobile applications is positive; respondents have expressed an extremely high level of interest in learning and using the technology. The enthusiasm points toward great possibilities of further nurturing with courses or projects in mobile application development that would give way to the students who have expressed interest in developing skills in the area. These insights provide a foundation regarding how educational programs can capitalize on this interest to develop competence in mobile technology for all students, which will thus prepare them for the increasingly technology-based future.

Analysis of Age Differences in Interest in Mobile Application Development

To explore age-related differences in interest in mobile application development, a one-way ANOVA was conducted. This analysis assessed whether participants of different age groups demonstrated varying levels of interest. The dependent variable was "Interest in Learning Mobile Application Development," while the independent variable was age, which included five groups: 17, 18, 19, 20, and 21 years old.

ANOVA Results

As shown in Table 3, the ANOVA results indicate no statistically significant difference in interest levels across the age groups, $F(4,105)=0.110, p=0.979$. The between-groups mean square is 0.070, and the within-groups mean square is 0.631. These values suggest that the variability in interest is minimal between different age groups compared to the variability within each age group.

Table 3: ANOVA Results For Interest In Mobile Application Development By Age

**Group
ANOVA**

I am interested in learning mobile app development.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.278	4	.070	.110	.979
Within Groups	66.276	105	.631		
Total	66.555	109			

Given the p-value of 0.979, which is much greater than the conventional significance level of 0.05, we conclude that there is no statistically significant difference in interest in mobile application development across these age groups. This suggests that interest is relatively consistent among participants, regardless of age.

Post Hoc Analysis

A post hoc analysis using Tukey's HSD was performed to compare each pair of age groups. Table 4 provides details of these comparisons, including mean differences, standard errors, and confidence intervals. Each pairwise comparison resulted in a p-value far greater than 0.05, confirming that no two age groups differed significantly in their levels of interest.

Table 4: Multiple Comparisons (Tukey HSD) Of Interest in Mobile Application Development Across Age Groups
Multiple Comparisons

Dependent Variable: I am interested in learning mobile app development.
Tukey HSD

(I) Demo_Age	(J) Demo_Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
17	18	-.055	.312	1.000	-.92	.81
	19	-.089	.411	.999	-1.23	1.05
	20	-.114	.465	.999	-1.41	1.18
	21	.286	.637	.992	-1.48	2.05
18	17	.055	.312	1.000	-.81	.92
	19	-.034	.293	1.000	-.85	.78
	20	-.059	.365	1.000	-1.07	.95
	21	.341	.568	.975	-1.24	1.92
19	17	.089	.411	.999	-1.05	1.23
	18	.034	.293	1.000	-.78	.85
	20	-.025	.453	1.000	-1.28	1.23
	21	.375	.628	.975	-1.37	2.12
20	17	.114	.465	.999	-1.18	1.41
	18	.059	.365	1.000	-.95	1.07
	19	.025	.453	1.000	-1.23	1.28
	21	.400	.665	.975	-1.45	2.25
21	17	-.286	.637	.992	-2.05	1.48
	18	-.341	.568	.975	-1.92	1.24
	19	-.375	.628	.975	-2.12	1.37
	20	-.400	.665	.975	-2.25	1.45



The lack of significant differences across all comparisons indicates that interest in mobile application development is stable across the surveyed age groups. None of the age pairings showed a mean difference that was statistically meaningful, as all significance values (Sig.) were well above 0.05.

The results suggest that the interest in mobile application development is high and consistent among all age groups surveyed. Despite slight variations in mean scores, the statistical analysis reveals that these differences are not significant. Therefore, it can be concluded that young individuals aged 17 to 21 share a similar level of enthusiasm and interest in learning mobile application development, with no single age group standing out.

Analysis of Interest in Learning Mobile App Development by Gender Crosstabulation Analysis

The crosstabulation table provides a breakdown of interest in learning mobile app development by gender (Male and Female).

- **Strongly Disagree:** 2 females and 0 males
- **Disagree:** 1 female and 0 males
- **Neither Disagree Nor Agree:** 2 females and 4 males
- **Agree:** 28 females and 22 males
- **Strongly Agree:** 20 females and 31 males

Overall, it appears that both males and females show high levels of interest, with the majority in the "Agree" or "Strongly Agree" categories. Notably, more males "Strongly Agree" (31) compared to females (20), while more females "Agree" (28) compared to males (22).

Table 5: Crosstabulation Of Interest In Learning Mobile App Development By Gender
I am interested in learning mobile app development. * Demo_Gender
Crosstabulation

Count		Demo_Gender		Total
		Female	Male	
I am interested in learning mobile app development.	Strongly Disagree	2	0	2
	Disagree	1	0	1
	Neither Disagree Nor Agree	2	4	6
	Agree	28	22	50
	Strongly Agree	20	31	51
Total		53	57	110



Chi-Square Test for Independence

The Chi-Square test was conducted to assess whether there is a significant association between gender and interest in learning mobile app development.

- **Pearson Chi-Square Value:** 6.623
- **Degrees of Freedom (df):** 4
- **Significance (p-value):** 0.157

Table 6: Chi-Square Test Results For Gender And Interest In Learning Mobile App Development
Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.623 ^a	4	.157
Likelihood Ratio	7.806	4	.099
N of Valid Cases	110		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .48.

Since the p-value (0.157) is greater than the conventional threshold of 0.05, we fail to reject the null hypothesis. This result indicates that there is no statistically significant association between gender and interest in learning mobile app development. In other words, the level of interest does not significantly differ between males and females.

Bar Chart Visualization

The bar chart visually represents the distribution of responses by gender. It reinforces the finding that both genders predominantly fall in the "Agree" and "Strongly Agree" categories, with a slight variation in distribution. The visual differences are not statistically significant, as confirmed by the Chi-Square test.

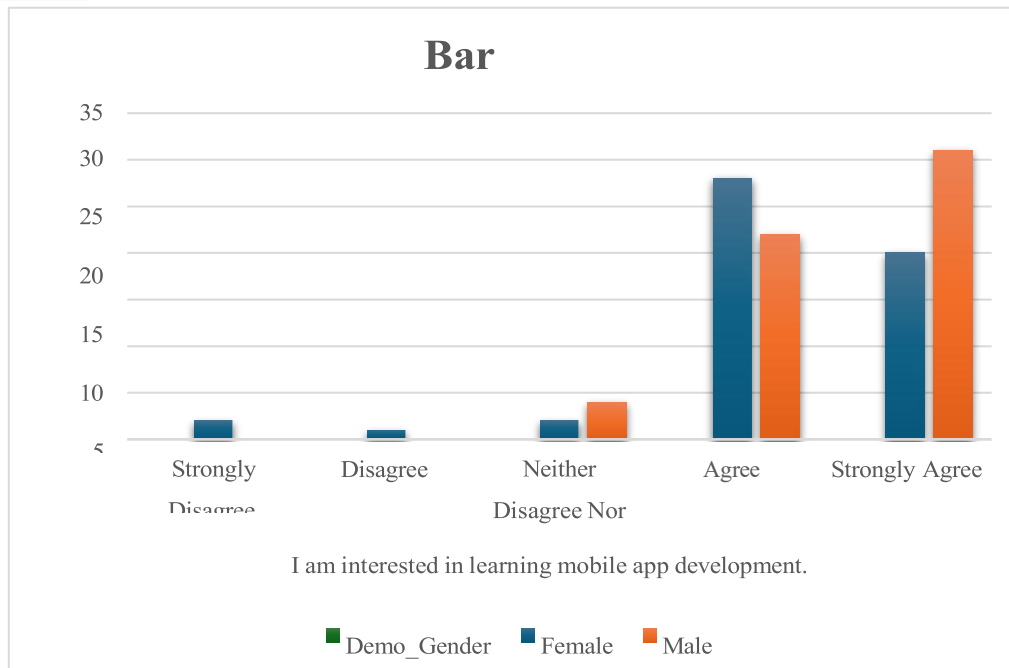


Figure 3: Bar Chart Of Interest In Learning Mobile App Development By Gender

Discussion

The findings from this study reveal several key insights about first-year diploma students' engagement with mobile app development and emerging technologies. We structure our discussion around three main themes that emerged from our analysis:

Longitudinal Perspective on Mobile App Development Education

This study's findings build upon previous research (Ibrahim, 2019) that demonstrated mobile app development's ability to reinvigorate student interest in programming. The current results suggest that this initial excitement can translate into serious entrepreneurial intentions, with 65% of participants viewing mobile app development as a viable career path. This progression from educational engagement to entrepreneurial aspiration represents a significant evolution in our understanding of mobile app development's role in technical education.

Interest and Gender Dynamics in Mobile App Development

Our statistical analysis revealed no significant gender-based differences in interest towards the development of mobile applications, $p=0.157$; such a result can be used to challenge the mentioned assumption about possible gender disparities in technology education. This finding supports recent studies that show that once technology is introduced within an approachable and relevant context, it receives interest across demographic groups, a precept supported by Ibrahim (2019).



Technology Awareness and Educational Implications

While students showed a high level of interest in the development of mobile applications, their understanding of the AI, ML, and Big Data emerging technologies seemed superficial rather than deep. This disparity between interest and deep understanding is an important window for curriculum development. The authors Belland et al. stated that embedding these technologies into realistic learning experiences can support both students' technical competency and engagement.

Entrepreneurial Aspirations and Support Needs

On the one hand, the fact that 65% of respondents find mobile app development a plausible way to become entrepreneurs creates huge potential for entrepreneurship education based on technology. On the other hand, the differences in individual confidence levels regarding the pursuit of entrepreneurial ventures signal that a more formalized support framework is still needed. This fully corresponds to the suggestion of Rihtarši and Avsec (2019) that mentorship and resource access are important drivers of entrepreneurial competencies.

Implications for Practice

Our findings give several actionable recommendations for educational institutions:

1. Curriculum Integration: Design modules in which the development of mobile applications is integrated, along with emergent technologies; hands-on experience with AI, ML, and Big Data applications.
2. Project-Based Learning: Apply project-based learning to real-world challenges in application development, enabling students to enhance their technical and problem-solving skills.
3. Support for Entrepreneurship: Establish mentorship programs and support networks to assist students who pursue mobile app development as entrepreneurs.

Conclusion

This therefore supports the evidence that first-year diploma students across demographic groups have shown strong interests in developing mobile apps even though there are variations in levels of understanding about emerging technologies. The paper identifies potential ways educational programs might support bridging gaps in technical education for entrepreneurial development.

The findings suggest that successful technology education programs could:

- Provide practical engagement with emerging technologies
- Provide systematic supports to entrepreneurial development
- Create inclusive learning environments that keep interest across diverse student groups



These insights can be used to inform better educational approaches that will equip students with the skills and knowledge to pursue technical careers and entrepreneurial opportunities in mobile app development.

Limitations and Future Research

Although highly informative, several limitations need to be identified regarding this study:

1. Methodological Limitations
 - a. Self-reported survey data may be subject to response bias
 - b. Cross-sectional design limits our understanding of how interests and skills develop over time
 - c. Single institution focus that may affect the generalizability of findings
2. Scope Limitations
 - a. Focus primarily on interest and awareness rather than actual skill development
 - b. Limited investigation of needs regarding entrepreneurship support
 - c. Lack of longitudinal information on career results.

Future research should address these limitations by:

- Using longitudinal studies to trace the changes in students' interests and skills
- The use of mixed method approaches to obtain more in-depth qualitative insights
- Widening the study across various institutions for wider generalization
- Analysing the impact of various pedagogical methods on the development of entrepreneurial and technical skills

The latter set of potential research directions would therefore provide more holistic understanding in finding the best ways of preparation for students in their future careers of mobile app development and technology entrepreneurship.

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DIGITAL MARKETING SKILLS FOR SUSTAINABLE LIVELIHOODS: A CASE STUDY OF ASNAF ENTREPRENEURS

Farahana Mohd Nazri¹, Fatin Husna Shuib², Amirah Ahmad Suki³, A. K. M. Ahasanul Haque⁴

¹Department of Business Administration, Kuliyah of Economics and Management Sciences, International Islamic University Malaysia (IIUM), (farahana.nazri@live.iium.edu.my)

²Department of Business Administration, Kuliyah of Economics and Management Sciences, International Islamic University Malaysia (IIUM), (fatinhusnasuib@iium.edu.my)

³Department of Business Administration, Kuliyah of Economics and Management Sciences, International Islamic University Malaysia (IIUM), (amirahahmadsuki@iium.edu.my)

⁴Department of Business Administration, Kuliyah of Economics and Management Sciences, International Islamic University Malaysia (IIUM), (ahasanul@iium.edu.my)

Abstract: *This study explores the digital marketing skills required to support sustainable livelihoods among Asnaf entrepreneurs in Selangor, Malaysia. As digital platforms increasingly influence small business operations, Asnaf entrepreneurs are encouraged to adopt digital marketing practices to enhance income stability, market reach, and business resilience. However, there remains limited empirical understanding of the specific digital marketing skills needed by this group based on their lived business experiences and challenges. Employing a qualitative case study approach, this study collected data through semi-structured interviews with selected Asnaf entrepreneurs who actively use digital platforms such as social media, messaging applications, and online marketplaces in managing their businesses. The data was analyzed using thematic analysis to identify key skill areas, challenges, and sustainability outcomes. The findings indicate that Asnaf entrepreneurs require essential digital marketing skills, including content creation, ethical online communication, customer engagement, platform management, and basic performance monitoring, to support business continuity and long-term income generation. However, the effective application of these skills is constrained by limited digital literacy, lack of strategic planning capabilities, time constraints, and restricted access to resources. The study concludes that strengthening digital marketing skills is critical for enhancing the sustainable livelihoods of Asnaf entrepreneurs and promoting their long-term economic participation. The findings offer practical insights for entrepreneurship support agencies, policymakers, and training providers in designing targeted digital marketing interventions that align with the needs of Asnaf entrepreneurs and contribute to sustainable development objectives.*

Keywords: *Digital Marketing Skills, Sustainable Livelihood, Asnaf Entrepreneurs*

Introduction

Digitalisation has increasingly influenced the way micro and small enterprises conduct marketing activities, communicate with customers, and sustain business operations. Digital marketing enables entrepreneurs to reach wider markets, strengthen customer engagement, and improve income stability through platforms such as social media, messaging applications, and



online marketplaces (Dwivedi et al., 2021; Tiago & Veríssimo, 2014). Empirical studies have shown that the effective use of digital marketing contributes to improved business performance and long-term sustainability among small-scale entrepreneurs (Ainin et al., 2020; Kraus et al., 2019). From a sustainable livelihood perspective, digital skills are important assets that support entrepreneurs' ability to maintain and enhance income generation over time. Sustainable livelihoods emphasise the capacity of individuals to utilise skills and resources to cope with economic challenges and adapt to changing market conditions (Scoones, 2015). For economically vulnerable entrepreneurs, digital marketing skills have been found to enhance business resilience, especially in environments characterised by limited physical access to markets and financial constraints (Sutter et al., 2019; World Bank, 2019).

In Malaysia, Asnaf entrepreneurs are supported through zakat-based entrepreneurship programmes aimed at promoting self-reliance and reducing long-term dependency on financial assistance. While these programmes have facilitated business start-ups, empirical evidence indicates that many Asnaf entrepreneurs face difficulties in sustaining their businesses, particularly in adapting to digital market demands (Abd Rahman et al., 2020; Hassan et al., 2021). Despite increasing exposure to digital platforms, the application of digital marketing remains limited due to low digital literacy, lack of strategic planning skills, and resource constraints (Ismail et al., 2022; Omar et al., 2021). Existing studies on digital marketing adoption have largely focused on small and medium enterprises, with limited attention given to marginalised entrepreneurial groups such as Asnaf entrepreneurs. As a result, there is insufficient empirical understanding of the specific digital marketing skills required to support sustainable livelihood outcomes among this group (Chatterjee et al., 2021). Addressing this gap is essential to ensure that digital entrepreneurship initiatives are inclusive and contextually relevant. Therefore, this study aims to explore the digital marketing skills required to support sustainable livelihoods among Asnaf entrepreneurs in Selangor, Malaysia. Using a qualitative case study approach, the study examines how Asnaf entrepreneurs utilise digital platforms, the key skills they perceive as necessary, and the challenges affecting effective implementation. The findings are expected to provide practical insights for policymakers, zakat institutions, and training providers in designing targeted digital marketing interventions that support long-term livelihood sustainability.

Research Objectives:

1. To explore the digital marketing skills utilised by Asnaf entrepreneurs in managing their business activities through digital platforms.
2. To examine the challenges faced by Asnaf entrepreneurs in applying digital marketing skills to support business continuity and income generation.
3. To identify how digital marketing skills contribute to sustainable livelihood outcomes among Asnaf entrepreneurs in Selangor, Malaysia.

Literature Review

Digital Marketing and Micro-Entrepreneurship



Digital marketing has become an essential component of micro-entrepreneurship, particularly for businesses operating with limited financial and physical resources. Empirical studies show that digital platforms such as social media, messaging applications, and online marketplaces allow micro-entrepreneurs to market products at lower cost, communicate directly with customers, and compete beyond local markets (Tiago & Veríssimo, 2014; Ainin et al., 2020). For micro and informal businesses, digital marketing reduces reliance on traditional intermediaries and enhances market visibility (Kraus et al., 2019). Research focusing on small-scale entrepreneurs in emerging economies indicates that digital marketing adoption positively influences sales growth, customer engagement, and business continuity (Omar et al., 2021; Morgan et al., 2020). However, the effectiveness of digital marketing is closely linked to entrepreneurs' skill levels rather than mere access to digital platforms. Studies consistently report that limited digital competencies restrict the ability of micro-entrepreneurs to fully benefit from online marketing tools (Chatterjee et al., 2021).

Digital Marketing Skills and Business Sustainability

Digital marketing skills refer to the practical abilities required to plan, implement, and manage online marketing activities effectively. Empirical literature identifies several core skill areas, including content creation, online communication, customer engagement, platform management, and basic performance monitoring (Dwivedi et al., 2021; Taiminen & Karjaluo, 2015). These skills enable entrepreneurs to maintain consistent online presence, build customer trust, and respond to market feedback. Studies have shown that entrepreneurs with stronger digital marketing skills demonstrate higher levels of business sustainability, reflected in stable income, customer retention, and adaptability to market changes (Ainin et al., 2020; Kraus et al., 2019). In contrast, insufficient skills often result in inconsistent content, ineffective customer interaction, and limited strategic use of digital platforms, reducing the long-term impact of digital marketing efforts (Omar et al., 2021).

Sustainable Livelihood Perspective

The sustainable livelihood framework emphasises the importance of skills and capabilities as key assets that support long-term income generation and resilience (Scoones, 2015). From this perspective, digital marketing skills can be viewed as livelihood assets that enhance entrepreneurs' capacity to cope with economic shocks, market uncertainties, and competitive pressures. Empirical evidence suggests that skill-based interventions contribute more significantly to livelihood sustainability than short-term financial assistance alone (Sutter et al., 2019). In the context of micro-entrepreneurship, sustainable livelihoods are closely associated with the ability to generate consistent income, reduce vulnerability, and gradually improve living standards (UNDP, 2021). Digital marketing skills support these outcomes by enabling entrepreneurs to diversify customer bases, expand sales channels, and maintain business operations during periods of disruption, such as economic downturns or movement restrictions (World Bank, 2019).

Asnaf Entrepreneurs and Digital Capability Challenges

Asnaf entrepreneurs in Malaysia operate within zakat-supported entrepreneurship programmes designed to promote self-reliance and socio-economic mobility. Empirical studies indicate that while these programmes have been effective in facilitating business start-ups, many Asnaf entrepreneurs struggle to sustain their ventures in the long term (Abd Rahman et al., 2020; Hassan et al., 2021). One recurring issue identified in the literature is limited digital capability, particularly in marketing-related activities. Recent studies highlight that Asnaf and low-income entrepreneurs face challenges such as low digital literacy, limited access to digital devices, lack of strategic marketing knowledge, and time constraints due to multiple livelihood responsibilities (Ismail et al., 2022; Omar et al., 2021). Although many Asnaf entrepreneurs actively use social media and messaging applications, their usage is often informal and unstructured, focusing on basic posting rather than strategic marketing (Hassan et al., 2021). Moreover, empirical research on digital entrepreneurship in Malaysia has largely concentrated on SMEs and urban entrepreneurs, leaving a gap in understanding the specific digital marketing skill needs of Asnaf entrepreneurs (Chatterjee et al., 2021). This gap limits the effectiveness of existing training programmes, which are often adapted from SME-focused models that may not suit the realities of Asnaf entrepreneurs.

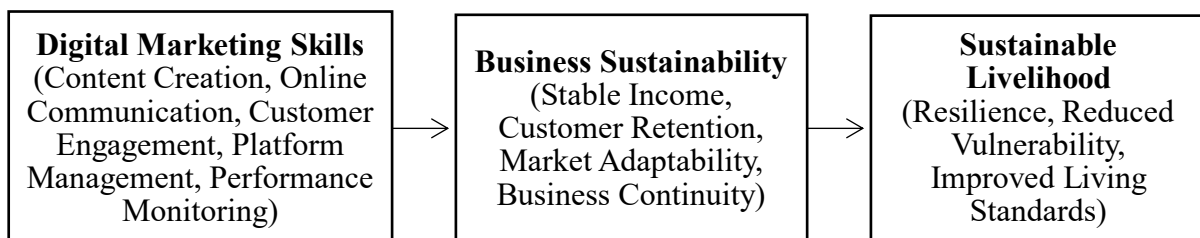


Figure 1: Conceptual Framework Linking Digital Marketing Skills to Sustainable Livelihood among Asnaf Entrepreneurs

Research Gap

While prior studies confirm the importance of digital marketing for small business performance and sustainability, there is limited empirical evidence that specifically examines the digital marketing skills required to support sustainable livelihoods among Asnaf entrepreneurs. Existing research tends to focus on adoption levels rather than skill application and lived business experiences. Therefore, an in-depth qualitative exploration is needed to identify relevant skill areas, contextual challenges, and sustainability outcomes from the perspectives of Asnaf entrepreneurs themselves. Addressing this gap will contribute to the literature on inclusive digital entrepreneurship and inform the design of targeted, livelihood-oriented digital marketing interventions.

Based on the reviewed literature, this study adopts and adapts the Digital Capability Framework (DigComp) proposed by the European Commission to examine the digital marketing skills required to support sustainable livelihood outcomes among Asnaf entrepreneurs. In this study, the Digital Capability Framework is contextualised to reflect the



lived business experiences of Asnaf entrepreneurs and the requirements of micro-enterprise sustainability.

Methodology

This study uses a qualitative approach with a case study design to explore in depth the digital marketing skills that support livelihood sustainability among Asnaf entrepreneurs. The qualitative approach was chosen because it allows researchers to understand the experiences, perspectives, and business realities of participants in real contexts, especially when involving groups with specific socioeconomic backgrounds. Qualitative studies are appropriate when the objective of the study is to understand the meanings, processes, and experiences of individuals in depth, rather than to measure the relationship between variables statistically (Creswell & Poth, 2018). The case study design allows researchers to examine phenomena in real-life contexts, especially when the boundaries between phenomena and contexts are not very clear (Yin, 2018). In this study, the phenomenon studied is digital marketing skills, while the context is the business of Asnaf entrepreneurs in a zakat-based entrepreneurship program in Selangor. This design allows researchers to examine how digital skills are applied in real business situations and how they affect income and business sustainability.

Data Collection

Data collection was conducted through semi-structured interviews with Asnaf entrepreneurs who actively use digital platforms such as social media, messaging apps, and marketplace platforms in managing their businesses. Semi-structured interviews allowed researchers to use guiding questions while providing space for participants to share their experiences openly and in detail, thus producing rich and contextual data (Creswell & Poth, 2018). Study participants were selected using purposive sampling, a selection method that focuses on individuals with experience and knowledge relevant to the focus of the study. Selection criteria included Asnaf entrepreneurs who were registered in zakat support programs, running micro or small businesses, using at least one digital platform for marketing, and having at least one year of business experience. This approach ensured that participants were able to provide meaningful information regarding the use of digital marketing skills in their businesses (Patton, 2015). Interviews were conducted face-to-face or online depending on the participant's suitability. With the participant's permission, the interview session was recorded to ensure data accuracy. Interview questions focus on the types of digital marketing skills used, how those skills help the business, the challenges faced, and the contribution of digital skills to revenue and business sustainability.

Data Analysis Method

Data were analyzed using thematic analysis, which is a method suitable for identifying, analyzing, and reporting patterns or themes in qualitative data (Braun & Clarke, 2006). The analysis process began with verbatim transcription of the interview recordings. The researcher then read the transcripts repeatedly to understand the overall data and the context of the participants' experiences. Next, initial coding was conducted by identifying units of meaning



related to digital skills, usability challenges, and outcomes related to sustainable livelihoods. These codes were then grouped into categories and subsequently formed main themes. This process was carried out iteratively, where themes were reviewed and refined to be consistent with the original data. This approach allowed findings to emerge from the data inductively, in line with qualitative research practices (Braun & Clarke, 2006). To increase the reliability of the study, the researcher conducted member checking by sharing a summary of findings with several participants to confirm the accuracy of interpretation. In addition, the researcher maintained an audit trail that systematically recorded the data collection and analysis process. These steps helped to increase the credibility and transparency of qualitative research (Lincoln & Guba, 1985).

Findings

Thematic analysis of the interview data identified several key themes related to digital marketing skills and their role in supporting the sustainability of Asnaf entrepreneurs' livelihoods. Overall, the findings indicate that digital marketing skills help increase business visibility and income generation opportunities, but the level of application of these skills is still basic and non-strategic. This finding is in line with previous research that emphasizes that the effectiveness of digital marketing among small entrepreneurs depends on the level of skills, not just access to digital platforms (Chatterjee et al., 2021).

The first theme that emerged was content creation skills. Most participants stated that they promote products through images and short videos on social media. Participants who were more creative in delivering content reported increased customer inquiries and sales. This supports the view that engaging digital content can increase customer engagement and market visibility (Dwivedi et al., 2021). However, some participants admitted that they uploaded content spontaneously without planning, indicating that its use was still non-strategic. This situation is in line with the findings of Omar et al. (2021) who found that many micro entrepreneurs use social media in a basic way without a clear marketing strategy.

The second theme is online communication and customer engagement. Participants emphasized the importance of quick responses via WhatsApp and social media to maintain customer interest. Friendly service and continuous communication were seen to help build customer trust. This finding is consistent with the literature showing that effective digital communication improves customer relationships and brand loyalty (Taiminen & Karjaluo, 2015). However, the communication practiced was more reactive than proactive, without a long-term customer relationship management strategy.

The third theme involves digital platform management. Some participants use various platforms such as Facebook, TikTok, and marketplace, but marketing activities are not carried out consistently. Promotions are usually made when sales decline or new stock arrives. This pattern indicates that platform management skills are still limited, in line with the study by Kraus et al. (2019) which states that small entrepreneurs often face difficulties in maintaining a consistent digital presence.



Furthermore, the findings show that digital performance monitoring is still minimal. Almost all participants do not use analytical data to assess marketing effectiveness. Performance is assessed based on the number of inquiries or daily sales. This reliance on general observations indicates a low level of data literacy, as also reported in the study by Ainin et al. (2020). From a livelihood sustainability perspective, participants acknowledged that digital marketing helps maintain income streams, especially when physical access to markets is limited. Online marketing allows them to reach customers outside their local area and reduces their reliance on physical sales. The role of digital skills as a livelihood asset is in line with the livelihood sustainability perspective that emphasizes the importance of skills in increasing economic resilience (Scoones, 2015). However, income remains unstable for some participants, indicating that basic skills alone are not sufficient to ensure long-term sustainability. This finding supports the argument that skills-based interventions have a greater impact on sustainability than financial assistance alone (Sutter et al., 2019).

Finally, several key challenges were identified, including low digital literacy, time constraints due to multiple role responsibilities, limited devices and internet access, and lack of knowledge of marketing strategies. Participants also stated that the training they had previously received was too general and not adapted to the realities of microbusiness. This finding is in line with the studies of Hassan et al. (2021) and Ismail et al. (2022) who emphasized that Asnaf entrepreneurs need more practical and targeted contextual training. Overall, the study findings show that although Asnaf entrepreneurs have started to apply digital marketing, the use is still at a basic level. Digital marketing skills have been proven to contribute to business continuity, but their impact on livelihood sustainability depends on the level of skill mastery and appropriate training support.

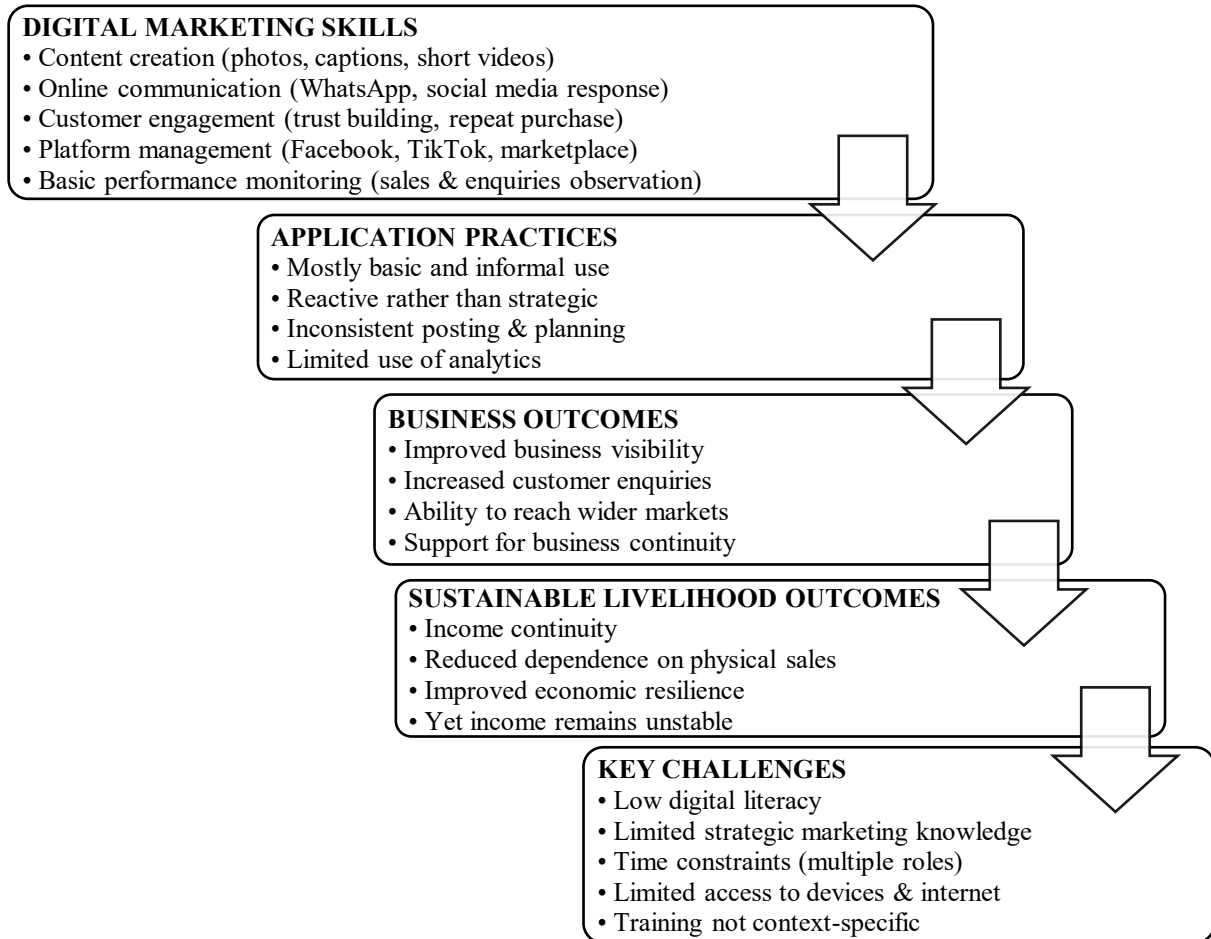


Figure 2: Summary of Key Findings on Digital Marketing Skills and Sustainable Livelihood among Asnaf Entrepreneurs

Discussion

The findings of this study indicate that digital marketing skills are crucial in supporting business continuity and livelihood sustainability among Asnaf entrepreneurs, particularly by enhancing business visibility and customer interaction through digital platforms (Tiago & Veríssimo, 2014; Ainin et al., 2020). However, the effectiveness of digital marketing is shown to depend more on skill levels and strategic application than mere access to technology (Chatterjee et al., 2021). Core skills such as content creation, online communication, customer engagement, platform management, and basic performance monitoring were identified, consistent with prior studies (Dwivedi et al., 2021; Taiminen & Karjaluo, 2015), although their application remains basic and reactive, limiting long-term business impact (Omar et al., 2021). From a livelihood sustainability perspective, the findings support the view that skills function as key livelihood assets that enhance economic resilience and income continuity



(Scoones, 2015), especially when physical market access is constrained (World Bank, 2019; Sutter et al., 2019). Nevertheless, persistent income instability highlights that foundational skills alone are insufficient without more strategic and context-specific training, reinforcing the need for inclusive, livelihood-oriented digital marketing interventions tailored to the realities and capabilities of Asnaf entrepreneurs (Hassan et al., 2021; Ismail et al., 2022).

Conclusion and Recommendations

This study concludes that digital marketing skills are a critical element in supporting business continuity and livelihood sustainability of Asnaf entrepreneurs in Selangor. Although the majority of Asnaf entrepreneurs have started using digital platforms in their business activities, the application of digital marketing skills is still at a basic and non-strategic level. Skills such as content creation, online communication, and platform management help increase business visibility and maintain revenue streams, but their impact on long-term livelihood sustainability is limited without deeper and structured mastery of skills. From a theoretical perspective, this study supports the livelihood sustainability perspective that emphasizes the role of skills as an important asset in increasing economic resilience. From a practical perspective, this study emphasizes that the development of digital capabilities among Asnaf entrepreneurs needs to focus on the application of skills that are strategic and contextual, in line with the reality of micro-businesses. Based on the study findings, it is recommended that entrepreneurship support agencies and zakat institutions develop digital marketing training programs that are more targeted, practical, and tailored to the level of digital literacy as well as the time and resource constraints of Asnaf entrepreneurs, with an emphasis on the application of skills in real business situations. Entrepreneur development programs should also integrate simple digital performance monitoring elements to improve basic data literacy and assist in the assessment of marketing effectiveness. In addition, policy support through the provision of access to devices, stable internet infrastructure, and ongoing post-training support are essential to ensure consistent application of skills and long-term impact on livelihood sustainability. Finally, further research is recommended to develop a livelihood-based digital marketing model specific to the Asnaf context and assess the long-term impact of skills development on improving livelihoods through longitudinal studies.

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DEVELOPING AI MODELS FOR ISLAMIC BANKS TO MANAGE LIQUIDITY RISK

Shehzad Ahmed¹, Alhassane Traore²

¹Usmani's Financial Consultancy, Karachi, Pakistan, (shahzad@usmanisfinancialconsultancy.com)

²Usmani's Financial Consultancy, Research Associate, Yogyakarta, Indonesia,
(alhassane@usmanisfinancialconsultancy.com)

Abstract: *This article analyzes the possibilities of developing an AI model for Islamic banks' liquidity risk management. Islamic banks work in compliance with Sharia, which forbids several products that conventional banks use. The prohibition of conventional products limits access to instruments and can cause difficulties in liquidity management. This study will make a comparative study of the liquidity management system between the two systems and demonstrate the usefulness of using AI to solve operational and analytical system problems. Studies in Malaysia and Indonesia have shown very high liquidity ratios that Islamic banks achieved during crises such as COVID-19. This study also shows that thanks to the innovative and automated system of AI, it can ensure Sharia compliance and respect for ethics. With the regulatory and technical difficulties linked to data, AI offers tools for forecasting and generating liquidity. And it allows for improving and facilitating decision-making and reducing the risk of liquidity and non-compliance. The study gives recommendations on the strategies of adaptation of AI by Islamic banks, to improve the Islamic banking system and to strengthen ethical integration.*

Keywords: *Artificial Intelligence (AI); Liquidity Risk Management; Islamic Banking; Sharia Compliance.*

Introduction

Liquidity risk is one of the critical challenges that confront Islamic banks in the world of today. It has been defined as banks' incapacity to fulfill their duties at a given moment without undergoing significant losses. Islamic banks have difficulty managing this risk for reasons of the prohibition of certain practices used by traditional banks to control their liquidity and deal with threats, such as Riba, gharar, and maysir (Zaheer & Farooq, 2014). In contrast to these, Islamic banks are prohibited from using liquidity instruments, such as Treasury bills, bonds, or interbank loans with interest (Van Greuning & Iqbal, 2007). This limitation reduces their benefits of use and exposes Islamic banks to liquidity problems, especially in moments of crisis (MABROUK & FARAH, 2021). The liquidity risk management systems that Islamic banks are enabled to use are often obsolete, rigid, or not adapted to the financial reality of today (Effendi & Disman, 2018). They have a very weak precision and do not allow for the identification of the signs that announce liquidity crises (Haroon Mahmood et al., 2018). In a context of instability of financial markets, geopolitical tensions, and increasing regulatory obligations, in particular those of Basel III, it is asked to search for a solution that is rapid and innovative, effective, and which conforms to Sharia, to reinforce the strength of Islamic



banks and avoid liquidity crises(Ling et al., 2022). The artificial intelligence integration isn't limited only to the improvement of the efficiency of liquidity risk management or to the operational(Crisanto et al., 2024). It helps to strengthen financial institutions' compliance, also improving the decision-making in Islamic banks, and to ensure their financial viability in the long term(Arsyad et al., 2025a). Face to the current situation of rapid digitalization in the financial system, Islamic banks do not have the choice to advance with technological innovation to guarantee competitiveness, resilience, and to stay faithful to the values of Islamic finance, that is to say, Sharia(Sain & Adinugraha, 2025).

In this perspective, artificial intelligence reveals itself as a precious and transformative tool(Hamadou et al., 2024). It can give an advanced analytical capacity to allow Islamic banks to treat several financial data in the same moment, which can reveal hidden trends and propose models that the existing tools will not offer(Martin Leo et al., 2019). AI can assist Islamic banks in anticipating the dangers with methods like machine learning, predictive analysis, and natural language processing, principally the liquidity risk, and to identify the processes of crisis and to implement mitigation methods adapted to Islamic finance(Mohd Najib et al., 2025). Moreover, we can personalize solutions so that they answer the needs of Islamic banks and conform to the principles of Sharia, combining thus innovation and Islamic ethics(Khan, 2025).

Islamic banks are in difficulties managing liquidity risk because they are always working with traditional tools, the tools that are not adapted to the current reality. Islamic banks cannot use the tools of conventional banks because they do not conform using Islamic financial concepts. The methods used by Islamic banks do not make it possible to avoid liquidity issues; they are limited and cannot very easily improvise unpredictable things, and cannot anticipate liquidity shocks. In this case, artificial intelligence has future solutions to prevent or resolve liquidity problems while respecting Sharia. This study aims to examine how Artificial Intelligence Can Improve Islamic Banks to Manage Liquidity Risk.

Literature Review

For years, the danger of liquidity has been recognized as a major issue in the banking domain, because it has a direct impact on the capacity of a banking institution to honor its engagements and to maintain the confidence within the financial system. In the conventional banking context, this risk is generally mastered thanks to a large range of market instruments like Treasury bills, State bonds, and interbank loan mechanisms. These tools give great flexibility and allow banking institutions to adjust their position in terms of liquidity. However, the strict application of this traditional model to Islamic banks is complicated by the ethical and legal restrictions resulting from the principles of Sharia(Al-Deek, 2025).

Islamic banks work in an economic system that prohibits usury (riba), excess of uncertainty (gharar), and speculative gambling (maysir). Thus, they do not have access to liquidity tools that traditional banks use and must find a solution that is compliant with the principles of Sharia(Rizkiah, 2018). The literature shows that Islamic banks have the habit of favoring tools such as sukuk, murabaha, tawarruq, and wakalah for the management of their liquidity. Although these instruments are legally and ethically acceptable, many experts have judged that



these tools do not have the same flexibility as traditional means, especially in the moment of financial crisis(Alzoubi, 2017).

It would seem that Islamic banks generally have liquidity ratios higher than those of conventional banks, highlighted by comparative studies on Islamic finance. This makes us know that Islamic banks are prudent in the management of their liquidity. However, this apparent robustness masks underlying weaknesses. Islamic banks have difficulties in reacting effectively to unexpected liquidity shocks due to the limitation of access to liquidity instruments and the non-development of activities in Islamic money markets(Firdaus et al., 2024a). During the COVID-19 crisis, for example, empirical data from countries such as Malaysia and Indonesia demonstrated that, even if Islamic banks had maintained their liquidity, they proved to be more likely to adjust their liquidity position than conventional banks(Butt & Chamberlain, 2025).

The writings address another crucial aspect concerning the behavior of depositors, that the clients of Islamic banks are not only interested in financial advantages, but also in religious and ethical aspects. This loyalty, built on trust, promotes stability while minimizing the dangers of mass withdrawals(Hanif Noor Athief & Ma'ruf, 2023). However, this could affect the capacity of the bank to act in a rapid way in terms of the management of its liquidity, given that customer deposits often serve to identify market capacity. This behavioral trait complicates the management of liquidity risk in Islamic banks compared to conventional systems.

In this framework, current research still explores the importance of the use of artificial intelligence in the management of banking risks. Conventional banks already use AI in operations such as the analysis of credit risk, the identification of fraud, stress tests, and asset–liability management. Machine learning models have been particularly appreciated for their aptitude to examine large volumes of data, to detect non-linear trends, and to make predictions. AI, thanks to these skills, proves to be a useful tool for the management of liquidity risk, where prior detection and rapid response are crucial(Gustanto et al., 2025a; Zainudin & Hidayatulloh, 2025).

Recent studies indicate that artificial intelligence has the capacity to optimize the management of liquidity by refining cash flow forecasts, ensuring constant monitoring of liquidity conditions, and quickly identifying the first indicators of financial difficulties, rather than waiting for the appearance of difficulties and acting in a preventive manner(Muhammad Bashri Bas et al., 2025). This anticipatory approach is particularly attractive for Islamic banks, given that it reduces their dependence on short-term instruments, often subject to debate, such as tawarruq(Gustanto et al., 2025a).

According to Sharia, the literature admits that AI is not intrinsically problematic. It is considered a neutral tool, and its conformity to Islamic principles depends on its fabrication and its use(Azwar et al., 2025). When AI is well managed, it can ensure the respect of Sharia by improving transparency and responsibility. For example, the automatic analysis of natural language could serve to examine the conformity of contracts and identify the points that could



imply riba (usury) or gharar (excessive risk), whereas automated monitoring systems can report the irregular transactions.

In parallel, experts have warned against a blind integration of AI in the field of Islamic finance. And it shows the existence of problems such as the absence of Sharia-compliant databases, legal uncertainty, algorithmic biases, and the restriction of the exploitability of decisions taken by artificial intelligence persist to be important issues. These difficulties highlight that strict surveillance by humans is necessary, particularly by Sharia committees, in order to guarantee that AI applications conform to the principles of Islamic law (Maqasid al-Shariah)(Bin-Armia & Kambakov, 2026; Wahab & Mahdiya, 2025).

In summary, even if current studies provide important insights into liquidity risk management and the uses of AI, the works that combine artificial intelligence with Sharia-compliant liquidity management are still rare. This rarity demonstrates the need for more in-depth research on the effective and ethical use of AI in order to be able to help Islamic banks with the management of liquidity risk, which is the objective of this study.

Methodology

This research employs a qualitative, descriptive, and analytical vision to evaluate the role of artificial intelligence (AI) for strengthening liquidity risk management in Islamic banks, while ensuring the compliance of activities with Sharia. The methodology is composed of four parts, which are coupled and together give assurance of rapid development and produce consequent results for this study.

Data collection

The analysis is entirely based on secondary data from a wide range of authoritative sources, including:

Peer-reviewed academic publications on Islamic banking, liquidity risk, and AI technologies; Institutional annual reports published by regulatory bodies such as the Basel Committee on Banking Supervision (BCBS) and the Islamic Financial Services Board (IFSB); Statistical bulletins of central banks and financial statements of Islamic and conventional banks; Books, conferences, and research papers indexed in international databases such as Scopus, ScienceDirect, Emerald Insight, and Google Scholar. And the documents were selected according to their relevance to the objectives of this research, their publication date (2018–2025), and the extent to which they directly cover liquidity risk management or the use of AI in Islamic financial institutions.

Analytical framework

The study uses two types of analytical approaches to interpret the collected data. A comparative study to identify the difference between the liquidity risk management systems of Islamic and conventional banks, based on available financial tools, regulatory contexts, and



resilience capacity during crisis periods. The thematic evaluation allows us to learn the impacts of AI, especially in machine learning, prediction, crisis-prevention models, and natural language processing (NLP), for the optimization of liquidity projections and for the improvement of the early-warning system and automated Sharia compliance management. With these two types of analyses, a link is woven between the operational constraints of Islamic finance and the technological capabilities offered by AI. Evaluation of the applicability of AI to Sharia-compliant liquidity management

The effectiveness of AI applicability in Islamic banks is evaluated based on three important criteria: 1. Technical efficiency, its predictive reliability, its ability to support decisions, and its ability to handle all heavy and complex financial data; 2. Sharia compliance, which quantifies the contribution of technology to prevent prohibitions such as *riba*, *maysir*, and *gharar*, while promoting transparency and fairness; 3. The ability of the technology to adapt to regulations, the compliance of AI instruments with AAOIFI standards, the Basel Committee, and national regulatory authorities (Bank Negara Malaysia and OJK Indonesia).

Reliability and validation of results

For the credibility of the results, several validation techniques were used, including: The combination of information extracted from academic documents, sector reports, and regulatory documents. Making international comparisons based on data from Malaysia, Indonesia, and the United Kingdom, covering the period from 2019 to 2024. This validation approach ensures, at several levels, that the study offers a balanced analysis and is supported by a significant influence of AI in the management of liquidity risk in Islamic banks.

Limitations

This research has some limitations. Artificial Intelligence adoption in the management of liquidity risk in Islamic banks, and also the models development, are in the testing phase, which will reduce empirical consumption. The research is based on information that does not necessarily represent the development of technology or changes in standards. Moreover, the differences in regulation, market conditions, and technological institutions between countries reduce the possibility of generalizing the results. Therefore, to increase the security of AI liquidity management instruments in Islamic finance, future research should deepen and adapt larger databases, and also the applications used.

Results And Discussion

Results

Islamic banks are facing a liquidity risk due to the prohibition of certain practices in the Islamic financial system, such as *riba* (interest), speculation, and gambling. (Mikou et al., 2024) Unlike conventional banks, which have access to several resources such as treasury bills, interbank loans, and bonds, Islamic banks have only a few very limited instruments (Mabrouk & Farah, 2021). The most widely used and widespread instrument today is the *sukuk*, an Islamic bond



generally issued by governments (Fitch Ratings, 2025). Sukuk are also used by Islamic institutions for their reliable and flexible liquidity needs. However, the sukuk market remains smaller than that of conventional bonds, with often limited performance for sukuk, which can hamper its role in times of crisis (Dey et al., 2025). Another commonly used tool is murabahah (tawarruq) regarding raw materials, which allows for the generation of liquidity by selling these materials at profit margins ("IFN - Commodity Murabahah," 2010). It is an instrument that is very effective in the short term, but it is also criticized by some scholars for its similarity to riba (interest). (Saifuzzaman & Rosli Mahmood, 2023). Wakalah placements are also a tool that allows the bank to transfer funds to other Islamic institutions for investment, but their use is dependent on the privacy of the local market (Press Release, n.d.). Furthermore, murabahah investment accounts mobilize funds from depositors, but only with their participation in the investment profile, even if the lack of a guarantee of return complicates planning (Jobst & Solé López-Pinto, 2020). Overall, the tools used by Islamic banks provide some liquidity management capability, but are less flexible than those used by conventional banks (Chapra, M. U. (Mohammad Umar) & Khan, T. (Tariqullah), 2000, pp. 55–56). Because of the limited markets and reliance on interbank placement, Islamic banks face liquidity pressures during economic downturns or even crises. (Daud Vicary Abdullah, 2010)

Traditional liquidity risk management instruments used by Islamic banks, such as sukuk, tawarruq, and wakalah investments, have shown their limitations in liquidity risk management. (Mikou et al., 2024) The first observation is that Islamic banks have a very limited portfolio compared to conventional banks (Rizkiah, 2018). This portfolio limitation shows that the Islamic banks don't have the exact flexible liquidity management techniques like conventional banks, especially in times of economic problems or money market tensions (Ledhem, 2022).

Furthermore, some products, such as murabahah, are only available for short-term liquidity management. Moreover, they are also very similar to the instruments conventional banks use, such as interbank interest-rate securities, which they seek to replace (Song et al., 2014).

Ultimately, they are also linked to the availability of excessive liquidity in interbank investments, which creates a kind of dependence on interbank investments and other short-term financial markets (Puja Sharma, 2025). On the other hand, during times of stress and economic slowdown, interconnection can have repercussions on liquidity and directly expose Islamic banks to very serious shocks (Nabil Bello et al., 2025).

Overall, while traditional instruments that Islamic banks use to manage the liquidity problem, to provide the fundamental means for Islamic banks to exist, the search for new, more advanced, and efficient methods is essential to maintain the ideal productivity of Islamic banks.

Artificial intelligence (AI) can provide Islamic banks with significant opportunities to address the challenges they face, such as liquidity and operational challenges, and Sharia compliance (Gustanto et al., 2025b). One of the most important fundamental principles is liquidity management and supervision in Islamic banks. It analyzes the current financial data, and AI can predict the risks of liquidity shortage and the scenarios of economic crisis (Hamadou



et al., 2024). This allows the banks to take rapid and effective measures to limit their dependence on short-term instruments, such as murabaha and tawarruq. The liquidity management of Islamic banks will thus be much more flexible and reliable in facing crises. AI can also play an important role in Sharia compliance. With the natural language processing system (NLP), AI analyzes the contracts and shows the conformity of the contract as well as the elements that do not conform to Sharia, and those that can be likely to involve riba, maysir, and gharar(Shalhoob & Babiker, 2025). Combined with technology and blockchain, AI facilitates the implementation of smart contracts for some products like ijara and murabaha, promoting transparency and minimizing the risk of non-compliance(Mohd Najib et al., 2025). AI enriches other aspects of Islamic banking, such as customer service and financial orientation. The chatbots powered by AI have the capacity to communicate in a direct way with customers, answer their questions, and propose to them products that conform to Sharia(Hamadou et al., 2024). The credit models supervised by AI, which are based on habits and operations instead of interest rates, facilitate access to financing for individuals and small enterprises far from the conventional banking system(Gateway, 2025).

Finally, AI can contribute to fraud detection and have an important role to play in the reinforcement of cybersecurity by examining unusual banking transactions, preventing money-laundering risks, and securing international transactions. The importance of AI in the functions of Sharia compliance and audit in Islamic finance is increasing, in particular for the missions of audit and Sharia compliance(Hafsa Nawaz, n.d.).

The comparison between the systems management liquidity risk in Islamic banks and conventional banks shows clear differences (Jaafar et al., 2024). Conventional banks work in an environment where they have a wide range of tools, such as Treasury bills, government bonds, and interbank loans. These instruments make it easy for them the manage their liquidity risks.

As for the Islamic bank, they are obliged to conform to Islamic financial principles, which frame the Islamic financial system by prohibiting instruments that have interest and speculation. They turn, therefore, towards tools such as sukuk, murabaha on commodities, or wakala, which are the principal instruments of liquidity mobilization with conformity. Although these instruments are operational, their flexibility is limited, especially when the capital markets are in difficult moments. Experience-based data highlights the effects of these disparities. The academic data put the emphasis on the effect of these disparities. During COVID-19 in Indonesia, some research has shown that liquidity difficulties had affected the two systems, but that Islamic banks had been more affected (Viverita et al., 2023). It is very important to note, when liquidity exceeds a certain threshold, the relationship between the bank and the clients becomes fragile, which shows the need for a deep analysis to improve the prediction tools that are reliable (Ahmad & Amran, 2023). And another study reveals that Islamic banks created higher liquidity than conventional banks, due to reasons of religion, the depositors showing themselves faithful to Islamic banks for reasons of their religious commitment(Firdaus et al., 2024b). In Malaysia, comparative studies have revealed that, despite lower returns and very limited reserves, Islamic banks very often display stronger

liquidity ratios than conventional banks, which, however, reduces their overall resilience (Javaria, Kiran, 2016).

The difference is also visible in the United Kingdom, where the Islamic bank Al Rayan Bank has liquidity reserves lower than the conventional bank HSBC UK Bank plc. However, Al Rayan Bank's reserves continue to increase, moving from £339,739,000 in 2019 to £539,046,000 in 2024, showing the efforts put in place by the Bank to improve its liquidity in all Sharia compliance. On the other hand, HSBC UK Bank plc has a much higher balance with the central bank, going from £37.1 billion in 2019 to £52.3 billion in 2024, which highlights the considerable gap between the two systems in terms of liquidity management, notably because of the instruments used and the regulatory access available.

These observations show that Islamic banks can't advance only with banking instruments and indicators used in the banking system. Rather, a very general strategy must take into account the behavior of depositors, legal configuration, and market rules (An Nisaa' Rahmadany et al., 2024). AI, with its ability to understand and analyze non-linear patterns and to group multiple elements, can provide vital support to Islamic banks in reducing the gap that exists between the systems of Islamic and conventional banks (Hamadou et al., 2024).

Table 1. Liquidity Coverage Ratio (LCR) Comparative analysis of Islamic and Conventional Banks in Malaysia (2019–2024)

Year	Conventional Banks (LCR %)	Islamic Banks (LCR % %)
2019	148%	152%
2020	152%	141%
2021	153%	139%
2022	153%	139%
2023	156%	142%
2024	153%	148%

Source: Author's Calculation Based On Data From *Bank Negara Malaysia, Monthly Statistical Bulletin (2019–2024)*.

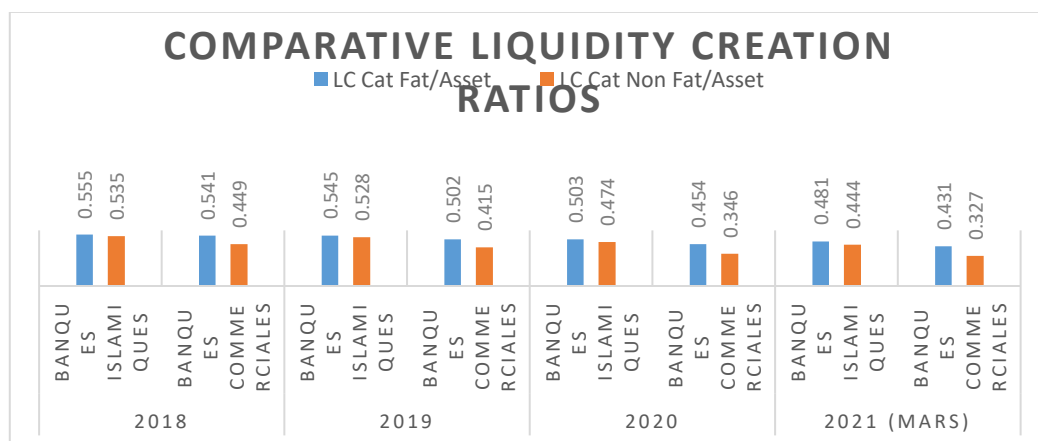


Figure 1: Comparative Liquidity Creation Ratios



Source: Viverita, Y., Bustaman, Y., & Danarsari, D. N. (2023). Liquidity Creation By Islamic And Conventional Banks During The Covid-19 Pandemic. *Heliyon*, 9(7), E15136. <https://doi.org/10.1016/j.heliyon.2023.E15136>

Table 2: Cash and Central Bank Balances of Al Rayan Bank and HSBC UK (2019–2024)

Year	Al Rayan Bank – Cash & Equivalents (£ 000s)	HSBC UK Bank plc – Cash & Balances at Central Banks (£ m)
2019	339 739	37 102 000
2020	385 376	76 513 000
2021	—	112 551 000
2022	—	94 471 000
2023	397 753	65 783 000
2024	539 046	52 334 000

Source: Al Rayan Bank Plc. (2019–2024). Annual Reports And Financial Statements. <https://www.alrayanbank.co.uk/about-us/financial-information/>; Hsbc Uk Bank Plc, *Annual Reports And Pillar 3 Disclosures* (2019–2024), Available At <https://www.hsbc.com/investors/results-and-announcements>.

Discussion

The results show that the liquidity risk management by Islamic banks faces structural and ethical limitations linked to Sharia. While conventional banks have a wide range of liquidity instruments like Treasury bills, bonds, and interbank loans, the Islamic banks work within a very strict structure, based only on sukuk, tawarruq, murabahah, and wakalah. These instruments are very functional but lack flexibility during periods of stress in financial markets (Mabrouk & Farah, 2021). The Malaysian and Indonesian examples show a double reality: Islamic banks show a higher liquidity ratio but remain more exposed to systemic shocks due to the limitation of instruments and the weakness of liquidity reserves. In addition, the loyalty of depositors is linked to a religious or ethical commitment, which acts both as a stabilizing factor and a source of firmness, thus affecting the process of liquidity creation. This one shows an unusual link between liquidity and financial stability. The adoption of artificial intelligence gives a future perspective to fill these gaps, and to improve the precision of stress tests, to estimate liquidity, and to develop optimization models that are compliant with Sharia, while also strengthening resilience and promoting innovation in the sector of Islamic banking sector (Mohd Najib et al., 2025).

From a Shariah perspective, using artificial intelligence in liquidity risk management it may be compliant with Sharia, with conditions that it must be designed and supervised according to the standards of Islamic finance (Waqar et al., 2025). In general, AI is a neutral technology; its compliance with the principles of Sharia depends on the data, the objectives of use (Arsyad et al., 2025b). Within Islamic banks, artificial intelligence can strengthen decision-making, especially by preventing the instruments prohibited in Islam. For example, predictive AI models optimize liquidity estimations by staying away from falling into the prohibitions. Also, AI assists the Sharia committee in making decisions on contracts more easily and quickly, by guaranteeing the transparency of contracts, and automates compliance controls and the monitoring of transactions in real time in order to detect any violation of Sharia (Bakar et al., 2025). However, experts request the need for human supervision to prevent algorithmic biases



and outcomes contrary to ethics. In this case, the use of artificial intelligence in Islamic banks can be compliant with Sharia if it is applied according to the ethical values of Islam, and oriented toward the Maqasid al-Sharia, which are the objectives of Islamic law.

In addition to enhancing compliance, Artificial Intelligence (AI) can offer Islamic banks several opportunities to promote the efficiency of products and compliance, and also improve the trust of customers in the services offered (Gustanto et al., 2025c). With AI tools such as automatic analysis of data and prediction, AI optimizes liquidity forecasts and asset and liability management by reducing compliance risks and checking the operations, the contracts, and the investment portfolio to ensure compliance, and also reduces operational costs and minimizes the errors that are linked to humans (Al-amrkani & Arabiyat, 2023). In addition, chatbots are a tool of personalized advice and assistance that strengthen the confidence of customers by offering them ethical and reliable financial solutions that respond to their needs (Iqbal et al., 2025). And in the field of liquidity management, AI has the capacity to identify the movements of financial evolutions and the behavior of depositors. The banks can also strengthen their short-term capital without resorting to prohibited instruments (Hendarti et al., 2024). This technology also gives perspectives of innovation for Islamic financial products, such as the flexible structuring of sukuk or smart contracts, which several Islamic banks have already begun to use for risk-sharing. In summary, the adoption of AI is an advantage for Islamic banks to position themselves well internationally and to strengthen transparency and the respect of Sharia principles.

AI gives considerable opportunities, but also, its use in Islamic banks has several difficulties and limitations. One challenge is the absence of a data model compliant with Sharia: artificial intelligence algorithms work many times with conventional banking databases, which affects compliance. In addition, the implementation of AI technology is interrupted by very expensive technological infrastructure costs and a lack of technical expertise and AI experts within the field of Islamic finance (Islam & Hasan, 2024). Regulatory issues also constitute a major obstacle, and most Islamic finance frameworks have not yet provided clear guidelines on the management and application of AI in large Islamic financial institutions. Moreover, transparency and responsibility in AI-driven decision-making are always considered important challenges, especially to ensure that automated systems respect Sharia standards. In short, small Islamic banks are confronted with risks linked to the evolution of trends and cybersecurity, which affects customer trust if the management tools are not adapted. These limitations show the need for an adequate Islamic analytical institution that adapts to the ethics of Islamic finance and to innovation.

In order to use artificial intelligence for liquidity risk management, Islamic banks must adopt planned strategies in full compliance with Sharia. In the first place, they must call on Shariah specialists and AI experts to develop an algorithm that respects the principles of Shariah and without databases based on interest and speculation (Eddy et al., 2025). In the second place, the improvement of skills is necessary: it is crucial to train the staff on AI technologies and on the basic foundations of Islamic finance, to guarantee transparency and Shariah compliance (Fitria, 2025). The regulatory institutions like AAOIFI and the central banks, like Bank Negara Malaysia or OJK Indonesia, have the responsibility to elaborate clear standards in the matter



of the use of AI. Again, the establishment of a regional network for transmitting data appears to improve the harmonization of liquidity forecasting models. Coordination with experts in Islamic finance FinTech could also improve innovation while assuring Shariah compliance (Hasan et al., 2020). To finish, a continuous analysis of AI models by the Shariah committee will contribute to ensuring that automation satisfies, and does not assume, the ethical and transparency aims of Shariah.

Conclusion

The adoption of artificial intelligence in liquidity risk management represents a development of Islamic finance. While conventional banks have flexible instruments, those of Islamic banks must respect Sharia rules, which control certain operations and create concrete difficulties in the field of liquidity risk management. AI offers solutions by providing more accurate forecasts, real-time control, and the automation of decision-making and Shariah compliance. However, to achieve these advantages, it is necessary to overcome the difficulties of technological, regulatory, and Shariah compliance. The results suggest that a collaboration between regulatory institutions, Shariah experts, and AI developers is necessary to ensure trust and transparency. The responsible use of AI allows Islamic banks to increase their strength, improve customer confidence, and recover their lack of operational activity compared to conventional banks. Finally, careful use of AI can help Islamic banks to achieve the objective: guarantee financial stability while respecting the Shariah and social principles that illustrate the Islamic financial systems.

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STRATEGIC MANAGEMENT AS A CATALYST FOR INNOVATION IN CIVIL ENGINEERING: DRIVING SUSTAINABLE AND RESILIENT INFRASTRUCTURE

Leviana Andrew¹, Awang Nasrizal Awg Ali^{2*}, Marlita Mat Yusof³, Vloreen Nity Mathew³

^{1,3,4}Faculty of Business and Management, Universiti Teknologi MARA Sarawak Branch (UiTM), Malaysia,
(leviana141@uitm.edu.my, marlita@uitm.edu.my, vloreen@uitm.edu.my)

²Faculty of Civil Engineering, Universiti Teknologi MARA Sarawak Branch (UiTM), Malaysia,
(awang295@uitm.edu.my)

Abstract: *The civil engineering sector is experiencing increasing pressure to deliver infrastructure that is not only technically efficient but also sustainable and resilient in the face of climate change, rapid urbanisation, and technological disruption. While advanced digital technologies and innovative materials offer significant potential to address these challenges, their implementation in practice remains uneven. This gap highlights the critical role of strategic management in translating technological innovation into tangible infrastructure outcomes. This study examines strategic management as an enabling mechanism for innovation in civil engineering, positioning it as the essential “soft infrastructure” that supports sustainable and resilient development. Adopting a qualitative, multi-phase research design, the study combines a narrative synthesis of existing literature with illustrative case studies drawn from smart city development and infrastructure resilience applications. The literature synthesis informs the development of an integrated conceptual framework linking innovation drivers with strategic management enablers, including governance, leadership, data-driven decision-making, lifecycle cost analysis, and change management. The case studies demonstrate how strategically aligned management practices facilitate the successful adoption of advanced technologies and materials by addressing organisational, financial, and institutional barriers. The findings suggest that innovation in civil engineering is not solely a technical endeavour but a strategic process shaped by managerial capability and organisational readiness. This study contributes to the literature by providing an integrative framework that bridges engineering innovation and strategic management, offering practical insights for infrastructure organisations and policymakers seeking to enhance long-term sustainability and resilience.*

Keywords: *Strategic Management; Civil Engineering Innovation; Sustainable Infrastructure; Resilient Infrastructure*

Introduction

The civil engineering sector is currently undergoing a profound transformation driven by rapid urbanisation, accelerating climate change, and the growing penetration of digital and material innovations. Infrastructure systems are increasingly required to be not only functional and cost-efficient but also sustainable, resilient, and adaptable to long-term environmental and societal uncertainties. In response, a wide range of technological solutions such as Building Information



Modelling (BIM), Internet of Things (IoT)-enabled monitoring, Digital Twins, and advanced materials including self-healing concrete have been developed to enhance infrastructure performance across its lifecycle.

Despite the availability of these innovations, their implementation in real-world infrastructure projects remains fragmented and inconsistent. Numerous studies have highlighted a persistent “execution gap” in which technically viable solutions fail to deliver their intended benefits due to organisational, institutional, and governance-related constraints. Engineering expertise alone is often insufficient to manage the complex stakeholder environments, regulatory pressures, financial risks, and organisational change processes that characterise contemporary infrastructure development. As a result, innovation in civil engineering is increasingly recognised not as a purely technical challenge, but as a strategic and managerial one.

Strategic management provides the organisational “soft infrastructure” necessary to translate technological potential into sustainable and resilient outcomes. Through mechanisms such as strategic planning, project governance, leadership, lifecycle-based decision-making, and change management, strategic management shapes how innovations are selected, adopted, and scaled within engineering projects. However, existing research tends to examine technological innovation and strategic management in isolation, resulting in a fragmented understanding of how these domains interact to influence infrastructure performance.

Accordingly, this study seeks to bridge the gap between engineering innovation and management scholarship by examining strategic management as an enabling mechanism for innovation in civil engineering. Rather than focusing on individual technologies, the study adopts an integrative perspective that links innovation drivers with managerial enablers and infrastructure outcomes.

The primary aim of this study is to examine how strategic management functions as an enabling mechanism for innovation in civil engineering, facilitating the development of sustainable and resilient infrastructure.

To achieve this aim, the study pursues the following objectives:

1. To synthesize existing literature on technological innovation in civil engineering and identify the strategic management mechanisms that enable effective adoption.
2. To examine, through case studies, how strategic management practices influence the successful implementation of advanced technologies and innovative materials in infrastructure projects.
3. To develop a conceptual framework linking innovation drivers (e.g., digital technologies and sustainability imperatives) with strategic management enablers such as governance, leadership, and data-driven decision-making.

By addressing these objectives, this study contributes to the growing body of knowledge at the intersection of civil engineering, strategic management, and innovation studies. It offers both theoretical insights and practical guidance for policymakers, project leaders, and infrastructure



organisations seeking to navigate the increasing complexity of innovation-led infrastructure development.

Literature Review

This study uses a narrative review approach to review previous research on strategic management and innovation in civil engineering. The review focuses on influential and representative studies, which include digital transformation, smart infrastructure and Digital Twins, advanced materials, and sustainability and resilience. The objective is to develop an integrated conceptual understanding of how strategic management can promote innovation-driven, sustainable, and resilient infrastructure in increasingly complex, uncertain, but demanding operating environments. Table 1 summarizes the strategic innovation areas and their contributions to sustainable and resilient infrastructure, which will be discussed in the next sections.

Table 1. Strategic innovation areas and their contributions to sustainable and resilient infrastructure

Innovation Area	Key Technologies / Materials	Contribution to Sustainability	Contribution to Resilience	Strategic Management Implications
Digital Transformation	AI, IoT, cloud computing	Resource efficiency, reduced waste, long-term value creation	Adaptive systems, data-driven decisions, continuous monitoring	Steering technology adoption, aligning innovation with organizational goals
Smart Infrastructure & Digital Twins	IoT sensors, AI analytics, Digital Twins	Optimized resource use, lower emissions, and operational efficiency	Real-time monitoring, predictive maintenance, extended asset life	Strategic vision, cross-disciplinary coordination, data governance
Advanced Materials	Self-healing concrete, nanomaterials	Extended service life, reduced maintenance, lifecycle cost savings	Improved durability, autonomous crack repair, enhanced strength	Lifecycle cost analysis, balancing upfront costs and long-term benefits
Sustainability & Resilience Frameworks	Integrated design, adaptive and risk-based strategies	Environmental, social, and economic value creation	Absorptive, adaptive, and rapid recovery capacity	Embedding sustainability goals in strategic planning and decision-making

Source: Wu et al., (2025)



Innovations in Civil Engineering: The Digital Transformation Imperative

The success in realizing sustainable and resilient infrastructure depends on a proactive strategic management approach, positioning leadership, governance structures, and organizational strategy as important factors for innovation in the civil engineering sector (Weil et al., 2023). Innovation in this context is no longer viewed as a purely technical activity but as a strategic process shaped by managerial intent, institutional capacity, and long-term organizational vision. Recent studies emphasize that strategic alignment and leadership commitment are essential for transforming emerging digital technologies and novel practices into tangible infrastructure outcomes that deliver sustained value (Suprun et al., 2024).

Contemporary civil engineering practice is being fundamentally reshaped by the Fourth Industrial Revolution (4IR or Industry 4.0), through the combination of digital technologies with physical assets, processes, and human expertise (Nassereddine et al., 2022). This transformation is redefining how infrastructure is conceived, designed, delivered, and managed across its lifespan, thus shifting the industry toward data-driven and system-oriented modes of operation (Montalbán-Domingo et al., 2020). However, the integration of digital technologies frequently faced organizational and institutional barriers, including shortages of skilled personnel, resistance to change, and perceptions of increased time and cost requirements. These challenges highlight the importance of strategic management in handling digital transformation efforts and to ensure that any technology adoption is aligned with organizational capabilities and their long-term objectives.

Smart Infrastructure and Digital Twins

Not just the emergence, but the combination of the Internet of Things (IoT), advanced sensing technologies, data analytics, and digital modeling has transformed traditionally static infrastructure assets into intelligent systems capable of real-time interaction with their operational environment (Jiang et al., 2021). These technological developments enable continuous data acquisition, system-level visibility, and enhanced control, laying the foundation for smart infrastructure that can dynamically respond to changing conditions (Ye et al., 2023). Within this broader transformation, Digital Twins have emerged as one of the most prominent and strategically significant innovations for infrastructure planning, operation, and maintenance (Lu & Antwi-Afari, 2025; Qiu et al., 2025; Watson et al., 2018).

Recent literature reviews show that Digital Twins, defined as virtual replicas of physical assets and systems, particularly in smart city contexts, enable real-time monitoring, advanced scenario simulation, and predictive maintenance capabilities (Huang et al., 2024; Sakr and Sadhu, 2024; Torzoni et al., 2024). This represents a fundamental shift from traditional reactive maintenance approaches to a more proactive and predictive asset management strategy. As a result, Digital Twins contribute to extended asset lifespans, reduced operational costs, and improved system reliability, thus enhancing the overall performance of infrastructure systems (Buuveibaatar et al., 2025; We et al., 2025; Wu et al., 2025).



At the core of Digital Twin systems is the integration of continuous data streams from IoT sensors with artificial intelligence-driven analytics, forming intelligent decision-support engines capable of autonomous and context-aware responses (Almulhim, 2025; Fu et al., 2024). From a strategic management perspective, the value of Digital Twins extends beyond their technological complexity. Their successful implementation requires clear strategic vision, cross-disciplinary collaboration, robust data governance, and alignment between organizational objectives and digital capabilities (Sacoto-Cabrera et al., 2025; Agostinelli et al., 2021). When strategically managed, Digital Twin-enabled smart infrastructure significantly enhances sustainability and resilience by optimizing resource utilization, reducing emissions, and strengthening preparedness for system disruptions (Bibri and Huang, 2025).

Advanced Materials for Next-Generation Infrastructure

To complement digital innovation, advances in material science are also driving a transformative shift in the durability, performance, and lifecycle management of the civil infrastructure (Tiza et al., 2024; Soliman et al., 2021). Emerging materials, including self-healing concrete and nanomaterials, have demonstrated significant potential to extend service life, reduce maintenance requirements, and improve long-term cost efficiency (Elkhayat et al., 2024). These developments indicate a move away from traditional inert construction materials toward smarter, high-performance materials that can better respond to environmental and operational stresses (Kaushal & Saeed, 2024).

Self-healing concrete, for example, is engineered to autonomously repair microcracks through intrinsic or extrinsic healing mechanisms, thereby mitigating reinforcement corrosion and slowing the progression of structural deterioration (He et al., 2025; Zhang et al., 2020). By addressing micro-level damage before it escalates into structural failure, such materials directly tackle one of the most persistent challenges in infrastructure management, premature degradation, while enhancing durability and reliability without continuous human intervention (Barros et al., 2023). Similarly, the incorporation of nanomaterials, such as carbon nanotubes, has been shown to enhance mechanical strength, durability, and impermeability, contributing to greater structural resilience under adverse conditions, including high pore-water pressure during intense rainfall events (Okem et al., 2024; Tiza, 2024).

Despite their technical advantages, the widespread adoption of advanced materials remains constrained by higher upfront costs, uncertainties regarding long-term performance, and limited industry familiarity (Rahman et al., 2025; Zhao et al., 2024). These barriers highlight the importance of strategic lifecycle cost analysis and managerial support in evaluating the true value proposition of material innovations (Tan et al., 2022). Strategic management plays a pivotal role in balancing short-term financial considerations with long-term sustainability and resilience benefits, enabling informed investment decisions that support the development and diffusion of next-generation infrastructure materials.



Sustainability, Resilience, and Strategic Management

The growing scale and complexity of global challenges, including climate change, uncontrolled rapid urbanization, and resource scarcity, have increased the need for strategic frameworks that place sustainability and resilience at the core of civil engineering practice (Reddy et al., 2025). Consequently, organizations related to the civil engineering sector are increasingly required to align project-level decisions with broader environmental, social, and economic objectives. Thus, rather than concentrating solely on short-term performance, the focus should be on generating long-term value for society (Okem et al., 2025).

The importance of climate-resilient infrastructure has become particularly visible, especially with the rising frequency and severity of extreme events, including floods and high structural loading conditions (Leal Filho et al., 2024; Bastida-Arteaga, 2021). Resilient infrastructure systems are characterized by their ability to absorb disturbances, adapt to evolving conditions, and recover rapidly from shocks. Achieving such resilience requires an integrated, holistic design philosophy that incorporates adaptive strategies, redundancy, and flexibility, while explicitly accounting for uncertainty throughout the infrastructure lifecycle (Qi et al., 2023; Suriyankietkaew & Petison, 2020).

The alignment of environmental stewardship, social responsibility, and economic viability represents a fundamentally strategic sustainability challenge (Leal et al., 2024). Strategic management is therefore essential for fostering organizational capabilities that support eco-innovation, interdisciplinary collaboration, and continuous learning (Afeltra & Alerasoul, 2024; Šūmakaris & Korsakienė, 2021; Demirel & Kesidou, 2019). By embedding sustainability and resilience objectives into strategic planning and decision-making processes, civil engineering organizations can enhance their competitiveness while contributing to long-term community well-being and environmental protection (Hohmann & Truffer, 2022). In this regard, strategic management emerges not merely as an administrative function but as a central driver of innovation-led, sustainable, and resilient infrastructure development.

In the Malaysian context, the adoption of Digital Twin technologies remains at an early stage, primarily embedded within BIM-enabled asset management systems, smart city initiatives, and utility monitoring platforms. These challenges and opportunities are particularly noticeable due to Malaysia's strong reliance on public-sector-driven infrastructure development, its exposure to climate-related risks such as flooding, and ongoing national initiatives aligned with the Fourth Industrial Revolution. Policy frameworks such as MyDIGITAL, the Construction Industry Transformation Programme, and the national BIM adoption roadmap underscore the strategic importance of integrating digital technologies, innovative materials, and sustainability principles into infrastructure planning and delivery. The effective realization of these initiatives, however, remains conditional on strategic management capabilities that can align organizational readiness, technological investment, and long-term resilience objectives within Malaysia's institutional and regulatory landscape.



Strategic Management in Engineering Projects

Strategic management functions as the core “soft infrastructure” that enables the effective implementation of the “hard infrastructure” underpinning the Fourth Industrial Revolution, including technologies such as the Internet of Things (IoT) and Building Information Modelling (BIM). Whereas engineering scholarship has typically emphasised the physical and technical dimensions of construction, the strategic management literature is concerned with the key processes that shape project delivery outcomes (Chinowsky & Taylor, 2012). In this sense, strategic management provides more than administrative oversight; it operates as a critical driver of innovation, actively supporting the creation of sustainable and resilient infrastructure systems (Manley & McFallan, 2006; Caniëls & Bakens, 2012). The deliberate integration of strategic and technical perspectives is particularly important because engineering competence on its own is often inadequate to manage the regulatory complexities and financial uncertainties characteristic of contemporary projects (Rehan, 2024). Establishing a “techno-strategic” fit, therefore, helps to ensure that technological decisions are grounded in, and reinforced by, organisational capabilities (Chen, Phawitpiriyakliti, Zheng, & Terason, 2025).

Project Governance and Leadership

Effective governance arrangements are widely recognised as the central means of managing the inherent complexity of megaprojects (Gamlath, 2024). Empirical studies indicate that major cost overruns and schedule delays are more often attributable to leadership shortcomings than to purely technical problems (Flyvbjerg, 2014; Love et al., 2016; Merrow, 2011). A key insight emerging from this body of work is that governance must come before technology: organisations that adopt tools such as BIM or AI in the absence of well-defined governance structures tend to experience repeated failures (Arayici et al., 2011; Succar, 2009). Sound governance establishes the framework within which authority is exercised, including mechanisms for resolving trade-offs between competing priorities such as cost efficiency and sustainability (Flyvbjerg, 2014; Müller & Lecoivre, 2014).

In addition, project performance is positively associated with particular leadership attributes, notably business acumen, integrity, and emotional intelligence (Geoghegan & Dulewicz, 2008; Müller & Turner, 2010). Within digital transformation initiatives, it is therefore incumbent on leaders to ensure that technological choices are consistent with and supportive of the organisation's broader strategic objectives.

Risk Management and Resource Allocation

Strategic resource allocation and comprehensive risk management are vital for infusing projects with sustainable value (Marcelino-Sádaba et al., 2014). To mitigate persistent project delay issues, Data-Driven Decision-Making (DDDM) has emerged as a crucial strategic approach (Sanusi et al., 2024). Using predictive analytics and IoT, managers can proactively identify potential risks. Furthermore, a shift in financial modelling from initial Capital Expenditure (CAPEX) to a Total Cost of Ownership (TCO) or Lifecycle Cost Analysis is essential (Higham et al., 2015).



Risk-sharing models, particularly within Public-Private Partnerships (PPPs), also encourage the testing of unproven technologies by distributing financial risks across multiple stakeholders (Bing et al., 2005). Ultimately, treating data as a strategic asset enables the predictive capabilities necessary for resilient infrastructure delivery (Tao et al., 2021).

Change Management

The adoption of transformative technologies like BIM requires substantial organisational change that extends far beyond technical implementation (Villena-Manzanares et al., 2020). Change management theories highlight the necessity of managing the "people side" of technology adoption to overcome institutional inertia (Musarat et al., 2023; Kotter, 1996). Strategic management research indicates that when organisations fail to embed change management within their strategic planning, technology adoption rates are significantly lower (Ahuja et al., 2009). Effective change architecture involves creating dual pathways, combining top-down strategic directives with bottom-up problem-solving mechanisms (Rafferty et al., 2013). Furthermore, phased implementation approaches that introduce technologies incrementally achieve higher success rates and greater workforce acceptance (Harty, 2005). Senior management support and a collaborative culture are essential organisational factors that drive the effectiveness of these implementations (Chan et al., 2004).

Methodology

To thoroughly investigate the synergy between strategic management and civil engineering innovation, this study adopts a qualitative, multi-phase research design that combines narrative literature synthesis with illustrative case studies. This approach is appropriate given the exploratory and theory-building nature of the research, which seeks to integrate insights across engineering, management, and sustainability domains rather than to test predefined hypotheses statistically, as proposed by Holmström et al. (2009). The research design is structured into two complementary phases, allowing for conceptual development followed by contextual validation.

Phase 1: Literature Synthesis

The first phase involves a broad data collection effort to establish a baseline of current industry practices. A pool of literatures is being studied to run the literature synthesis. This systematic review was carried out using multiple databases namely Scopus and Web of Science, covering areas in digital transformation imperatives, smarter infrastructure and digital twins, advanced materials for next-generation infrastructure, sustainability, resilience and strategic management, strategic management in engineering projects, project governance and leadership, risk management and resource allocation, change management and stakeholder management. The narratives provide opportunities to link between strategic management and innovation in civil engineering towards sustainable and resilient infrastructure.

Rather than aiming for exhaustive coverage, the literature synthesis prioritised influential, high-quality, and representative studies to capture dominant theoretical perspectives, emerging



trends and key managerial challenges. This approach enabled the identification of recurring patterns linking innovation drivers with strategic management mechanisms, such as governance structures, leadership capabilities, lifecycle cost analysis, risk management, and organizational change processes. The findings from this phase informed the development of an integrated conceptual framework that positions management as the “strategic bridge” between technological innovation and sustainable, resilient infrastructure outcomes.

Phase 2: Case Studies

The second phase employs case studies to contextualize and substantiate the conceptual framework, aims to describe the success and failure of certain strategies. Case study methodology is particularly well suited for to examining complex socio-technical phenomena where contextual factors, organizational dynamics, and managerial decision-making play a critical role. For this study, two major infrastructure projects were selected for in-depth analysis:

- ***Smart City Integration: The Digital Precinct***
This case study proves that good strategic management facilitates innovation in engineering using a smart city project called the Digital Precinct as an example. The project targeted to cut down energy use by 20% a mixed-use urban area by using digital technologies such as Building Information Modelling (BIM) and the Internet of Things (IoT) to monitor and manage assets in real time.
- ***Infrastructure Resilience: Self-Healing Materials***
This case examines a coastal bridge project employing self-healing concrete to combat saltwater corrosion, a common and destructive environmental factor. The models used in the case study.

The literature synthesis provides generalizability, representing the connection between strategy and innovation is statistically significant. On the later, the case studies ground the context, suggesting in-depth narratives on how management frameworks are reasonably used as engineering problems solutions. By combining conceptual synthesis with empirical evidence, this research design allows for a nuanced understanding of how strategic management enables innovation in civil engineering. The methodology is particularly suited to addressing “how” and “why” questions related to innovation adoption, organisational readiness, and long-term infrastructure performance, thereby aligning closely with the study’s aims and objectives.

Analysis and Discussion

The integration of strategic management into civil engineering is not merely an administrative exercise; it is a fundamental determinant of project success in the modern era. Our analysis indicates that while technological readiness is high, organizational readiness often lags, creating a bottleneck for innovation.



The Strategic Influence on Technology Adoption

The empirical evidence underscores a profound paradigm shift in the civil engineering sector, where the traditional focus on physical construction is being superseded by the integration of cyber-physical systems. Within this evolving landscape, strategic management emerges not merely as an administrative necessity but as the definitive "soft infrastructure" required to sustain and operationalise "hard infrastructure" innovations (Koppa et al., 2023). The successful assimilation of technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), and Digital Twins is contingent upon a robust managerial environment that provides the structural integrity for technological deployment.

A key finding of this research is that governance must come before technology. When sophisticated tools are introduced into an organization with no clear decision-making authority, accountability frameworks, or dispute resolution procedures, stakeholder frustration, cost overruns, and systemic failure are unavoidable. Robust strategic governance serves as both a filter and an accelerator, ensuring that technological choices are in line with institutional goals and environmental conditions. This alignment enables a shift from a "technology-push" approach, which frequently results in institutional inertia and cultural opposition, to a "market-pull" framework in which innovation is driven by strategic intent and operational need.

The effectiveness of this strategic strategy is most evident in the rapid adoption of digital advances. Organisations can reduce implementation friction by using structured change management frameworks to address the "people side" of transformation. This entails establishing dual paths for engagement in which top-down strategy instructions are matched with bottom-up problem-solving, allowing the workforce to participate in technological adaption to their individual workflows. This bidirectional involvement turns technology adoption into an opportunity for organizational learning, rather than a source of disturbance.

Furthermore, strategic management influences the financial and risk profiles of infrastructure projects. By shifting their attention from initial capital investment to total cost of ownership or lifecycle analysis, strategic leaders can justify the higher upfront expenditures of innovative materials and smart systems with long-term operating savings and increased resilience. Effective governance also allows for more sophisticated risk-sharing arrangements, such as collaborative contracting and public-private partnerships, which spread the risks of untested technology among several stakeholders. Finally, treating data with the same strategic rigour as physical assets enables predictive maintenance and proactive asset management, ensuring that modern infrastructure is not only technologically advanced, but also strategically sustainable and capable of meeting the challenges of the twenty-first century. Based on the analyses of the literature review, the researchers propose the governance-conditioned framework for innovation adoption in civil engineering as exhibited in Figure 1.

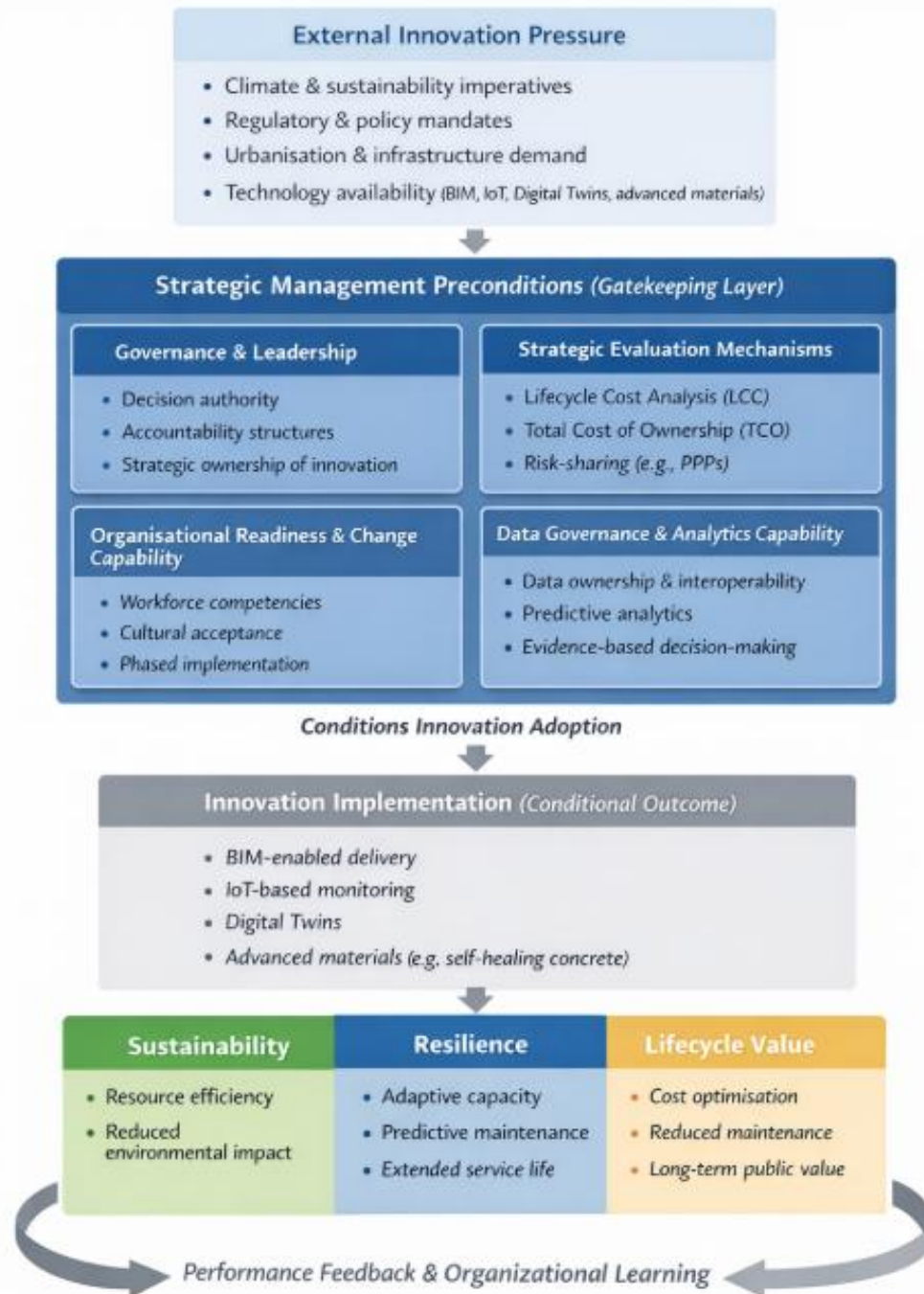


Figure 1. A Governance-conditioned Framework for Innovation Adoption in Civil Engineering

Lifecycle Value

Innovation inherently carries risk, but our findings demonstrate that strategic management provides the essential tools for effective risk mitigation and significant cost optimization within



civil engineering projects. A key shift highlighted in recent literature is the move from a narrow focus on initial Capital Expenditure (CAPEX) to a comprehensive Lifecycle Costing (LCC) approach, which accounts for Operational Expenditure (OPEX) over the entire lifespan of an asset (Ascione et al., 2024; Wu et al., 2023). For instance, while advanced materials like self-healing concrete may present higher upfront costs, a strategic LCC analysis often justifies this investment through substantial reductions in maintenance, repair, and replacement costs over a 50-year horizon or more, ultimately leading to greater long-term economic viability and sustainability (Bras et al., 2021; De Gooyert, 2020). This strategic foresight is critical for making informed decisions that balance immediate financial outlays with future operational savings and environmental benefits (Singh, 2024).

Furthermore, effective governance structures, often facilitated by strategic management, enable improved risk-sharing models, particularly in Public-Private Partnerships (PPPs). These models encourage the adoption and testing of unproven yet potentially transformative technologies without exposing any entity to catastrophic financial loss (Baldini et al., 2019). By clearly allocating risks and responsibilities among public and private stakeholders, PPPs can serve as incubators for innovation, enabling careful piloting and scaling of new engineering solutions that might otherwise be deemed too risky for traditional procurement models (Li et al., 2022). This strategic approach to risk allocation is pivotal to fostering an environment in which technological innovation in civil engineering can thrive responsibly (Sanchez-Silva & Baker, 2024).

Sustainability and Resilience Outcomes

Modern infrastructure development has progressed beyond the days when environmental factors were viewed as optional add-ons or secondary compliance concerns. Today's most successful projects place sustainability and resilience at the heart of their strategic identity. Organisations guarantee that ecological health and structural durability are prioritised at all stages of decision-making by incorporating these objectives directly into the project's founding charter rather than treating them as external requirements. This strategic shift fosters a culture of responsibility in which environmental performance is evaluated as a primary criterion of project success, ensuring that high-level visions are turned into measurable, on-site outcomes.

Strategic procurement serves as a powerful engine for this transformation, turning purchasing decisions into catalysts for industry-wide innovation. When a project mandates strict green standards for its materials and services, it does more than just select sustainable options; it actively reshapes the supply chain. By signalling a non-negotiable demand for low-carbon materials and energy-efficient technologies, project leaders incentivize suppliers to invest in research and development. This ripple effect pushes the entire market toward more creative and sustainable solutions, proving that a well-defined strategic framework can extend a project's positive impact far beyond its own physical boundaries.

Ultimately, the integration of sustainability and resilience within a single governance structure ensures that infrastructure remains functional and beneficial over the long term. A project is only truly successful if it can balance immediate environmental stewardship with the strength



to withstand future climate stresses or unforeseen shocks. This holistic approach prevents the common pitfall of sacrificing long-term durability for short-term "green" wins. By formalizing these values in the strategic charter, leadership provides the necessary protection for these goals, ensuring they are not stripped away during budget cuts or cost-saving exercises. This creates a unified front where all stakeholders are aligned toward delivering infrastructure that is both enduring and environmentally responsible.

Phase 2: Case Studies

Smart City Integration: The Digital Precinct

This case focuses on a major urban development project that integrated Building Information Modeling (BIM) and the Internet of Things (IoT) for real-time asset management (Huang et al., 2024; Pandey et al., 2025).

The Challenge: The project aimed to reduce energy consumption by 20% across a mixed-use precinct. The primary technical challenge involved integrating disparate data systems from various urban services, such as water, energy grids, and traffic management, into a cohesive, actionable platform (Aleke et al., 2025).

Strategic Approach: The project leadership adopted a "Platform Ecosystem" strategy, moving beyond treating contractors as isolated vendors. They established a unified data governance protocol that mandated interoperability and open data standards among all participants. This strategic decision was crucial for creating a collaborative environment where data could flow seamlessly and be leveraged effectively (Asare et al., 2025; Shehata et al., 2025). This approach reflects a growing trend in smart city development toward integrated, citizen-centric governance (El-Agamy et al., 2024).

Outcome: The strategic decision to mandate open data standards was the linchpin of this success. The seamless integration enabled the creation of high-fidelity Digital Twins, thereby enabling predictive maintenance of HVAC systems and other critical infrastructure components (Kessler & Köhncke, 2025; Sakr & Sadhu, 2024). By anticipating failures and optimizing performance in real time, the project successfully met its ambitious energy-reduction targets, demonstrating the power of strategically managed digital integration (Abdelalim et al., 2025).

Infrastructure Resilience: Self-Healing Materials

This case examines a coastal bridge project employing self-healing concrete to combat saltwater corrosion, a common and destructive environmental factor (Soliman et al., 2022; Tiza et al., 2024).

The Challenge: Traditional concrete in this aggressive coastal environment typically requires costly repairs and extensive maintenance every 10 years, leading to significant lifecycle costs and operational disruptions (Adhikary et al., 2024; Osibodu et al., 2025). The proposed engineering solution was to use bacteria-infused concrete that autonomously repairs its own



microcracks, thereby resisting corrosion and extending structural longevity (Bras et al., 2021; He et al., 2025).

Strategic Approach: The high upfront cost of these innovative materials initially threatened the project's viability. However, the management team strategically utilized a "Total Cost of Ownership" (TCO) model to present a compelling financial argument to government stakeholders (Ascione et al., 2024; Wu et al., 2023). This model demonstrated that despite higher initial investments, the long-term savings from reduced maintenance, extended service life, and enhanced resilience provided a superior economic outcome (De Gooyert, 2020). Furthermore, stringent managerial oversight and performance-monitoring protocols were implemented to track the material's real-time performance and validate TCO projections (Firoozi et al., 2024; Wohlleben et al., 2024).

Outcome: The project received approval based on its demonstrated long-term value and improved resilience, validating the critical role of strategic financial modeling and robust performance verification in championing innovative engineering solutions (Kaewunruen et al., 2025). This case highlights how strategic management can bridge the gap between technical innovation and practical implementation by focusing on holistic value propositions.

Lessons Learned

Modern infrastructure innovation is not just about adopting the latest technology; it is about changing how we manage projects, information, and partnerships. Research suggests that while technical solutions often exist, the real challenge lies in the human and organizational systems that support them. Thus, by focusing on clear governance, data stewardship, and smarter procurement, organizations can move from traditional, rigid practices to more resilient and innovative outcomes.

Establish Clear Governance Before Adopting New Technologies

The most important lesson for any infrastructure project is to set up a "decision-making map" before buying expensive technology. Many organizations rush to purchase advanced tools like Building Information Modelling (BIM) or Artificial Intelligence (AI) without first deciding who is in charge of them. This often results in "technological confusion," where sophisticated systems are underused because no one knows who is responsible for the data or the final results. Thus, without this "soft infrastructure" of rules and leadership, even the most expensive tools will fail to deliver their intended value. Effective governance provides a clear framework for deciding between competing priorities, such as cutting costs versus achieving sustainability goals. It is about breaking down the walls between departments, like engineering, finance, and operations, so they can share goals and collaborate. All in all, history shows that projects usually fail because of leadership and organizational gaps rather than technical glitches. Therefore, by putting governance first, organizations ensure that technology serves their strategic goals, rather than forcing them to scramble and fix problems afterward.



Recognize Data as a Strategic Asset Deserving Serious Management

Infrastructure projects generate a massive amount of information every day, from sensor readings to financial logs. Nevertheless, most firms treat this data as "digital trash" that is forgotten once a project ends. Hence, this is a missed opportunity, since data should be treated as a valuable resource, just like concrete or steel, because it allows managers to make decisions based on facts rather than guesses. On that account, when information is collected consistently and organized well, it unlocks the ability to spot risks before they become expensive emergencies.

Treating data as a strategic asset requires a shift in mindset. Organizations need systems where different software platforms can "talk" to each other and keep information secure. While these steps might seem like boring paperwork, they allow managers to see which suppliers are reliable and which building systems actually save energy. The long-term financial returns from managing information well can rival the returns from physical equipment. Ultimately, firms that commit to this kind of "data stewardship" gain a massive advantage by being able to predict the future performance of their assets.

Transform Procurement Practices to Enable Rather Than Restrict Innovation

Many great ideas normally never make it to the construction site because they are blocked by old-fashioned contracts. Traditionally, contracts tell builders exactly how to work, which materials to use, and which steps to follow. While this reduces some uncertainty, it also kills innovation because builders are forbidden from trying something better. Thus, in order to fix this, leading organizations are moving toward "outcome-based" contracts. Instead of listing every material, they specify the goals, like reducing carbon emissions or making sure a structure lasts 50 years, and then invite experts to propose the best way to get there.

This change also means moving away from always choosing the "cheapest bid." Novel solutions often cost more at the start, but they save money over time. As a result, by using Total Cost of Ownership analysis, organizations can justify upfront investments in materials like self-healing concrete that reduce maintenance costs for decades. Finally, successful firms are moving away from adversarial relationships and toward genuine partnerships with their contractors. Accordingly, when owners and builders work together to test new ideas in small pilot projects, they reduce risk and turn procurement into a powerful engine for innovation.

Strategic Recommendations: Framework for Integration: The "Techno-Strategic" Approach

Based on the analysis, we propose the following strategic imperatives for the civil engineering sector to harness innovation and develop sustainable, resilient infrastructure effectively.

Firms in the civil engineering sector should adopt a comprehensive "Techno-Strategic" framework to systematically integrate emerging technologies and innovative practices into



their core operations (Gledson et al., 2023; Zulu et al., 2024). This framework consists of three interconnected phases:

Phase 1: Continuous Environmental Scanning for Emerging Technologies. This initial phase involves actively monitoring the technological landscape for advancements such as Artificial Intelligence (AI), advanced robotics, nanomaterials, and new data analytics tools that could impact civil engineering (Lu et al., 2024; Nyokum & Tamut, 2025). Strategic managers should establish mechanisms for horizon scanning, technology scouting, and continuous learning to identify potential innovations early (Kringelum et al., 2024; Purwanto et al., 2024). This proactive approach ensures that organizations are aware of disruptive technologies and can assess their relevance to future projects and operational efficiencies (Karmakar & Delhi, 2021).

Phase 2: Aligning Technology Selection with Organizational Capabilities and Strategic Goals. Once potential technologies are identified, the next phase focuses on rigorous strategic alignment. This involves evaluating how new technologies fit with the firm's existing capabilities, resources, and overarching strategic objectives (Cruz et al., 2023; Jeong & Park, 2023). It is crucial to conduct thorough feasibility studies, cost-benefit analyses (including LCC and TCO), and risk assessments to ensure that selected innovations directly contribute to the organizational goals of sustainability, resilience, and operational excellence (Ascione et al., 2024; Wu et al., 2023). This phase also involves assessing the workforce's and organizational culture's readiness to adopt and integrate these new technologies (Lopes & Filho, 2024; Montalbán-Domingo et al., 2020).

Phase 3: Using Agile Project Management to Pilot and Scale Innovations. The final phase involves the practical implementation and scaling of selected innovations. Adopting agile project management methodologies can facilitate the piloting, testing, and incremental deployment of new technologies, allowing for flexibility, rapid iteration, and continuous feedback (Asare et al., 2025; Shehata et al., 2025). This approach enables organizations to learn from early implementations, adapt strategies as needed, and scale successful innovations more efficiently across larger projects and portfolios. Effective execution also requires establishing robust performance monitoring systems (e.g., through Digital Twins) to track the impact of innovations and validate their contributions to project outcomes and organizational goals (Kessler & Köhncke, 2025; Sakr & Sadhu, 2024).

Conclusion

This paper has argued that strategic management is the essential means for innovation in civil engineering. The engineering challenges of the 21st century demands more than technical solutions. A strategic management has proven its effectiveness towards achieving a sustainable and resilient infrastructures. The application of managerial skills among engineers are required for this and for managers to understand engineering will also provide a good balance between a project-centric view and strategic-centric view. This holistic approach is believed to build infrastructure that stands the test of time for a more sustainable future.



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TRADITION, MUSICAL LANGUAGE, AND PERFORMANCE INTERPRETATION IN A CONTEMPORARY GUZHENG CONCERTO: *NIGHT MOORING AT MAPLE BRIDGE*

Guo Qianru¹, Tee Xiao Xi^{2*}

¹Faculty of Creative Industries, City University Malaysia, Malaysia, (948055513@qq.com)

²Faculty of Creative Industries, City University Malaysia, Malaysia, (teexiaoqi@city.edu.my)

Abstract: *The guzheng concerto Night Mooring at Maple Bridge exemplifies the integration of traditional Chinese musical elements within a contemporary concerto framework. Drawing inspiration from classical poetry, regional folk idioms, and operatic traditions, the work offers a valuable case for examining how traditional materials are reconfigured in modern Chinese instrumental music. This article investigates the concerto from two complementary perspectives: compositional organisation and performance interpretation. Through score-informed analysis, the study examines how elements derived from Kunqu opera, Jiangnan sizhu, southern Jiangsu folk song styles, and classical Chinese poetic imagery shape the work's melodic language, tonal organisation, and formal structure. Particular attention is given to the ways in which these elements are adapted rather than directly quoted, resulting in a distinctive contemporary musical language. In addition, the study considers how performers realise and reinterpret these traditional elements in practice. By close listening and score-informed examination of articulation, timbral treatment, tempo flexibility, and expressive techniques such as glissando, scraping, and tremolo, the analysis demonstrates how performance interpretation contributes to the construction of poetic atmosphere and emotional progression across different sections of the work. The findings suggest that traditional musical elements in Night Mooring at Maple Bridge function not only at the level of compositional design, but are actively re-shaped through embodied performance practice. By linking structural analysis with interpretative insight, this study contributes to performance-centred research on the guzheng concerto and offers perspectives relevant to contemporary Chinese instrumental performance and pedagogy.*

Keywords: *Guzheng Concerto, Chinese Traditional Musical Elements, Compositional Organisation, Performance Interpretation, Contemporary Chinese Instrumental Music*

Introduction

Composer Background

Wang Jianmin is a renowned Chinese composer from Wuxi, Jiangsu Province. His musical compositions span multiple genres, including symphonic works, chamber music, and pieces for traditional Chinese instruments (Wang & Li, 2021). His works for traditional instruments primarily focus on the erhu and the guzheng, and he has released multiple solo albums (Wang & Kantasiri, 2024). His works are characterised by a strong national stylistic orientation and have contributed to the contemporary development of Chinese traditional instrumental music.

While incorporating modern compositional techniques with diverse Western musical elements, Mr. Wang Jianmin also promotes traditional Chinese music and culture within his works (Huan



& Maneewattana, 2024). For example, various Chinese traditional elements, such as ancient Chinese poetry, folk music and opera, and historical figures, have been incorporated into his musical works. His compositions feature both familiar and catchy traditional themes and melodies, as well as innovative dramatic developments. The rich harmonic colors and innovative performance techniques have made his works highly popular among performers.

Background of the Composition

Night Mooring at Maple Bridge is one of Wang Jianmin's signature works, a concerto for Guzheng and piano inspired by the ancient poem of the same name by the poet Zhang Ji (Wang, 2015). The composition vividly recreates the scenes depicted in the poem, immersing both listeners and performers in the depicted atmosphere.

This work exhibits distinct characteristics of *program music*. Within instrumental composition, *program music* refers to works that employ explicit titles or extramusical references to evoke specific imagery or narratives (Hepokoski, 2014). In Guzheng music, the titles of such works often draw from poetry, historical allusions, natural phenomena, and similar non-musical subjects, serving as inspiration for composing descriptive Guzheng pieces.

Composer Wang Jianmin integrates the ancient poetic context of *Night Mooring at Maple Bridge* with the Guzheng concerto, weaving elements of Kunqu opera and classical poetry into its unique musical language. This enriches the concerto with depth and distinctive style. The poetic elements evoke the melancholy beauty and profound loneliness of the Jiangnan nightscape as perceived by a traveller in a foreign land. They further express the poet's frustration at being unrecognised for his talents, the bitterness of displacement, and a longing for peace and stability amid turbulent times (Li, 2021).

The composer altered the traditional pentatonic tuning of the Guzheng, expressing his personal artistic style and reflections on art through a modified string sequence. With meticulous refinement, he crafted his Guzheng concerto.

Problem Statement

As a traditional Chinese instrument, the guzheng has continuously expanded its expressive range within the broader process of musical modernisation (Chen & Li, 2023). The guzheng concerto *Night Mooring at Maple Bridge*, inspired by the poetic imagery of Zhang Ji's Tang dynasty poem, integrates traditional Chinese musical elements within a contemporary concerto framework. Through this integration, the work reconfigures traditional materials at the levels of musical language, structure, and performance technique, making it a significant case for scholarly investigation.

However, existing studies tend to focus on isolated aspects, **which, from a performance-oriented perspective, makes it difficult to derive coherent interpretative guidance for performers.** Systematic discussion of how traditional Chinese elements are organised within compositional structures and subsequently realised through performance interpretation remains limited. In particular, the interpretative role of performers in shaping, transforming, and conveying these traditional elements has not been sufficiently examined.



Moreover, the presentation of traditional elements in concerto repertoire is not determined solely by compositional design, but is also closely connected to performers' technical decisions, aesthetic judgement, and stylistic understanding (Clarke & Doffman, 2014). The lack of integrated analytical perspectives linking compositional organisation with performance interpretation has made it difficult to offer coherent interpretative guidance for performance practice, pedagogy, and scholarly analysis.

In response to these gaps, this study examines *Night Mooring at Maple Bridge* from two complementary dimensions: compositional organisation and performance interpretation. Through score-informed listening analysis and close observation of performance practice, the study explores how traditional musical elements are structured, articulated, and reinterpreted in performance, thereby contributing to a more integrated understanding of contemporary guzheng concerto interpretation.

Literature Review

Research on the guzheng has long emphasised the instrument's historical development and its evolving relationship with tradition and modernity. Within contemporary composition and performance, scholars have noted that guzheng music increasingly reflects a synthesis of national stylistic identity and multicultural influences, particularly in the expansion of large-scale forms such as ensemble works and concerto repertoire (Du & Wang, 2024; Huang & Huang, 2025). These studies highlight how traditional musical elements continue to be reinterpreted within modern compositional contexts, contributing to the diversification of guzheng musical language.

Existing scholarship on the incorporation of traditional Chinese elements in guzheng concertos has primarily focused on three areas: the nationalisation of musical language, the expression of poetic and cultural imagery, and the inheritance and innovation of performance techniques. While these studies offer valuable stylistic insights, **they remain largely descriptive and do not sufficiently address how interpretative decisions emerge in performance practice.**

Specific research on the guzheng concerto *Night Mooring at Maple Bridge* has largely concentrated on its artistic characteristics and technical features. Scholars have examined the work's melodic organisation and tonal design, noting the layered thematic development and its alignment with a distinctly Chinese aesthetic orientation (Pearce, 2005). Other studies have explored the interaction between traditional Chinese elements and Western compositional models, particularly the concerto form and the use of the piano as a collaborative instrument (Zhang, 2021; Zhang, 2023). From a performance perspective, research has discussed the expressive potential of guzheng techniques and their role in conveying recitative qualities and aesthetic depth (Wang, 2025), while performer-informed reflections have contributed practical insights into interpretative practice (Blom & Poole, 2004).

In recent years, some studies in music performance research have introduced digital tools and visualisation methods to examine performance processes (Yang & Huang, 2016; Yang, 2017; Cancino et al., 2018). Although such approaches have expanded methodological possibilities, their application to guzheng concerto performance remains limited and has not yet produced a



coherent interpretative framework that integrates compositional structure with performance practice.

Overall, existing literature has established a foundational understanding of the compositional background and technical features of *Night Mooring at Maple Bridge*. However, a gap remains in studies that systematically examine how traditional Chinese musical elements are organised within the concerto's structure and subsequently realised through performance interpretation. By focusing on the relationship between compositional organisation and interpretative practice, the present study seeks to address this gap and contribute a performance-centred perspective to contemporary guzheng concerto research.

Research Methods

This study adopts a performance-centred interpretative approach grounded in attentive listening, score-informed analysis, and contextual examination of compositional and stylistic features. The research begins with a critical review of existing scholarship on guzheng music, traditional Chinese musical elements, and concerto repertoire in order to establish the cultural and theoretical context of the work.

Rather than prioritising technological measurement or quantitative data, the analysis focuses on how traditional Chinese musical elements are organised at the compositional level and realised through performance interpretation. The study examines musical structure, tonal organisation, rhythmic design, and performance techniques as interrelated dimensions, emphasising the interpretative decisions through which performers articulate musical meaning in practice.

Score analysis is employed to identify the structural framework, modal organisation, and thematic processes of *Night Mooring at Maple Bridge*. These observations are complemented by close listening to representative performance recordings, through which variations in articulation, timbre, tempo flexibility, and expressive gesture are examined. By relating compositional design to interpretative practice, the study seeks to clarify how traditional elements are transformed and recontextualised within a contemporary guzheng concerto.

Through this integrated analytical perspective, the research aims to contribute to performance interpretation studies of Chinese instrumental music, offering insights relevant to scholarly analysis, pedagogy, and performance practice.

Score analysis of the Guzheng concerto *Night Mooring at Maple Bridge* *Tuning Characteristics of the Work*

The melody and tuning of *Night Mooring at Maple Bridge* are more complex than those of typical traditional instrumental works. As shown in Figure 1, the composer adopts a traditional heptatonic court music system as the foundational mode, synthesising three *gong* (宫) modes to create an artificial modal scale tailored specifically for this piece (Wang, 2015).



Figure 1: *Night Mooring at Maple Bridge*, tuning system and modal organisation.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

The fundamental tuning principle of the guzheng follows the pentatonic scale pattern of “one string, one position, one pitch.” However, this tuning method imposes certain limitations and a degree of uniformity on guzheng composition (Wang, 2025). In contrast, artificial modal tuning refers to modal systems intentionally designed by composers to meet the specific expressive demands of individual works. This compositional approach was pioneered by the Western modernist composer Olivier Messiaen (Lundblad, 2023).

In *Night Mooring at Maple Bridge*, Wang Jianmin employs a distinctive approach to tuning by blending the B $\flat$ -zhi (徵) pentatonic scale with the C-yu (羽) yayue (雅乐) scale. This modal combination forms a characteristic tonal framework that underpins the work’s harmonic language. The resulting modal complexity extends the piece beyond conventional technical and expressive boundaries, enriching its musical content and lending it a more song-like quality. The artistic conception conveyed through this tonal organisation aligns closely with the imagery and emotional atmosphere evoked by the poetic source.

In addition, the temporary modulations required by the melodic progression cannot be achieved solely through left-hand pitch alteration. Instead, the performer must execute two temporary adjustments to the bridge during performance in order to fulfil the modulation requirements, as illustrated in Figure 2.

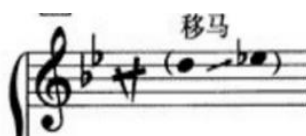


Figure 2: *Night Mooring at Maple Bridge*, bar 36.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

Analysis of the Work's Structure

The work is organised into three principal stages framed by an introduction and a coda, and may be divided into three main sections: a slow-tempo thematic section, a middle section comprising *Andante* and *Allegretto*, and a recapitulation of the slow-tempo theme.

The introduction is serene and expansive, drawing inspiration from the *Kunqu* (昆曲, traditional Chinese opera) technique of *jinda manchang* (紧打慢唱, “fast tempo with slow singing”). The slow section employs a seven-note classical mode with added altered pitches and is characterised by a relatively free and relaxed rhythmic organisation. This is followed by an expressive, song-like *Andante* section in which tempo flexibility and emotional intensity gradually increase. As the music accelerates, its affective trajectory rises and falls,



progressively intensifying the thematic material. The return of the slow-tempo theme leads into a coda that evokes a sense of stillness and closure.

The beginning and ending of the work, as well as the transitions between sections, are articulated through relatively free, unmetered passages. Notably, two cadenzas function as structural bridges linking the principal sections, with melodic material alternating between melancholy and impassioned character. The formal structure of the work is summarised in Table 1.

Table 1: Form Structure of *Night Mooring at Maple Bridge*

Section	Bars
Introduction	1–8
Slow-tempo theme	9–35
Transition	36–37
Andante–Allegretto	38–82
Cadenza	83–93
Recapitulation	94–118
Coda	119–128

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

Application of Chinese Traditional Elements

The composition preserves the melodic characteristics and tonal orientation of Chinese folk music while incorporating elements of classical Chinese poetry into its musical language. Through this integration, traditional Chinese elements contribute to the formation of a coherent and evocative artistic conception throughout the work.

Application of Kunqu (昆曲) Musical Elements

Kunqu, when classified according to modal systems, may be broadly divided into *Nanqu* (南曲, Southern opera) and *Beiqu* (北曲, Northern opera) traditions (Lau, 2023). *Nanqu* typically employs pentatonic scales that omit scale degrees “4” and “7”, whereas *Beiqu* melodies are heptatonic and frequently incorporate these pitches. On this basis, *Night Mooring at Maple Bridge* may be associated more closely with the musical style of *Beiqu*.

Rather than directly quoting *Beiqu* melodies, the composer adapts characteristic *Kunqu* melodic materials by incorporating commonly used motivic patterns. *Kunqu* influence is evident in the frequent use of descending stepwise motion, as well as in characteristic melodic motifs such as “1–7–6” and “1–2–7–6”. These motifs appear in varied forms throughout the guzheng composition.

The first instance of this motivic prototype is illustrated in Figure 3, where the motif is employed within phrases and at phrase endings in a manner comparable to its usage in *Beiqu* melodies.

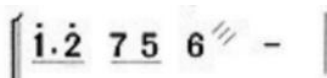


Figure 3: Night Mooring at Maple Bridge, bar 42.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

In Figure 4, the composer expands the “1–2–7–6” motif by incorporating scale degree “5”. This modification smooths the melodic contour, accentuating the characteristic timbral qualities of the guzheng while softening the directness often associated with northern *Kunqu* melodies. At the same time, it introduces a more flowing and lingering quality reminiscent of southern *Kunqu* styles, aligning the music more closely with the gentle aesthetic of Jiangnan traditions. This technique recurs throughout the work.



Figure 4: Night Mooring at Maple Bridge, bar 14.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

As shown in Figures 5 and 6, further variation is achieved by adding ornamental notes to scale degree “6” or by introducing a glissando leading into this pitch. Both approaches enhance the melodic expressiveness and contribute to a more vocal, singing quality.

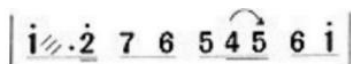


Figure 5: Night Mooring at Maple Bridge, bars 19–20.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

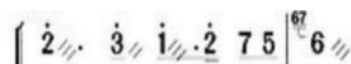


Figure 6: Night Mooring at Maple Bridge, bar 31.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin guzheng works collection.

Beyond motivic reference, the composer frequently reworks *Kunqu*-derived melodic material to generate new thematic content. As illustrated in Figure 7, the *Adagio* theme of the piece exhibits a melodic structure closely related to the fifth phrase of *Xin shui ling* (新水令, “New Water Order”), with ornamental and passing tones added between the principal pitches. In parallel, pitch-shifting techniques are employed extensively to establish a distinctive tonal system within the work.

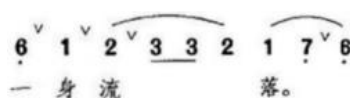


Figure 7: Xin shui ling (新水令), fifth phrase.

Source: Traditional *Kunqu* repertoire.

Application of Jiangnan Sizhu (江南丝竹) Musical Elements

Jiangnan Sizhu (江南丝竹), a traditional Chinese musical genre, is a significant branch of *sizhu* (丝竹, “silk and bamboo”) music and was historically known as *xiansuo* (弦索), serving as an accompaniment tradition for Kunqu opera (Chen & Sensai, 2023). The term *sizhu* in Jiangnan Sizhu music refers to the combined use of string and wind instruments in traditional Chinese instrumental ensembles. Among these, the *erhu* and *qudi* typically function as the principal melodic instruments, while instruments such as the *pipa*, *yangqin*, *guzheng*, *ruan*, and *sheng* serve accompanying and harmonic roles (Thrasher, 2023).

In *Night Mooring at Maple Bridge*, only the *guzheng* and piano are employed. However, the composer utilises a variety of playing techniques to achieve a seamless integration between the two instruments. Through these techniques, the sonic characteristics of instruments commonly associated with Jiangnan Sizhu ensembles are evoked, thereby recreating the timbral impression of a full traditional Chinese instrumental group.

In the introduction of the piece, the composer simulates the sonic qualities of the *yangqin*. As illustrated in Figure 8, the playing technique employed in this passage imitates the rapid, percussive articulation characteristic of *yangqin* performance.



Figure 8: Night Mooring at Maple Bridge, introduction, bar 1.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin *guzheng* works collection.

In the extended phrases of the *Adagio* theme, shown in Figure 9, the extensive use of tremolo highlights the fluidity of the melodic line. In performance, the resulting timbre resembles that of the *qudi* or the *erhu*—the two principal instruments in Jiangnan Sizhu music.



Figure 9: Night Mooring at Maple Bridge, Adagio section, bars 19–20.

Source: Wang Jianmin, *Night Mooring at Maple Bridge*, Wang Jianmin *guzheng* works collection.

Application of Sunan minge (苏南民歌) Music's Elements

Sunan minge (苏南民歌) refers to folk songs originating from southern Jiangsu Province in China (Huang et al., 2024). Rather than directly quoting specific *Sunan minge* melodies, this *guzheng* concerto incorporates the stylistic language and expressive characteristics associated with these folk traditions. Through the adaptation of melodic contour, rhythmic flexibility, and phrase organisation, the composer evokes folk-song idioms within an instrumental context.

As summarised in Table 2, this study combines musical examples with relevant literature to analyse the presence of *Sunan minge* stylistic features in the work. The table outlines how folk-song characteristics are manifested across dimensions such as tonality, phrase structure, and developmental processes. Through this approach, the concerto's integration of folk idioms is shown to function not as direct quotation, but as stylistic transformation within a contemporary compositional framework.

Table 2: Music Features Associated with *Sunan Minge* Stylistic Elements in *Night Mooring at Maple Bridge*.

Section	Musical features	Analytical focus
Introduction and slow-tempo theme	Predominantly pentatonic pitch organisation; stepwise melodic motion; flexible rhythm	Establishes a lyrical, folk-song-like expressive tone
Development of the slow-tempo theme	Phrase-based structure with call-and-response relationships	Reflects folk-song dialogic thinking and melodic singability
Middle section and cadenza	Rhythmic and motivic development of tonal material	Transformation of folk elements in an instrumental context
Recapitulation and coda	Reappearance of thematic material with rhythmic flexibility	Emotional culmination and structural coherence

Source: Analytical Summary by the Author, Based on Score Analysis and Relevant Literature.

The Application of Elements from Classical Chinese Poetry

Zhang Ji's poem *Night Mooring at Maple Bridge* is widely known both in China and internationally for its vivid imagery and emotional depth (Yong, 2023). The poem depicts a late-autumn night scene marked by the setting moon, the cry of crows, river lanterns, and a solitary boat, conveying the inner reflections of a traveller far from home. Through the interaction between external scenery and inner emotion, the poem expresses feelings of loneliness, displacement, and longing amid turbulent times.

The guzheng concerto draws direct inspiration from this poetic source, and the musical structure mirrors the emotional progression of the poem. The first line establishes a melancholic atmosphere, which is reflected in the introduction through softly articulated phrases that emerge from a distance, approach gradually, and then recede. The subsequent slow-tempo section corresponds to the second line of the poem. Here, alternating 4/4 and 6/4 time signatures create subtle rhythmic fluctuations, reinforcing the sense of emotional unease and introspection.

The third line of the poem is characterised by increased motion and intensity, which is mirrored in the music through a faster tempo and heightened rhythmic activity, while the overall melodic direction remains descending, sustaining a sombre emotional tone. The fourth line returns to a slower tempo, with musical material gradually fading from intensity to calmness. The work concludes with left-hand arpeggiations that evoke stillness and introspection, intensifying the sense of solitude expressed in the poem.



The close integration of poetic imagery and musical structure gives the concerto its distinctive expressive character. In the slow section, a subsidiary “one-beat-per-note” line beneath the main theme suggests visual images such as flickering lanterns and distant bell sounds. A sudden acceleration in tempo subsequently captures the wandering thoughts of the traveller. Measures 41–44 and 45–48 form two converging phrases that employ a “fish-tail” compositional technique, analogous to *anadiplosis* in classical poetry. Just as *anadiplosis* links poetic lines into a continuous flow, this technique ensures melodic continuity in the *Andante* section, producing a seamless, lingering expressive effect.

Performance Interpretation: Expressing Musical Meaning through Technique

The Guzheng concerto *Night Mooring at Maple Bridge* was premiered by the Guzheng performer Ren Jie, as documented in an early audio recording released by Guzheng.cn (2009). The audio materials used in this study were obtained from publicly available recordings and analysed with a focus on interpretative strategies employed in the Guzheng part.

Introduction: Shaping Rhythm, Breath, and Dynamic Flow

The introduction consists of two closely related phrases, with the second echoing the first in melodic contour and rhythmic organisation. Rather than following a strict metrical structure, the phrasing unfolds with considerable flexibility, marked by pronounced dynamic contrasts. In this passage, Ren Jie’s interpretation captures the Kunqu aesthetic of *jinda manchang* (紧打慢唱, “fast tempo with slow singing”), in which rhythmic tension and expressive elasticity coexist.

In performance, the opening perfect fourth intervals are articulated through a carefully shaped alternation of tension and release, producing a “tight–loose–tight” gestural profile. As the passage progresses, a gradual acceleration in tempo is paired with a controlled increase in dynamic intensity. The playing technique evolves from right-hand *yaozhi* (摇指, tremolo) to alternating hands, and subsequently to counter-rotating finger tapping, leading toward a restrained local climax. The use of a sharply accented attack followed by an immediate withdrawal of sound enhances the sense of musical breath. The introduction concludes with an arpeggiated counterpoint between the two hands, moving from slow to fast and returning to stillness, creating a striking rhythmic contrast that prepares the expressive atmosphere of the work.

In addition, vibrato and slow-to-fast strumming are extensively employed in this section, recalling the drawn-out melodic gestures (*laqiang*, 拉腔) characteristic of Kunqu singing. Through these techniques, the Guzheng timbre approaches vocal expressivity, reinforcing the connection between technical execution and emotional projection. This approach exemplifies the aesthetic principle of *yiji dayi* (以技达意, expressing meaning through technique) (Jia, 2023).



Scraping Technique as an Interpretative Device Across Structural Sections

The scraping technique functions as a recurrent but highly adaptable interpretative device throughout the concerto, appearing prominently in the slow movement, the cadenza, and the recapitulation of the slow section. Although the same basic technique is employed across these passages, its execution, timbral character, and expressive function vary significantly according to structural context and emotional trajectory.

In the opening slow section, scraping is performed with restrained force and moderate speed, primarily centred on the middle region of the strings. This produces a subdued and inward sonic character that aligns with the imagery of nocturnal stillness and anchorage. The technique here serves a poetic function, contributing to an atmosphere of calm introspection rather than dramatic display.

By contrast, in the cadenza, scraping becomes markedly intensified. Increased speed, greater physical force, and heightened registral emphasis transform the gesture into a driving expressive force. In this virtuosic context, scraping propels the music toward its emotional and structural climax, amplifying tension and projecting an expansive sonic presence.

In the recapitulation of the slow movement, the scraping technique is once again transformed. The performer adopts a gentler approach, characterised by slower motion and reduced intensity, often executed on the left side of the bridge. This results in a softened timbral quality and a sense of emotional repose, guiding the music toward closure.

A comparative consideration of these three passages demonstrates that scraping is not applied as a mechanically repeated gesture, but is continuously reconfigured in response to changes in musical structure, expressive intent, and poetic imagery. Through this differentiated interpretative use, the scraping technique acquires dynamic expressive significance, shaping both the emotional contours and the formal progression of the concerto as a whole.

Conclusion

This study has examined the guzheng concerto *Night Mooring at Maple Bridge* through two interrelated dimensions: the organisation of traditional Chinese musical elements within the composition and their realisation through performance interpretation. Drawing on existing scholarship and score-informed analysis, the research has explored how traditional materials are integrated into a contemporary concerto framework and how their expressive potential is activated in performance.

At the level of musical language, the work makes extensive use of traditional modal systems, pentatonic pitch organisation, and *gong modes* principles. Rather than preserving these elements in a fixed or historical manner, the composer reconfigures them through modal alternation, scale expansion, and structural adaptation, enabling a contemporary rearticulation of traditional musical vocabulary. This approach allows the concerto to maintain cultural continuity while achieving a modern expressive language.

Structurally, the work follows the formal conventions of the concerto while incorporating narrative and poetic principles derived from Chinese aesthetic traditions. The interaction



between sectional organisation, thematic development, and free transitional passages reflects a synthesis of Western formal rigour and Chinese poetic logic, contributing to the work's distinctive structural character.

From a performance perspective, the study highlights the active role of interpretation in shaping musical meaning. Techniques such as glissando, scraping, tremolo, and dynamic shaping are not merely technical devices, but function as expressive resources through which performers articulate poetic atmosphere and emotional progression across different sections of the work. Through embodied performance practice, traditional elements are reinterpreted and transformed, extending their expressive significance beyond the level of compositional design.

Overall, the findings suggest that traditional Chinese musical elements in *Night Mooring at Maple Bridge* operate through a dynamic interaction between composition and performance. By linking structural analysis with interpretative insight, rather than offering a definitive analytical model, this study proposes a way of **listening to and performing** *Night Mooring at Maple Bridge* that foregrounds the interaction between structure and embodied interpretation. Future research may further expand this line of inquiry by comparing interpretative approaches among different performers, examining additional guzheng concertos within similar stylistic contexts, and exploring broader questions concerning the transmission and reinterpretation of traditional musical elements in contemporary Chinese instrumental music.

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EXTRA-VOCAL SOUND AND CONDUCTING GESTURE IN *CLOUDBURST*: A PRACTICE-LED PERSPECTIVE

Huang Yi¹, Tee Xiao Xi^{2*}

¹Faculty of Creative Industries, City University Malaysia, Malaysia, (370454003@qq.com)

²Faculty of Creative Industries, City University Malaysia, Malaysia, (teexiaoxi@city.edu.my)

Abstract: *This paper examines conducting gesture and related techniques required to realise extra-vocal sound in Cloudburst by Eric Whitacre, a widely performed work in the contemporary choral repertoire. Rather than relying solely on pitched singing, Cloudburst incorporates air sounds, body percussion, indeterminate vocal noise, and spatialised sound actions to evoke natural phenomena such as wind, rain, and thunder. Adopting a practice-led perspective, this study investigates how these sound-generating actions function structurally and expressively, and how conductors translate them into coherent musical and emotional outcomes through gesture design and rehearsal practice. The research is structured around three phases of inquiry: score analysis, rehearsal-based observation, and practice-led reflection. Particular attention is given to conducting gesture, dynamic control, rhythmic coordination, and spatial organisation in rehearsal and performance contexts. The findings suggest that the integration of extra-vocal sound significantly expands choral expressivity while placing increased demands on the conductor's physical communication, rehearsal planning, and interpretative decision-making. By articulating practical conducting strategies grounded in professional practice, this paper offers pedagogical insights into contemporary choral conducting and performance practice.*

Keywords: *Eric Whitacre, Cloudburst, Choral Conducting, Extra-Voice Sound*

Introduction

Eric Whitacre's choral work *Cloudburst* exists in two versions, a choral version and an orchestral version. Composed in 1995 and inspired by Octavio Paz's poem *The Cloudburst*, the work is widely recognised for its distinctive sonic imagination and evocative depiction of a rainstorm, from its initial formation to its eventual eruption (Grassi, 2010). Rather than relying solely on pitched singing and conventional harmonic progression, *Cloudburst* incorporates a range of extra-vocal sound materials, including air sounds, body sounds (such as snapping fingers and high-fives), non-traditional vocal timbres, and spatialised sound design. These elements generate a strong sense of immersion by mimicking natural phenomena such as wind, raindrops, and thunder. While such sound materials have often been discussed in relation to Whitacre's compositional language and atmospheric effect, their implications for conducting gesture and rehearsal practice merit closer examination.

Air sounds and accents constitute one of *Cloudburst*'s core expressive devices, representing subtle variations of nature through indeterminate pitch and dynamic nuance. From a conducting perspective, these sounds require particular attention to dynamic control, breath coordination, and rhythmic cohesion in rehearsal, as the conductor must guide singers to sustain musical



continuity without the support of fixed pitch structures (Wilkes, 2017). Body sounds, including snapping fingers and high-fives, function as rhythmic representations of rainfall, evolving from sparse gestures to dense, cascading textures. For the conductor, this process demands precise control over entrances, pacing, and accumulative intensity in order to preserve both clarity and dramatic momentum.

In addition, non-traditional vocal timbres—such as non-fixed pitch chanting and blurred vocal boundaries—further increase the expressive and technical demands placed on performers (Mabry, 2002). These challenges foreground the conductor's role in maintaining musical coherence through flexible gesture, refined dynamic shaping, and attentive listening across the ensemble. Another significant feature of *Cloudburst* is its spatial sound design, which often requires singers to be positioned in different locations or around the audience. While this spatialisation enhances the immersive quality of the work, it also places heightened demands on the conductor's ability to coordinate ensemble balance, visual communication, and rehearsal planning in performance contexts.

Overall, the integration of extra-vocal sound materials in *Cloudburst* has a profound impact on conducting practice. Beyond technical competence, conductors must develop strategies to translate these unconventional sound actions into coherent musical and emotional outcomes through gesture, rehearsal structure, and interpretative decision-making (Krudop, 2003). Adopting a practice-led perspective, this study examines how conducting gesture functions as a mediating tool between extra-vocal sound, ensemble coordination, and expressive realisation in *Cloudburst*, thereby contributing pedagogical insights into contemporary choral conducting practice.

Score Analysis on the Non-Verbal Elements

This section outlines the formal framework within which extra-vocal sound actions are structurally deployed, providing an analytical point of reference for the subsequent discussion of conducting practice.

Table 1: Formal Structure and Tonal Design of *Cloudburst*

Section	Formal Unit	Subsection	Measures	Tonality	Performance Feature
I. Opening	A	a / a1	1–9	A major	A cappella
	Link	—	10	—	Baritone solo
	B	b / b1	11–27	E minor	A cappella
	A1	a2	27–32	A major	A cappella
	Link	—	32–34	—	Spoken text
II. Middle	C	c	34–39	E minor	A cappella
	D	d	39–42	G major	A cappella
	E	e	43–46	B major	A cappella
	F	f / g	47–57	A major	Textural expansion
	Link	—	58–59	—	Solo soprano / air sound
III. Coda	Coda I	—	60–69	A major	Percussive effects
	Coda II	—	70–75	A major	Body percussion
	Coda III	—	76–84	A major	Full ensemble



Source: Table Compiled by the Author Based on Score Analysis of *Cloudburst* (Whitacre, 1996).

As summarised in Table 1, *Cloudburst* adopts a non-repetitive, tripartite formal design articulated through a continuous process of textural and timbral transformation rather than thematic recapitulation. The opening section establishes a predominantly a cappella sound world, within which extra-vocal gestures are gradually introduced as integral structural elements rather than ornamental effects.

The middle section intensifies this approach through progressive textural expansion and increasing rhythmic activity, creating a structural framework that supports the accumulation of non-verbal sound actions. In the final section, the incorporation of body percussion and full ensemble participation produces a climactic convergence of vocal and extra-vocal materials. This formal organisation, characterised by evolving texture and the strategic deployment of non-pitched sound, reflects Whitacre's broader compositional emphasis on sonority and atmosphere and provides a clear structural basis for the conductor's management of non-verbal elements in rehearsal and performance (Grassi, 2010; Hall, 2012; Larson, 2004).

The Conductor's Perspective on Non-Verbal Communication with the Performers

In Eric Whitacre's *Cloudburst*, the use of non-verbal elements such as air sounds, snapping fingers, thighs tapping, and clapping constitutes a central expressive feature of the work. These extra-vocal sound materials enrich the rhythmic and emotional palette of the choral texture while enabling the piece to move beyond conventional pitch-based choral writing. Such practices can be situated within a broader twentieth-century tradition of extended vocal and non-pitched sound techniques, in which the voice is treated as a flexible sound-producing medium rather than a purely melodic carrier (Mabry, 2002; Crump, 2008; Montgomery, 2005).

Within this performative context, the conductor assumes a crucial mediating role. Beyond the precise coordination of sound actions, the conductor must ensure that extra-vocal elements integrate coherently with the sung choral parts in order to maintain expressive clarity and dramatic continuity (Johnson, 2019). Bodily communication—particularly gesture and facial expression—therefore becomes central to the successful realisation of these sound materials.

Air sounds are frequently employed to express subtle emotional fluctuations and to evoke natural phenomena such as wind or rain. As these sounds rely solely on controlled airflow rather than fixed pitch, they contribute an ethereal and transparent sonic texture, particularly effective in the articulation of atmospheric states. For example, in bar 59 of *Cloudburst* (Figure 1), air sounds are used to suggest the presence of wind immediately preceding the storm.



Figure 1. Eric Whitacre, *Cloudburst*, SATB score, bars 58–59 (air sounds).

Source: Whitacre (1996)

From a conducting perspective, the effective realisation of air sounds depends primarily on physical communication rather than verbal instruction. Previous studies have identified conducting gesture as a form of non-verbal communication that shapes performers' perception of timing, intensity, and expressivity (Ford, 2001; Krudop, 2003; Luck et al., 2010; Poggi et al., 2020). In practice, the conductor must employ highly restrained gestures and subtle bodily cues to guide singers' breath control and sustain ensemble cohesion. Because air sounds lack rhythmic anchoring and pitch reference, continuity is maintained through gentle, sustained motions, complemented by focused eye contact and minimal facial cues. Such restrained gestural strategies function to stabilise collective airflow while preserving an atmosphere of sonic fragility.

70 Handbells *ad lib.*, gradually quickening...

SI
mah-o - (m) *ojos de agua de sueño

SII
mah-o - (m) *ojos de agua de sueño hay que can - tar

A (+Ten I)
mah-o - (m) *ojos de agua de sueño voz al - ta **voz - al - ta

T
mah-o - (m) *ojos de agua de sueño re - lam - pa - gos **re - lam - pa - gos re - lam - pa - gos

B
mah - o - (m) *ojos de agua de sueño

Figure 2: Eric Whitacre, *Cloudburst*, SATB score bars 70-74 (finger snapping).

Source: Whitacre (1996)

Snapping fingers represent another characteristic non-verbal element in *Cloudburst*, functioning as a sonic analogue to falling rain and contributing to the work's dramatic escalation. Whitacre has noted that this gesture derives from a traditional campfire game, adapted to serve the expressive needs of the composition (Swan, 2016). In bars 70–74 (Figure 2), snapping fingers are marked to crescendo, symbolising the onset of the rainstorm. Here, the conductor must demonstrate precise rhythmic control and clearly differentiated gestural cues to coordinate the accumulation of sound while maintaining alignment with the sung choral parts. Rapid, clearly articulated gestures—often differentiated between hands—enable the conductor to shape both rhythmic intensity and vocal coordination simultaneously.

70 Handbells *ad lib.*, gradually quickening...



SI
mah-o - (m) *ojos de agua de sueño

SII
mah-o - (m) *ojos de agua de sueño

A
mah-o - (m) *ojos de agua de sueño

T
mah-o - (m) *ojos de agua de sueño

B
mah-o - (m) *ojos de agua de sueño

hay que can-tar

voz al - ta **voz-al - ta

re - lam - pa - gos **re-lam - pa - gos re-lam-pa-gos

Figure 3: Eric Whitacre, *Cloudburst*, SATB score bars 70-74.

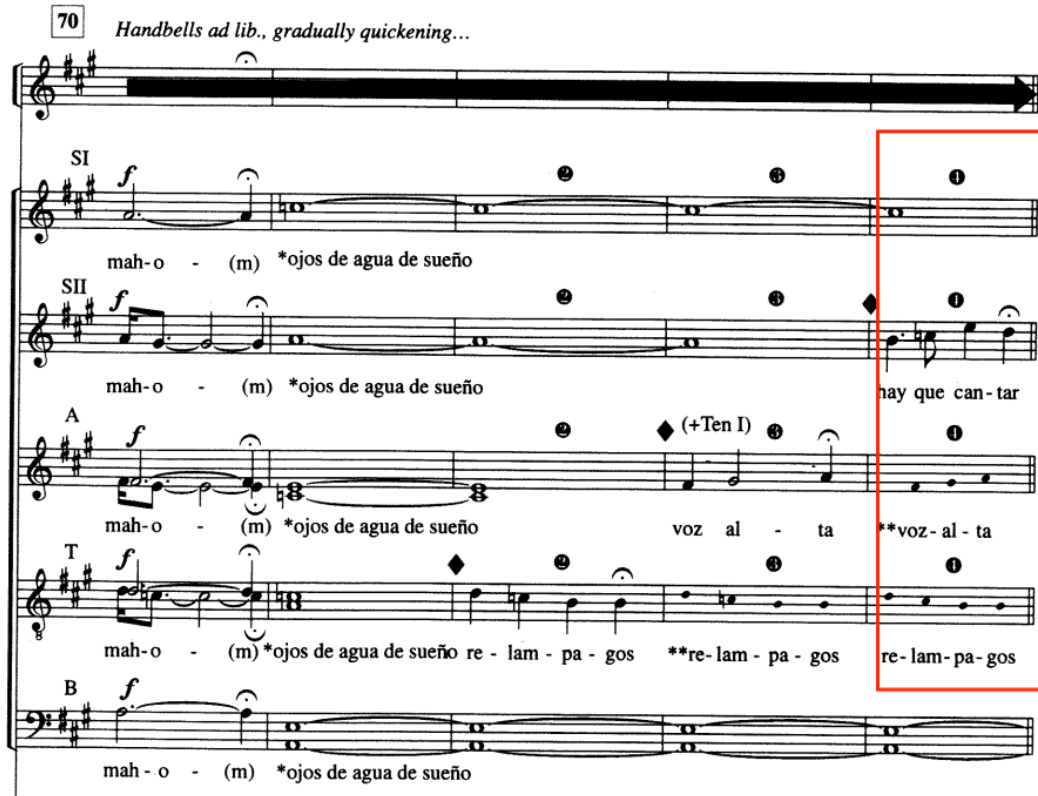
Source: Whitacre (1996).

Thighs tapping is employed as a percussive device that further intensifies the sonic representation of rainfall, suggesting the impact of rain on varied surfaces. This embodied sound action expands the work's textural palette while enhancing the listener's sensory engagement with the natural imagery. In bars 70–74 (Figure 3), choir members are instructed to tap their thighs without a fixed rhythmic pattern, producing a dense, irregular texture. From the conductor's perspective, this requires careful preparatory cueing and continuous gestural guidance to balance freedom of execution with ensemble coherence. The conductor must therefore negotiate between controlled timing and performative openness, ensuring that the resulting texture remains integrated within the overall musical trajectory.

Clapping constitutes the most overtly collective non-verbal gesture in *Cloudburst*, intensifying the sonic impact at moments of heightened tempo and emotional intensity. As shown in bar 74

(Figure 4), clapping is indicated without strict uniformity, allowing natural rhythmic variation to enhance the vividness of the soundscape. The conductor's role in this context shifts from enforcing precision to shaping collective energy, using visible bodily gestures to cue entrances and regulate intensity rather than to impose strict rhythmic alignment. This shared physical action reinforces ensemble participation and strengthens the connection between performers and audience, transforming the choral texture into a multisensory expressive event.

70 Handbells *ad lib.*, gradually quickening...



SI
mah-o - (m) *ojos de agua de sueño

SII
mah-o - (m) *ojos de agua de sueño may que can - tar

A
mah-o - (m) *ojos de agua de sueño (+Ten I) voz al - ta **voz - al - ta

T
mah-o - (m) *ojos de agua de sueño re - lam - pa - gos **re - lam - pa - gos re - lam - pa - gos

B
mah-o - (m) *ojos de agua de sueño

Figure 4: Eric Whitacre, *Cloudburst*, SATB score bars 70-74 (clapping).

Source: Whitacre (1996).

From a conducting standpoint, these body-based sound actions rely on clearly differentiated gestural cues and nuanced intensity signalling, which may be understood as part of an expressive gesture grammar rather than as purely mechanical beat indication (Gibet, 2024). Through the integration of air sounds, snapping fingers, thighs tapping, and clapping, *Cloudburst* exemplifies how non-verbal sound practices reposition the conductor as an embodied mediator of sound, gesture, and collective attention. The conductor's role thus extends beyond traditional rhythmic control to encompass leadership in non-verbal expression and embodied musical communication.

Challenges in Conducting *Cloudburst*

In *Cloudburst*, the challenges faced by the conductor arise primarily from the work's extreme dynamic range, dense harmonic language, and the integration of multiple non-verbal sound actions within a highly expressive musical framework. These challenges require conductors to negotiate continuously between technical precision and expressive flexibility. From a practice-

led perspective, such negotiation foregrounds conducting practice itself as a site of problem-solving, reflection, and pedagogical knowledge production (Wilkes, 2017; Nelson, 2022).

One of the most immediate challenges lies in the management of dynamic contrast. *Cloudburst* traverses an exceptionally wide dynamic spectrum, ranging from pp passages characterised by air sounds and fragile vocal textures to climactic ff sections involving full ensemble participation (Figures 5 and 6). Conductors must therefore ensure that dynamic transitions remain controlled and coherent rather than abrupt or overwhelming. Excessive dynamic force may compromise vocal balance and intonation, while insufficient control at softer levels risks the loss of textural clarity. Through carefully calibrated gestural restraint and anticipatory cueing, conductors can shape gradual dynamic trajectories that preserve both vocal health and expressive intensity during rehearsal and performance.

The image shows a page from a musical score for the song 'Lluvia' by Joaquín Rodrigo. The score is written for four voices: Soprano, Alto, Tenor, and Bass. The key signature is three sharps (F#, C#, G#) and the time signature is 4/4. The lyrics are in Spanish: 'Llu - via *a_ O_ (m) mf > **ojos de agua de sombra,'. The score includes dynamic markings such as *pp* (pianissimo), *mf* (mezzo-forte), and *a2* (second ending). A red box highlights the first measure of the Soprano and Alto parts, which both start with the note 'La' (A) on a whole note. A blue box with the text 'Aa' is placed next to the Soprano staff. The score is presented in a clear, professional layout with a white background and black musical notation.

Figure 5: Eric Whitacre, *Cloudburst*, SATB score bars 1-4.

Source: Whitacre (1996)



Figure 6: Eric Whitacre, *Cloudburst*, SATB score bars 75-78.

Source: Whitacre (1996).

A further challenge concerns harmonic density and intonational stability. Whitacre's choral writing frequently employs closely spaced sonorities and extended tertian harmonies, which demand heightened sensitivity to pitch alignment and timbral balance. In bars 37–39 (Figure 7), the succession of harmonies—including Am, G, F#m7b5, C, and D7—within a 6/4 metric context significantly increases the cognitive and auditory load placed on singers. Conductors may address this complexity by adopting subdivided conducting patterns, such as a 3+3 beat framework (Figure 8), to clarify metric structure and support ensemble coordination. Rehearsal strategies including sectional pitch reinforcement, layered harmonic construction, and focused listening exercises can further stabilise intonation while preserving harmonic richness.

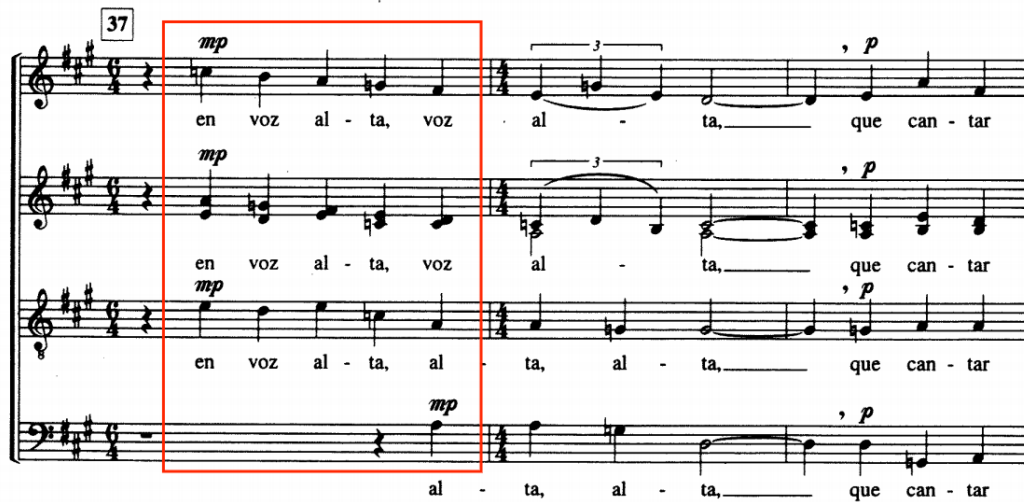


Figure 7: Eric Whitacre, *Cloudburst*, SATB score, bars 37-39.

Source: Whitacre (1996).

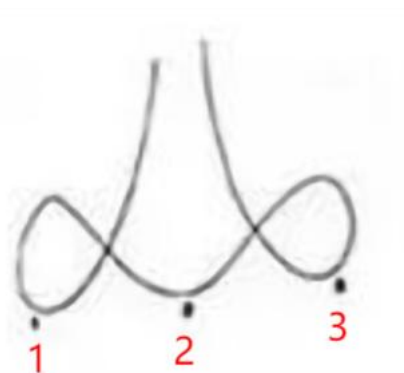


Figure 8: Three-beat conducting pattern (3+3 subdivision)

Source: Author's illustration

Beyond technical considerations, the creation of an expressive atmosphere presents an additional challenge. *Cloudburst* evokes natural imagery through gradual textural accumulation and subtle shifts in colour, requiring conductors to cultivate a shared emotional and imaginative framework within the ensemble. If gestural communication becomes overly rigid or mechanistic, the work's poetic delicacy risks being compromised. Effective conducting in this context therefore involves the use of metaphor, imagery, and embodied gesture to guide singers toward a flexible and responsive expressive state.

The coordination of non-verbal sound actions—such as air sounds, snapping fingers, clapping, and thighs tapping—further complicates the conductor's task. These actions must align precisely with sung material without disrupting overall acoustic balance. In passages involving dense rhythmic activity (Figure 9), conductors must clarify the function and intensity of each non-verbal element while maintaining ensemble cohesion. This often requires more explicit gestural differentiation and heightened physical presence to support rapid transitions between vocal and non-vocal modes of sound production.



Figure 9: Eric Whitacre, *Cloudburst*, SATB score bars 70-74.

Source: Whitacre (1996).

Finally, timbral integration remains a persistent challenge throughout the work. The interdependence of closely voiced harmonies, air-based sounds, and soft vocal textures places significant demands on collective listening and balance. Conductors must therefore engage in continual adjustment of vocal weight and colour during rehearsal, encouraging singers to negotiate a delicate equilibrium between technical control and expressive openness.

Taken together, these challenges position *Cloudburst* as a work that tests not only the conductor's technical proficiency but also their capacity for embodied leadership and interpretative judgement. Navigating dynamic extremes, harmonic density, and non-verbal sound coordination requires a conducting approach that integrates precision, imagination, and responsiveness, underscoring the multifaceted role of the contemporary choral conductor.

Conclusion

This study has examined *Cloudburst* as a paradigmatic example of how extra-vocal sound actions function not merely as surface effects but as structurally and expressively integrated components of contemporary choral writing. Through score-based analysis and practice-led reflection, the article has demonstrated how air sounds, body percussion, and spatialised sound actions generate specific demands on conducting gesture, rehearsal strategy, and ensemble coordination.



From a conducting perspective, the findings highlight the necessity of approaching non-verbal sound not as an ancillary layer to vocal performance but as an embodied mode of musical communication. The conductor's role is thereby redefined as that of a mediator who integrates sonic, physical, and expressive dimensions through differentiated gesture, bodily presence, and interpretative judgement. Such an approach foregrounds conducting practice itself as a form of knowledge production, aligning with broader practice-led and artistic research paradigms.

While the discussion has focused on *Cloudburst*, the analytical framework and practical insights developed here may inform the interpretation of other choral works that employ non-pitched sound, body-based actions, and extended vocal techniques. Further research may explore how these principles operate across different ensemble contexts and repertoires, contributing to the ongoing re-evaluation of the conductor's role within expanded modes of choral performance.

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GENDERED NARRATIVES IN WOMEN-ORIENTED MICRO-SHORT PLAYS: A CROSS-CULTURAL STUDY

Feng Nana¹, Tee Xiao Xi^{2*}, Nur Farazilla Mohd Arsad³

¹Faculty of Creative Industries, City University Malaysia, Malaysia, (731800491@qq.com)

²Faculty of Creative Industries, City University Malaysia, Malaysia, (teexiaoxi@city.edu.my)

³Faculty of Creative Industries, City University Malaysia, Malaysia, (nur.farazilla@city.edu.my)

*Corresponding Author: teexiaoxi@city.edu.my

Abstract: *Women-orientated micro-short plays have become a unique audiovisual genre of the modern digital media networks, especially with respect to the experience and the identity of women. This paper analyses the gendered discourse in women-orientated micro-short plays in the cross-cultural context, with reference to the impacts of such discourse on the female audience and their relevance to the larger socio-cultural background. The research is a mixed qualitative study that will involve analysing data from a questionnaire survey, conducting textual and narrative analyses of selected micro-short plays, and performing a case study on a representative micro-short series focused on women, which is distributed on a large short-video platform. According to the findings, the narratives, which focus on females' self-development, emotional bargaining, work life, and social identity construction, are at the core of generating audience interest. The economical form and heightened narrative of the micro-short plays only enhance an emotional effect and enable identification with the female audience. The cross-cultural comparison shows common and different trends of gender representations. Whereas domestic productions tend to emphasise family morals and relationship negotiation, international productions highlight personal autonomy and self-realization, while the feminist awareness and female agency of the characters are usually foreshadowed. The paper foregrounds female-directed micro-short plays as a gendered media form by providing new research on the topic of digital audiovisual storytelling and reflecting on the cultural implications of the short-storytelling genre in the present-day gender representation.*

Keywords: *Women-oriented micro-short plays, Gendered narratives, Female representation, Audience reception, Digital media*

Introduction

Women-oriented micro-short plays have emerged as a distinctive form of short-form audiovisual media within contemporary digital platforms, gaining significant popularity among women audiences. Characterised by brief episode durations—typically ranging from 30 seconds to 15 minutes—these productions are well suited to fragmented viewing patterns shaped by mobile media consumption (Zhao & Fu, 2024). Unlike conventional television dramas, women-oriented micro-short plays prioritise narrative themes closely aligned with women's lived experiences, including emotional negotiation, everyday life, workplace challenges, and self-development. Narrative construction and character design are often shaped by the aesthetic preferences and affective expectations of women viewers, facilitating emotional engagement and identification.



From a media studies perspective, women-oriented micro-short plays function not merely as entertainment products, but as gendered cultural forms shaped by platform logics, narrative conventions, and audience reception within social media entertainment ecosystems (Cheng & Shao, 2024; Cunningham & Craig, 2019). Popular genres such as romance, melodrama, revenge narratives, and time-travel rebirth employ compressed storytelling strategies through which women’s desires, frustrations, and agency are articulated. Through concise pacing, heightened emotional intensity, and recurring gendered tropes, these micro-short plays operate as a narrative space in which contemporary constructions of femininity are negotiated and circulated.

Although this media form has expanded rapidly in recent years, **industry reports indicate a significant increase in production volume, audience reach, and commercial investment in micro-short plays** (iiMedia Entertainment Industry Research Institute, 2023). Studies that examine narrative strategies, gender representation, and audience reception—particularly from a cross-cultural perspective—remain limited. This lack of focused analysis is especially evident in research addressing women-oriented micro-short plays as a distinct gendered media form within digital audiovisual storytelling. Market reports also indicate rapid sectoral expansion in recent years, providing a material platform ecology for the proliferation of micro-dramas, including women-oriented subgenres (iiMedia Entertainment Industry Research Institute, 2023).

The development of women-oriented micro-short plays is closely linked to broader transformations in short-form audiovisual media. Early women-oriented narrative traditions emerged across television and online literature platforms, where gender-targeted storytelling emphasised emotional relationships and personal growth. As short-video platforms evolved, these narrative logics gradually migrated into audiovisual formats, giving rise to micro-short plays characterised by condensed narration, intensified emotional appeal, and platform-oriented circulation. This institutional transformation is further evidenced by a series of regulatory and policy initiatives that formally recognised and stabilised micro-short plays as an audiovisual format in China, as summarised in Table 1.

Table 1: Policy Milestones Shaping the Institutionalisation of Micro-Short Plays in China

Time and leading authority	Policy and regulatory initiative	Key implications for micro-short plays
December 2020 State Administration of Radio and Television (SARFT)	Notice on matters concerning the content review of micro-plays in online film and television productions	Micro-short plays were formally recognised as online audiovisual works. Regulatory definitions, review standards, and approval procedures were clarified, marking the initial institutional acknowledgement of the format.
November 2022 General Office of SARFT	Notice on further strengthening the management of online micro-short plays and implementing the content	Targeted governance measures were introduced to regulate “mini-program” micro-short plays, promote standardised production

December 2022 SARFT Development Research Centre	creation enhancement programme Promoting the standardisation and high- quality development of online micro-short plays	practices, and encourage higher- quality content creation. Platform responsibilities were consolidated, guidance mechanisms for high-quality content were established, and regulatory supervision was strengthened to stabilise the industry.
December 2022 SARFT	Opinions on promoting the prosperous development of short plays	Policy emphasis shifted towards thematic innovation, creative quality, talent cultivation, and the establishment of a modern dissemination and market framework for short plays.
March 2023 Guided by SARFT; co- hosted by the Online Audiovisual Programme Service Association and Kuaishou	Tenth Online Audiovisual Conference: Micro-short plays industry development forum	Industry-level discussions addressed content innovation, business models, and market sustainability, reinforcing micro-short plays as a recognised sector within the audiovisual industry.
November 2023 Department of Online Audiovisual Programme Management, SARFT	Working meeting on the management of online micro-short plays	Special governance measures were implemented to curb disorderly practices, strengthen platform accountability, and support the production of high-quality micro- short play content.
November 2023 SARFT Development Research Centre	Micro-short plays: Balancing development and governance with dual strengthening	Micro-short plays were framed as an emerging form of contemporary audiovisual expression, with emphasis on achieving sustainable and culturally positive development.
November 2023 Department of Online Audiovisual Programme Management, SARFT	Multiple measures implemented to sustain the governance of online micro-short plays	Governance of micro-short plays entered a routine phase, with continued emphasis on refining content review mechanisms and formulating detailed production guidelines.

Source: Public Policy Documents Issued by the State Administration of Radio and Television (SARFT) and Affiliated Institutions; Compiled by The Authors.

Together, these policy initiatives demonstrate the gradual institutional consolidation of micro-short plays in China, transforming them from an experimental platform-driven format into a formally recognised audiovisual category. Importantly, this process did not merely regulate production practices, but also delineated narrative boundaries, content responsibility, and thematic orientation within short-form storytelling. Industry reporting likewise frames micro-dramas as entering an upgrading phase, strengthening the conditions for women-oriented



micro-short plays to circulate as a stabilised audiovisual form (China Network Audiovisual Programme Service Association, 2024).

Within this regulatory framework, women-oriented micro-short plays were able to emerge as a stabilised narrative subcategory. The clarification of content standards and platform responsibilities created conditions under which gender-focused storytelling—particularly narratives centred on emotional negotiation, everyday life, and women’s social experiences—could be systematically produced and circulated. Table 1 therefore provides not only a policy background, but also an institutional context that helps explain the rapid normalisation of women-oriented micro-short plays as a legitimate form of gendered audiovisual expression in contemporary Chinese digital media.

Literature Review

Research on Micro-Short Plays and Platform Development

Research on micro-short plays has expanded rapidly in recent years, largely driven by the growth of short-form digital media platforms. Existing studies have predominantly focused on **industrial development, platform governance, and regulatory frameworks**, reflecting the institutional and economic dimensions of micro-short play production (Zhao et al., 2024). This industrial–governance emphasis is also evident in recent Chinese scholarship that maps the current situation and development trends of micro-plays, reinforcing the field’s prevailing focus on sectoral growth rather than gendered narrative analysis (Zhao et al., 2024). While this body of literature provides important contextual insights, relatively limited attention has been paid to narrative structures, gender representation, and audience reception, particularly in relation to women-oriented micro-short plays.

Women-oriented narrative traditions in Chinese media can be traced back to the emergence of gender-targeted television channels and online literature platforms in the late 1990s and early 2000s. This historical trajectory is illustrated by the rise and subsequent decline of dedicated women-targeted television channels in China (Shao, 2024). Early women-centred media content emphasised emotional relationships, personal growth, and everyday life, establishing narrative conventions that resonated strongly with women audiences. With the rise of online literature platforms, women-oriented sections further institutionalised these narrative patterns, creating a reservoir of gendered storytelling that later informed audiovisual adaptations and short-form digital narratives.

Women-Oriented Narrative Traditions in Chinese Media

Women-oriented narrative traditions in Chinese media can be traced back to the emergence of gender-targeted television channels and online literature platforms in the late 1990s and early 2000s. Early women-centred media content emphasised emotional relationships, personal growth, and everyday life, establishing narrative conventions that resonated strongly with women audiences. With the rise of online literature platforms, women-oriented sections further institutionalised these narrative patterns, creating a reservoir of gendered storytelling that later informed audiovisual adaptations and short-form digital narratives. For example, major platforms such as Qidian formalised women-oriented sections as an identifiable content category in the late 2000s (Qidian Chinese Network, 2009). Popular media commentary has



also noted a gradual shift in women-oriented narratives, from idealised romance and formulaic heroines towards more complex portrayals of female agency and self-definition (Zhang, 2023).

However, the closure of China's first professional television channel explicitly branded for women audiences in 2024 marks a symbolic turning point, highlighting the decline of traditional broadcast-based gender segmentation and the rise of platform-driven, algorithmic content distribution (Shao, 2024).

The transition from long-form television dramas and online literature to short-form audiovisual content marked a significant transformation in women-oriented storytelling. As short-video platforms gained prominence, narrative logics rooted in women-oriented literature and television were adapted into compressed audiovisual formats characterised by concise storytelling, intensified emotional pacing, and rapid circulation (Zhao & Fu, 2024). Within this context, micro-short plays emerged as a new narrative vehicle through which gendered stories could be aligned with fragmented viewing habits and platform-based media consumption.

Institutional and Regulatory Context of Micro-Short Plays

From a regulatory and institutional perspective, micro-short plays have gradually been formalised as a recognised audiovisual format in China. Policy documents and governance measures introduced since 2020 have clarified production standards, content orientation, and platform responsibilities, contributing to the stabilisation of micro-short plays as a legitimate media form. Although such policy texts do not constitute academic scholarship in a strict sense, they shape the media environment in which women-oriented micro-short plays operate and provide an important contextual backdrop for scholarly analysis.

Gender Representation and Cross-Cultural Perspectives

Beyond the domestic media landscape, women-oriented micro-short plays have increasingly circulated within international digital environments. Existing studies on overseas short-form drama platforms highlight processes of localisation and cultural adaptation, whereby narrative themes, character construction, and representational strategies are adjusted to suit local audiences (Liao, 2024). While the specific term “women-oriented micro-short plays” is not widely used in international scholarship, research suggests that narratives centred on emotional experience, self-development, and female agency demonstrate transnational resonance.

Scholarly discussions of gender representation in women-oriented micro-short plays indicate that emotionally charged narrative tropes—such as relational conflict, moral confrontation, and personal transformation—are frequently employed to generate affective engagement (Ni & Wang, 2024). Recent studies further argue that women's genre micro-dramas increasingly experiment with narrative models that foreground female agency and self-definition, even while relying on highly compressed emotional pacing (Liu, 2025). At the same time, critiques note tensions between emotional fulfilment and simplified value expression in some women's genre short dramas, indicating ambivalence within the empowerment discourse (Gao, 2025). Such narratives often position women protagonists as active agents who negotiate social constraints and pursue self-definition, aligning with broader cultural discourses surrounding contemporary femininity and women's empowerment.



Some industry tracking also suggests that women-oriented narratives form a substantial share of overseas short-drama attention, indicating that gendered storytelling travels alongside platform expansion (DataEye, 2023). Commentary on ReelShort further highlights how localisation strategies translate Chinese short-drama formats into international markets (Zhang, C., 2025).

Research Gaps

Despite the growing body of literature on micro-short plays, significant research gaps remain. Existing studies have largely prioritised industrial growth, governance mechanisms, and market dynamics, while narrative analysis and audience reception—particularly from a cross-cultural perspective—remain under-examined. Moreover, few studies have systematically addressed women-oriented micro-short plays as a distinct gendered media form. Addressing these gaps, the present study adopts a cross-cultural approach to examine gendered narratives and audience engagement in women-oriented micro-short plays, contributing to media and communication scholarship on short-form digital storytelling and contemporary gender representation.

Methodology

This study adopts a mixed qualitative research design integrating audience survey data, textual and narrative analysis, and a focused case study. The methodological approach is designed to examine gendered narratives in women-oriented micro-short plays while situating audience reception within broader socio-cultural and cross-cultural contexts.

Data were collected through three complementary sources. First, a questionnaire survey was administered to women viewers to explore viewing habits, narrative preferences, and perceptions of gender representation in women-oriented micro-short plays. A total of 53 valid responses were obtained. The survey focused on general demographic characteristics, viewing frequency, narrative appeal, and perceived socio-cultural influence. Rather than serving as a standalone quantitative investigation, the survey data function as contextual evidence supporting the qualitative analysis.

Second, a corpus of representative women-oriented micro-short plays distributed on major short-video platforms was selected for textual and narrative analysis. Selection criteria included audience visibility, thematic relevance, and narrative clarity. Third, a women-oriented micro-short play series with significant public exposure was chosen as a case study to enable more detailed examination of narrative strategies, emotional framing, and audience engagement within a specific production context.

The data analysis proceeded in three stages. Survey responses were first reviewed descriptively to identify general patterns in audience demographics, viewing habits, and thematic preferences. These patterns informed the interpretation of audience engagement but were not subjected to statistical modelling.

Textual and narrative analysis focused on identifying recurring narrative themes, character configurations, and emotional structures within the selected micro-short plays. Particular attention was paid to representations of female identity, agency, and emotional negotiation.

Finally, the case study was analysed through interpretive comparison, examining how narrative design, platform context, and audience interaction collectively contributed to emotional resonance and social circulation. By triangulating survey insights, narrative analysis, and case-based interpretation, the study identifies cross-cultural similarities and contextual differences in gendered storytelling within women-oriented micro-short plays.

Findings and Discussion

The findings presented below are derived through the triangulation of three sources: audience survey responses, textual and narrative analysis of selected women-oriented micro-short plays, and an in-depth case study. This integrated approach allows for cross-validation between audience perception, narrative construction, and platform-specific practices.

Audience Profile and Viewing Tendencies

As illustrated in Figure 2 and Figure 3, the audience of women-oriented micro-short plays is predominantly composed of women aged between 26 and 45, many of whom are engaged in full-time employment or freelance work.

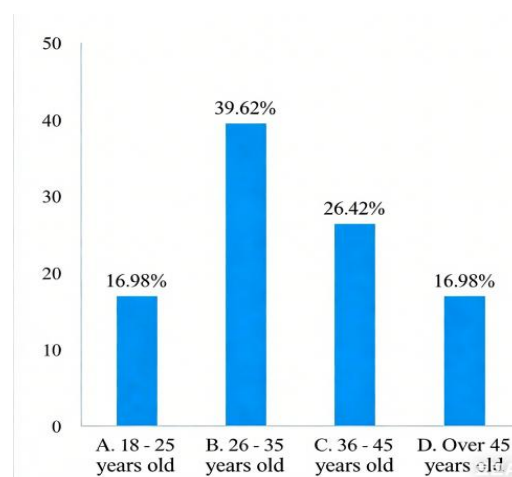


Figure 2: Age Distribution of Respondents Viewing Women-Oriented Micro-Short Plays.

Source: Questionnaire Survey Conducted by The Authors (N = 53).

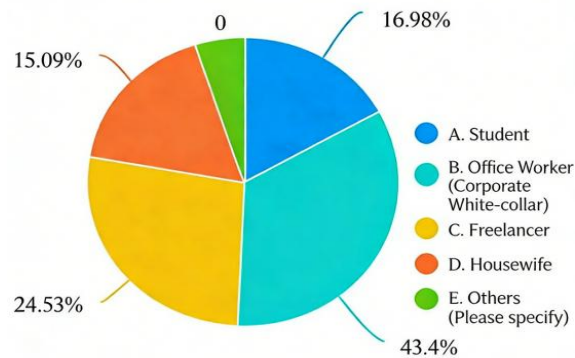


Figure 3. Occupational Background of Respondents Viewing Women-Oriented Micro-Short Plays.

Source: Questionnaire survey conducted by the authors (N = 53).

This demographic concentration is significant, as it corresponds to a life stage commonly associated with intensified pressures related to career development, intimate relationships, and self-identity negotiation.

Rather than functioning merely as casual entertainment, women-oriented micro-short plays appear to operate as narrative spaces where the lived experiences and emotional tensions of contemporary women are reflected and processed. The frequent viewing patterns reported by respondents indicate that these micro-short plays have been incorporated into everyday media routines, suggesting sustained emotional engagement rather than sporadic consumption. This aligns with broader observations that short-form, platform-native audiovisual content increasingly embeds itself into everyday routines through algorithmic distribution and affective engagement (Cunningham & Craig, 2019).

The occupational profile further reinforces this interpretation. Women navigating flexible yet demanding work environments often experience fragmented time structures and heightened emotional labour. The short episodic format and emotionally condensed storytelling of women-oriented micro-short plays align closely with these conditions, enabling meaningful engagement within limited time frames. In this sense, the appeal of women-oriented micro-short plays lies not only in their thematic focus on women's issues, but also in their capacity to accommodate the temporal, emotional, and social realities of contemporary women audiences.

Narrative Appeal and Gendered Identification

Across survey responses and textual analysis, narrative content centred on women's emotional experiences, self-development, and workplace challenges emerged as a key factor driving audience engagement. Rather than relying solely on visual spectacle or celebrity casting, women-oriented micro-short plays frequently employ compressed yet emotionally intensified storytelling to foreground moments of personal crisis, moral choice, and emotional bargaining.

Textual analysis reveals that female protagonists are often constructed as active agents who negotiate constraints rather than passively endure them. Common narrative patterns include self-reflection following emotional setbacks, strategic decision-making within intimate



relationships, and redefinition of personal success beyond traditional romantic or familial fulfilment. These patterns align with survey responses indicating strong audience identification with characters who demonstrate emotional resilience and self-awareness.

Case Illustration: Narrative Construction and Female Identification

The women-oriented micro-short play series *During the New Year* is employed in this study as an illustrative case to demonstrate how gendered narratives are articulated within short-form digital storytelling. Rather than serving as a comprehensive industrial or commercial analysis, this case is used to exemplify narrative strategies commonly observed in women-oriented micro-short plays.

Narratively, the series centres on a female protagonist navigating emotional conflict, marital expectations, and questions of self-worth within everyday social contexts. The character is portrayed as an active subject engaged in reflection and decision-making, rather than as a passive figure shaped solely by external circumstances. Through compressed episodic structures, the narrative foregrounds moments of emotional confrontation and moral choice, enabling viewers to recognise familiar social pressures and emotional dilemmas.

The short episodic format intensifies emotional pacing while minimising narrative redundancy. Each episode delivers a concise yet complete emotional arc, allowing cumulative identification to develop across the series. This narrative economy aligns with the fragmented viewing conditions of short-video platforms, while also enhancing emotional resonance and immediacy.

Audience responses, as reflected in online commentary and engagement practices, suggest that the series functions as a site of collective emotional recognition rather than mere entertainment consumption. Viewers frequently articulate identification with the protagonist's emotional struggles and expressions of autonomy, reinforcing the role of women-oriented micro-short plays as spaces for negotiating contemporary female identity.

As an illustrative case, *During the New Year* supports the broader findings of this study by demonstrating how narrative compression, emotional framing, and female-centred perspectives converge to produce gendered storytelling within short-form digital media.

Cross-Cultural Patterns and Variations

Comparative analysis reveals both convergence and divergence in gender representation across domestic and international contexts. In domestic productions, narratives tend to foreground emotional negotiation within family and relational frameworks, reflecting cultural emphases on social harmony and moral responsibility. In contrast, international women-oriented micro-short plays more frequently highlight individual autonomy, self-realisation, and personal boundary-setting.

Despite these differences, both contexts share a common emphasis on female agency and emotional self-determination. This suggests that while gendered narratives are culturally inflected, women-oriented micro-short plays tap into transnational concerns regarding identity, emotional labour, and self-worth. The cross-cultural resonance observed supports the



positioning of women-oriented micro-short plays as a gendered media form with broader cultural significance.

Conclusion

This study has examined women-oriented micro-short plays as a gendered form of short-form digital media, focusing on narrative construction, audience identification, and cross-cultural variation during the 2023–2024 period. Drawing on audience survey data, textual and narrative analysis, and an illustrative case, the findings demonstrate that these micro-short plays function not merely as entertainment products, but as narrative spaces through which contemporary women negotiate emotional experience, self-identity, and social expectations.

The analysis indicates that the appeal of women-oriented micro-short plays lies in the convergence of narrative compression, emotional intensity, and female-centred perspectives. These elements enable short-form narratives to resonate with women audiences navigating fragmented time structures and heightened emotional labour.

Cross-cultural comparison reveals both convergence and divergence in gender representation. While domestic productions tend to emphasise emotional negotiation within relational and familial frameworks, international productions more frequently foreground individual autonomy and self-realisation. Despite these differences, a shared emphasis on female agency and emotional self-determination underscores the transnational relevance of women-oriented micro-short plays as a gendered media form.

By foregrounding women-oriented micro-short plays within media and communication scholarship, this study contributes to ongoing discussions on short-form digital storytelling and contemporary gender representation, highlighting their cultural significance beyond industrial or platform-centred perspectives.

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RECONTEXTUALISING FRANCESCO PAOLO TOSTI'S ITALIAN ART SONGS WITHIN LATE NINETEENTH-CENTURY VOCAL CULTURE

Chen Guanyi¹, Tee Xiao Xi^{2*}

¹Faculty of Creative Industries, City University Malaysia, Malaysia, (chengguanyi9527@gmail.com)

²Faculty of Creative Industries, City University Malaysia, Malaysia, (teexiaoxi@city.edu.my)

Abstract: *Francesco Paolo Tosti's Italian art songs have traditionally been on the margins of the musicological discourse and have often been characterised as a lightweight, sentimental salon repertoire or reduced to elementary material for vocal education. These categories have been inclined to blur their aesthetic superiority and historical value to the late nineteenth-century vocal culture. The given article recontextualises the Italian songs of the art by Tosti, putting them into the background of the stylistic, poetic and performative language of the Belle Époque, with special emphasis laid on the connections to the bel canto tradition and contemporary salon practices. The work can be studied through close reading of several scores and poetic texts to discuss repeat patterns of melodic structures, interaction of music and text, emphasis on treatment of the vowels, dynamic nuance, and legato altogether, and declamatory style. Instead of the pedagogical reading of the works, the analysis focuses on the way they are micro-dramatic structures bargaining intimacy and expressivity on a small musical scale. The article attempts to re-establish the cultural and aesthetic significance of the songs of Tosti within a historical vocal context and thus advocates a reassessment of these pieces as part of the Italian art-song repertoire as well as valuable data regarding the performance practice and the vocal expression of the time at the turn of the twentieth century.*

Keywords: *Italian Art Song, Bel Canto Tradition, Vocal Culture, Belle Époque, Performance Practice*

Introduction

Francesco Paolo Tosti's songs continue to occupy a visible place in vocal recitals, where they are valued for their singable melodic contours and their direct, lyrical appeal. Despite this sustained performance presence, their position within musicological scholarship has remained uncertain. They are most often encountered either as sentimental salon repertoire or as introductory material within vocal curricula, and consequently they have attracted relatively limited analytical attention in broader musicological debates (Sanvitale, 1996; Munson, 2018).

Approaching the repertoire primarily through these functional categories has tended to sideline the specific historical circumstances in which Tosti's songs circulated, as well as the subtle compositional choices that shape their musical language. In many cases, the qualities performers and audiences find most appealing—the sense of ease, immediacy, and apparent naturalness—have also contributed to a long-standing reluctance to treat these works as objects of sustained scholarly enquiry. Rather than signalling compositional simplicity, however, such surface fluency often reflects a highly refined engagement with text, vocal gesture, and contemporary listening practices.



This article returns to Tosti's Italian art songs from an explicitly musicological standpoint, treating them as evidence of late nineteenth-century vocal culture situated between bel canto inheritance, Belle Époque salon practice, and everyday operatic expression. Rather than extending existing biographical narratives, the discussion concentrates on aspects of vocal writing, Italian prosody, and recurring stylistic patterns across a selected group of works.

Attention is given to the interaction between poetic rhythm and melodic design, as well as to features such as legato shaping, dynamic nuance, vowel-centred vocality, and declamatory inflection. Read together, these elements suggest that Tosti's songs operate as compact, micro-dramatic forms in which expressive detail carries cultural meaning. From this perspective, the repertoire can be reconsidered not as marginal salon material, but as a revealing lens through which performance practice and musical taste in the Belle Époque may be more closely understood.

Literature Review

Scholarship on Francesco Paolo Tosti has developed unevenly, with attention distributed across biography, performance-oriented commentary, and pedagogical discussion, while broader musicological recontextualisation has remained comparatively limited. Existing studies have provided a solid factual basis for understanding Tosti's career and the practical circulation of his songs, yet they have also tended to reinforce an understanding of the repertoire primarily in functional or instructional terms.

The most substantial foundation for Tosti studies is provided by the work of Francesco Sanvitale. His early monograph *Francesco Paolo Tosti: Vita e opere* (1991), together with the later *Il canto di una vita* (1996) and its expanded English version *The Song of a Life* (Sanvitale, 2004), offers essential biographical documentation and a detailed chronological framework for situating Tosti within his historical context. These studies, however, remain largely documentary in orientation and engage only selectively with questions of musical style, vocal aesthetics, or broader cultural meaning. This emphasis on documentary richness has also been noted in Anglophone scholarship. Contemporary reviews of Sanvitale's work tend to foreground its archival and historical value, while leaving issues of musical language and stylistic interpretation largely unexplored (Allsop, 2006).

Subsequent research has built upon this biographical groundwork primarily through approaches grounded in vocal performance and studio practice. Studies by Munson (2018) and Kano (2016, 2021), for instance, concentrate on technical challenges, interpretative considerations, and applied performance issues, positioning Tosti's songs as resources for vocal development. While such practice-based studies do not aim to develop sustained musicological argument, they nonetheless attest to the ongoing circulation of Tosti's songs within applied performance contexts and pedagogical traditions in higher music education, as reflected in graduate recital documentation and performance-based theses (Cai, 2025; Hawkins, 2016).

More recent contributions have begun to move tentatively beyond this framework. Groth and Seesholtz (2025), although still operating within a bel canto-oriented technical perspective, raise broader questions concerning aesthetic tradition and the processes of repertoire



canonisation within Italian vocal literature. From a different angle, scholarship on Italian musical migration and vocal pedagogy in London has highlighted how vocal practices circulated across pedagogical, salon, and professional spheres, providing a broader cultural context for composers such as Tosti who operated within these transnational networks (Rutherford, 2021).

Taken together, existing research has made significant contributions in the areas of biography and performance-oriented application, yet a clear gap remains in the systematic recontextualisation of Tosti's songs within late nineteenth-century vocal culture. In particular, there is limited scholarship that situates these works within the aesthetic environment of the Belle Époque, examines the interaction between poetic text and musical design, or considers their role as micro-dramatic forms bridging salon practice and operatic sensibility. The present study addresses this gap by re-examining Tosti's Italian art songs through a musicological lens, aiming to recover their historical, aesthetic, and performative significance beyond the long-standing label of sentimental or merely functional repertoire.

Analytical Framework for Recontextualizing Tosti's Italian Art Songs

This study approaches Tosti's Italian art songs as products of a specific late nineteenth-century vocal environment, shaped by bel canto inheritance, salon conventions, and contemporary operatic sensibilities. Rather than treating the repertoire primarily as pedagogical material, the analysis considers performance as a historically situated expressive practice, attentive to the ways musical detail, text setting, and vocal gesture interact within particular cultural contexts.

The scope of repertoire examined is deliberately restricted in order to allow for close, work-centred analysis. Four songs—*L'ultima canzone*, *'A vucchella*, *L'alba separa dalla luce l'ombra*, and *Malia*—are selected as case studies because, when considered together, they bring into focus recurring stylistic and expressive tendencies within Tosti's output. Unless otherwise indicated, musical examples and analytical references in this study are based on Ricordi editions of these works (Tosti, 1984; Tosti, 2003).

Each song foregrounds a different aspect of vocal and expressive design: extended legato phrasing and sustained continuity in *L'ultima canzone*; vowel-centred lyricism and dialect-inflected articulation in *A vucchella*; refined dynamic shading and messa di voce in *L'alba separa dalla luce l'ombra*; and flexible declamation shaped by speech-like rhythmic inflection in *Malia*. Taken collectively, these works span a spectrum from intimate lyricism to heightened dramatic expression, making them particularly suited to examining Tosti's characteristic micro-dramatic approach to vocal writing.

The analytical discussion proceeds along two closely connected lines. On the one hand, attention is directed towards the musical score itself, with close reading used to identify features of vocal construction such as phrase design, register negotiation, portamento, and the shaping of melodic ascent and descent. In this context, particular emphasis is placed on vowel treatment and tonal consistency, in dialogue with established discussions of Italianate vocal production within the bel canto tradition (Miller, 1986). On the other hand, these musical observations are situated within their broader expressive, linguistic, and historical setting. This involves close engagement with the poetic texts, consideration of salon performance environments

characteristic of the Belle Époque (Parker, 1989), and examination of how emotional meaning is articulated through specific musical gestures.

These two perspectives are treated as inseparable. Technical features are not discussed in isolation, but are understood in relation to questions of style, meaning, and historical practice. Read in this way, Tosti's Italian art songs emerge as compact yet sophisticated forms of vocal expression, whose apparent immediacy is underpinned by a carefully calibrated interaction between musical design, poetic nuance, and performance convention. Rather than functioning merely as utilitarian repertoire, they can be approached as culturally situated artefacts that reflect the vocal aesthetics and expressive priorities of their time.

Analytical Perspectives on Vocal Writing and Expressive Design in Tosti's Italian Art Songs

Legato and Breath Management in the Extended Phrase

Tosti's handling of extended melodic writing is clearly evident in *Malia*. The opening phrase unfolds across a relatively wide span, often extending over two to three bars without internal pauses or explicitly notated breath marks. Rather than presenting discrete, segmented units, the vocal line is shaped as a continuous melodic gesture, one that relies on sustained airflow and carefully balanced support to maintain its stability (see Figure 1).



Figure 1: Francesco Paolo Tosti, *Malia*, opening phrase (bars 10–14), illustrating extended legato design and breath continuity.

Source: Tosti, *Malia*, Voice and Piano Score, Ricordi Edition.

What is particularly striking is the way breathing is implied rather than prescribed. In *L'ultima canzone*, for instance, long phrases frequently reach a point of melodic descent accompanied by a momentary relaxation in the piano texture. These passages create a brief expressive suspension, within which a breath may be taken without disrupting the continuity of the musical line. Such moments function as musically articulated breathing points, allowing extended phrasing to be sustained across successive sections. The interaction between melodic contour, harmonic support, and expressive pacing plays a central role in shaping the coherence and flowing quality characteristic of Tosti's vocal writing.

Dynamic Nuance and Messa di Voce

In *L'alba sepàra dalla luce l'ombra*, Tosti employs messa di voce as a central expressive device to articulate the shifting imagery of light and shadow at dawn. The poetic contrast embedded in the text is translated into precise dynamic organisation within the vocal line. Ascending melodic motion associated with the word *luce* is frequently accompanied by a controlled crescendo, while references to *ombra* are marked by immediate dynamic withdrawal, often to piano or più piano (Figure 2).



Figure 2: Francesco Paolo Tosti, *L'alba sepàra dalla luce l'ombra*, climactic phrase (bars 2–5), showing messa di voce and dynamic shaping on sustained pitch.

Source: Tosti, *L'alba sepàra dalla luce l'ombra*, Ricordi edition.

At climactic moments, sustained pitches are shaped through clearly indicated dynamic expansion and contraction. The notation of crescendo–diminuendo on a single pitch demands exceptional stability of intonation and timbral consistency across dynamic change. Comparable techniques appear in *A vucchella*, where sudden contrasts between accented and immediately withdrawn dynamics contribute to a playful and expressive vocal character. In both cases, dynamic nuance functions not as ornament, but as an integral component of musical meaning.

Vowel Purity and Italianate Tone

In *A vucchella*, Tosti places particular emphasis on the acoustic and expressive potential of open Italian vowels as a means of shaping an Italianate vocal timbre. The title itself foregrounds resonant vowel sounds, which are frequently positioned at melodic peaks or sustained tones. Such placement highlights the forward resonance and clarity associated with bel canto vocal aesthetics (Figure 3).



Figure 3: Francesco Paolo Tosti, *A vucchella*, vocal phrase featuring open vowels at melodic peak (bars 12–15).

Source: Tosti, *A vucchella*, Ricordi edition.

Closed vowels in the upper register are treated with comparable compositional sensitivity, particularly in *Malia*. Rather than assigning sustained high pitches to acoustically restrictive vowels, Tosti often integrates them within stepwise or passing melodic motion. This compositional strategy facilitates subtle vowel modification within fluent melodic movement, supporting tonal uniformity and timbral coherence across the range. These passages reflect a sophisticated understanding of the interaction between vocal production, linguistic articulation, and melodic design.

Text Declamation and Agility

Tosti's art songs exemplify a close integration of music and poetry, a quality particularly evident in *A vucchella*, set to a text by Gabriele d'Annunzio. The predominantly syllabic setting aligns musical rhythm closely with the natural prosody of the Italian language, allowing verbal stress patterns to shape melodic articulation. This approach results in a declamatory vocal style in which musical rhythm serves linguistic clarity and expressive immediacy.

At the same time, Tosti introduces passages requiring agility and rhythmic flexibility to intensify textual expression. In *Malia*, ornamental figures and rapid passing notes evoke the unsettling sense of "charm" or "enchantment" suggested by the text. These gestures demand clarity and precision while remaining subordinate to poetic meaning. Agility here is not deployed as virtuosic display, but as a vehicle for heightened expressive nuance, enabling a seamless fusion of text and music at the micro-level.

Contextualizing Tosti within Italian Vocal Culture *Moving Beyond the Cliché of the Sentimental Label*

For much of the twentieth century, Tosti's songs have frequently been described as 'sweet', 'sentimental', or simply as salon music—labels that render them pleasant yet trivial and risk obscuring their artistic and cultural depth. To move beyond this view, his work must be situated



within a broader historical and aesthetic frame. What is often dismissed as Tosti's sentimentality can instead be understood as a small-scale manifestation of late nineteenth-century Italian realism in chamber vocal music. Rather than projecting the public, explosive conflicts associated with works such as *Cavalleria rusticana*, Tosti directs the realist gaze inward, toward private emotional experience, tracing subtle tremors of longing, loss, and memory.

In a song such as *Non t'amo più* ("I No Longer Love You"), the music does not simply indulge in sadness. Through restrained harmonic language and speech-like, quasi-recitative vocal writing, it articulates a clear yet painful emotional resolution, offering a highly concentrated form of expressive truth. More broadly, Tosti's art songs may be heard as a sonic reflection of post-unification Italian bourgeois culture. They responded to the expectations of middle-class and aristocratic salons that valued accessibility and elegance without sacrificing emotional depth. Within the formal constraints of the genre, Tosti consistently achieves a balance between concentrated affect, refined compositional control, and pointed poetic expression. To reduce his output to mere sentimentality is therefore to overlook the subtle compositional strategies at work, his finely calibrated treatment of Italian prosody, and his role as a stylistic bridge between the *bel canto* tradition and emerging popular vocal idioms of the early twentieth century. Seen from this perspective, Tosti's songs emerge not as minor sentimental artefacts, but as finely tuned micro-narratives of everyday emotion situated within the aesthetic horizon of the Belle Époque.

Poetic and Linguistic Analysis in Dialogue Between Text and Music

Much of Tosti's expressive success lies in his acute sensitivity to the musical potential of poetic language. His songs frequently grow out of a close engagement with textual rhythm and imagery, allowing music and poetry to function in a mutually reinforcing dialogue. Selective in his choice of texts, Tosti set poems by prominent literary figures of his time, including Gabriele d'Annunzio and Renzo Cikoni, using musical means to intensify, extend, or subtly reframe poetic meaning.

At the most fundamental level, Tosti demonstrates careful attention to the natural cadence of spoken Italian. In *Aprile* ("April"), for example, the vocal line closely mirrors the rise and fall of speech, aligning melodic stress with linguistic accent to such an extent that the sung phrase approaches a form of heightened, musicalised declamation characteristic of late nineteenth-century Italian vocal practice. Elsewhere, Tosti translates visual and sensory imagery into sound. In *Malecalle*, continuous, wave-like arpeggiation in the piano accompaniment evokes the shimmering surface of the Bay of Naples, while in *The Last Song* extended descending chromatic motion conveys emotional irreversibility and loss. Harmonic inflection further shapes poetic atmosphere, particularly in settings of d'Annunzio's symbolist verse, where semitonal shifts and tonal ambiguity contribute to a hazy, dream-like sound world. In this sense, Tosti's songs are not simply musical adornments of pre-existing texts; rather, they constitute joint artistic creations in which poetry and music complete one another, transforming the poem into a script for intimate musical drama.



Stylistic Interpretation Through Belle Époque Performance Practice

Any historically informed reading of Tosti's songs must take into account the performance contexts in which they circulated, particularly the vocal aesthetics associated with Belle Époque salon culture. In contrast to the expansive, overtly dramatic style of the opera house, salon performance favoured intimacy, immediacy, and expressive flexibility. Within this environment, vocal delivery prioritised nuanced timbral variation over sheer volume, allowing singers to move fluidly between confidential softness and warm lyrical projection. This quasi-whispered mode of expression played a central role in shaping listeners' experience of Tosti's songs and contributes significantly to their affective impact.

Rhythmic flexibility likewise formed a core element of Belle Époque vocal practice. Notated rhythmic values functioned less as rigid prescriptions than as expressive frameworks, within which performers exercised interpretative elasticity. Subtle lingering at emotionally charged moments and fluid transitions through narrative passages enhanced the speech-like quality of musical delivery. Contemporary accounts further suggest that restrained ornamentation—such as discreet appoggiaturas, vibrato shading, or brief cadential embellishment—was both acceptable and expected, particularly in repeated phrases. Crucially, such expressive interventions were understood as serving emotional trajectory rather than virtuosic display. Recovering these historically grounded conventions is essential for moving beyond strictly score-bound modern readings and for restoring the intimate expressive character that originally defined Tosti's vocal works.

The Bridge to Grand Opera

Although widely associated with the art-song repertoire, Tosti's musical language remains closely connected to the traditions of nineteenth-century Italian grand opera. His songs may be understood as condensed dramatic utterances—miniature counterparts to operatic arias—capable of projecting psychological depth within a compressed formal span. This affinity helps to explain why celebrated opera singers such as Enrico Caruso and Beniamino Gigli regularly included Tosti's songs in their concert programmes.

The vocal writing in these works supports the projection of sustained melodic arches, dramatic contrast, and role-based expression comparable to operatic practice. Extended legato phrasing, nuanced dynamic shaping, and shifts in vocal colour function as tools for character construction rather than as displays of technical prowess. In songs such as *Ideale*, the musical design invites the articulation of a complete psychological arc, progressing from yearning through intensity to emotional disillusionment. In this way, Tosti's art songs occupy a distinctive position between salon intimacy and operatic drama, offering singers a medium through which bel canto technique and realist expressive impulse are fused within the scale of chamber music.

Conclusion

Combined, the discussions made in this paper indicate that Italian art songs by Francesco Paolo Tosti are worth being reevaluated in the context outside their traditional links with salon shows or practical singing. A careful examination of a few representative songs reveals a certain standard of compositional awareness in the vocal writing and text setting that is frequently



ignored. These songs do not simply provide pleasant tonal backgrounds, but they form small but precisely focused emotional scenarios, where the line of the voice, the rhythmic cycle of the poetry, and the gesture of expression are woven into one another.

The songs of Tosti can be interpreted as the manifestations of the vocal culture that appreciated intimacy, immediacy, and expressive delicacy when placed in the aesthetic space of the Belle Époque. Aspects of extended legato phrasing, dynamic shading, vowel-focused timbral organisation and speech-inflected declamation are not only technical effects but stylistic reactions to modern listening and performance practice. In this regard, the repertoire is not merely a collection of well-rendered miniatures but rather a glimpse of the normal vocal expression at work but independent of the operatic tradition at the time.

To be more general, the approach taken from this perspective tends to be an orientation toward the other repertoires of the song, which are also called "light" or "peripheral". By restoring technical specificity and poetic form, as well as historical context, a re-evaluation of such work becomes possible; it is now heard on its terms, not in terms of the large-scale forms of drama. In this perspective, the Italian art songs of Tosti, rather than appearing as peripheral accompaniments to the operative culture, can be seen as the artefacts of expressivity, which are directed to express a specific vocal sensibility, that is, a sense of realism, refinement, and emotional restraint, and whose value in Italian musical life in the late nineteenth century is therefore worth consideration.

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IMPACT OF THE I-URUSDIRI MOBILE APPLICATION ON LEARNING ENGAGEMENT AND SELF-MANAGEMENT SKILLS AMONG SPECIAL EDUCATIONAL NEEDS STUDENTS IN PRIMARY SCHOOLS

Rozita Zubir¹, Juniza Zamri², Norzaida Bular³, Kama Shaffeei⁴

¹Faculty of Human Development, Universiti Pendidikan Sultan Idris (UPSI), Malaysia,
(rozitazubir@gmail.com)

²Design & Visual Communication Department, Politeknik Tuanku Syed Sirajuddin (PTSS), Malaysia,
(junizaa.zamri@gmail.com)

³Design & Visual Communication Department, Politeknik Tuanku Syed Sirajuddin (PTSS), Malaysia,
(ayda909@gmail.com)

⁴Faculty of Human Development, Universiti Pendidikan Sultan Idris (UPSI), Malaysia,
(kama@fpm.ups.edu.my)

Abstract: *The i-UrusDiri Mobile App is an educational innovation aligned with Industrial Revolution 4.0, designed to support special education for students with learning disabilities. Traditional instructional approaches and conventional teaching aids such as books, flashcards, and physical models are often ineffective, time-consuming to maintain, and limited in sustaining student engagement. This study aims to evaluate the impact of the i-UrusDiri Mobile App as a digital teaching tool to enhance interest, motivation, and understanding of basic self-management among primary school students with special educational needs. A mixed-method design was employed, integrating quantitative survey data and qualitative feedback from teachers, parents, and students. The findings indicate that the i-UrusDiri Mobile App successfully stimulates learning interest, improves student motivation, and is perceived as highly suitable for classroom use. Additionally, teachers reported that the integrated e-modules ease access to instructional resources, making lesson delivery more efficient. The study emphasises the theoretical possibilities of mobile learning applications as impactful pedagogical tools in special education, contributing to more engaging and inclusive digital learning environments.*

Keywords: *Education Technology, Learning Motivation and Interest, Mobile Learning Applications, Self-Management Skills, Special Education Students (Learning Disabilities)*

Introduction

Self-management abilities play a key role in primary school special education, impacting kids' social and academic achievement. Students need to have the ability to manage daily routines, understand instructions, control behavior, and carry out tasks independently. However, students with special needs, especially those with hearing impairments, often face difficulties understanding oral communication and verbal instructions in the classroom. This situation causes them to be more dependent on teachers and parents, thus limiting their learning autonomy.

In the era of digital education, the use of mobile technology is seen as an approach that can help bridge this gap. Mobile learning allows learning to occur in a flexible, visual, and



interactive manner, thereby increasing access to students with special needs. Ally (2009) stated that mobile device-based learning allows content to be delivered in a more personalized and contextual manner. For students with hearing impairments, visual approaches such as icons, pictures, animations, and step-by-step instructions are very helpful in improving understanding (Marschark & Hauser, 2012). The field of education has experienced a shift in line with the rapid pace of mainstream modernization. The use of mobile devices is among the technologies accepted as an alternative to existing education that can assist the learning process. The use of mobile applications was introduced to achieve the level of effectiveness of the learning process that can be achieved through the use of smartphones, (Ku Yahaya & Ibrahim, 2022).

i-UrusDiri Mobile App is a teaching aid for teachers or self-study that can stimulate the interest of special education students (learning disabilities) and can help students learn to understand basic self-management topics well. Basic self-management topics at this early stage include the topics of human body parts, management when bathing and brushing teeth. This mobile application was developed using the Raxbit digital platform and Adobe Photoshop CS6 Portable. The development of the i-UrusDiri Mobile App involves the development of mobile application software and the organization of materials in it. The content of the i-UrusDiri Mobile App material refers to the Curriculum and Assessment Standard Document (DSKP) for Life Management, Special Education Self-Management Component for Years 1 and 2. This reference makes the innovative development materials that are built have validity and reliability.

In this regard, this study was conducted to assess the usability and effectiveness of the i-UrusDiri application in supporting the learning of special education students. Specifically, this study aimed to identify the level of suitability of the application, assess its impact on learning engagement and students' self-management skills, and analyze teachers' and parents' perceptions of the application's function as a teaching aid.

Literature Review

Self-Management Skills in Special Education

The concept of self-management is often associated with the theory of self-regulated learning, which emphasizes the ability of individuals to plan, monitor, and evaluate their own learning. Zimmerman (2002) explained that students who have self-regulation skills tend to show higher motivation, better resilience, and more consistent academic achievement. In the context of special education, self-management training has been found to have a significant impact on increasing focus, reducing problem behavior, and developing independence among students. Alper and Raharinirina (2006) also emphasized that the use of assistive technology can support the ability of students with special needs to manage their daily tasks more autonomously, thus reducing dependence on teachers or caregivers.

In line with the development of digital technology, the self-management approach is no longer limited to manual methods such as checklists or printed schedules, but is also strengthened through the use of interactive and visual mobile applications. This approach is seen as more suitable for students with communication or hearing problems because instructions can be delivered through icons, pictures, animations and step-by-step instructions that are easier to understand. Therefore, the integration of visual elements and mobile technology has the



potential to increase the effectiveness of self-management training, thereby helping students build confidence and independence in daily learning.

Learning Engagement and Student Motivation

Learning engagement is also an important factor in determining the effectiveness of the learning process. Fredricks, Blumenfeld, and Paris (2004) stated that engagement encompasses behavioral, emotional, and cognitive dimensions, where students who are more actively involved tend to perform better. The use of interactive technology such as mobile applications is able to stimulate all three dimensions through multimedia and gamification elements.

The use of mobile technology (mobile learning) is seen as one of the effective strategies in increasing learning engagement. Hwang and Tsai (2011) stated that mobile devices enable learning to occur in a flexible, contextual and personalized manner, thus providing opportunities for students to interact with learning content anytime and anywhere. Multimedia features such as animation, audio, video and interactive touch elements also help to attract students' attention and maintain their focus for a longer period of time.

In terms of engagement, it becomes more critical because students often face challenges in terms of concentration, communication and understanding instructions. Low levels of motivation can cause students to be passive and less interested in participating in learning activities. Therefore, an interactive, visual and student-centered teaching approach is needed to stimulate interest and increase their active participation. Studies have shown that learning environments that provide visual stimuli, immediate feedback and game-like activities (gamification) can increase students' intrinsic motivation, thus encouraging more consistent engagement (Sung, Chang, & Liu, 2016).

Mobile Learning and Assistive Technology for Special Education Learners

The development of mobile technology has transformed the modern education landscape by providing more flexible, accessible and student-centered learning methods. The concept of mobile learning refers to the use of mobile devices such as smartphones and tablets to enable learning to take place anytime and anywhere without being tied to a traditional classroom environment. According to Ally (2009), mobile-based learning allows content to be delivered in a more personalized, interactive and contextual manner, thus increasing student engagement and self-control over their learning.

In the context of special education, mobile technology is often categorized as part of assistive technology because of its ability to help students overcome physical, cognitive or communication constraints. Alper and Raharinirina (2006) explained that assistive technology can increase the level of independence, self-confidence and active participation of students with special needs in daily learning activities. For students with hearing impairments in particular, presenting information visually through icons, animations, pictures and simple text is more effective than verbal instructions alone (Marschark & Hauser, 2012). This approach helps students understand tasks more clearly and reduces dependence on teachers. In the context of hearing-impaired students, a mobile application-based learning approach is seen as more effective because it emphasizes visual and interactive elements. Samsudin et al. (2018)



reported that a Malaysian Sign Language application developed specifically for deaf and mute students successfully improved understanding and the effectiveness of teaching and learning. This finding indicates that mobile technology has great potential as an assistive technology in special education.

Several studies have also reported that the integration of mobile devices into learning can consistently increase student motivation, interest, and engagement. Hwang and Tsai (2011) found that mobile learning supports a more flexible and responsive learning experience to individual needs, while Sung, Chang, and Liu (2016) showed that the use of digital devices has a positive impact on student achievement and engagement. De La Cruz et al. (2023) study showed that mobile applications are able to increase student understanding and engagement through an interactive learning approach.

The effectiveness of mobile learning applications does not only depend on technological elements, but is also influenced by pedagogical design and usability aspects. Zurita et al. (2019) emphasized the importance of pedagogical usability in ensuring that applications are user-friendly and support the achievement of learning outcomes. Along with that, Kraveva and Kravev (2018) suggested evaluating special education applications using utility function metrics to measure the level of suitability and effectiveness of their use. Therefore, the development of user-friendly and pedagogically designed mobile applications, such as the i-UrusDiri application, represents a relevant approach to supporting learning among special education students.

Instructional Design and Evaluation of Educational Apps

From the perspective of developing digital learning materials, the ADDIE model is often used as a systematic framework to ensure that the product produced meets the needs of users. According to Branch (2009), this model allows the design process to be carried out in stages starting from needs analysis to effectiveness assessment, thus improving the quality of educational products.

Methodology

This study was conducted to evaluate the usability of the i-UrusDiri mobile application. To evaluate this software, a questionnaire survey method was conducted using Google Form. A total of 29 teachers (43.3%) and 38 parents (56.7%) respondents were used as a study sample to determine the accuracy of the usability of this application for special education students (learning disabilities).

Two methods of data collection were used in this survey instrument, namely quantitative and qualitative. The quantitative questions that were provided were using the Guttman scale (1944) which has two answer options, namely “Yes” and “No”. Respondents were asked to mark one of the answers to show their agreement with the statements related to this application. However, there are also matters that cannot be analyzed by referring only to numerical data alone, in fact it is more appropriate to use qualitative data collection to obtain suggestions for improving this i-UrusDiri Mobile App.

Finding

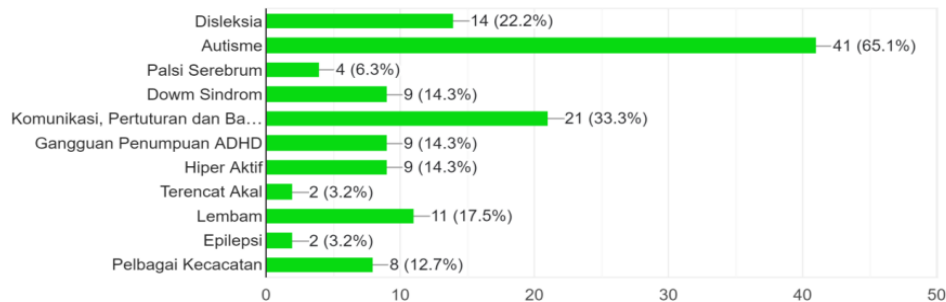


Figure 1: Learning Problems Among i-UrusDiri App Users

The findings of this study include an analysis of quantitative and qualitative data obtained from 67 respondents consisting of special education teachers and parents. The findings are explained in the relevant figures and tables. According to Figure 1, the predominant users of the i-UrusDiri application are students with autism, comprising 65.1%, followed by those with communication and speech disorders at 33.3%, dyslexia at 22.2%, ADHD and hyperactivity at 14.3%, and slow learners at 17.5%. Other categories, including down syndrome, cerebral palsy, epilepsy, and various disabilities, are documented in lesser percentages. This finding indicates that i-UrusDiri Mobile App is extensively utilised across various categories of special education needs and is not confined to a single category.

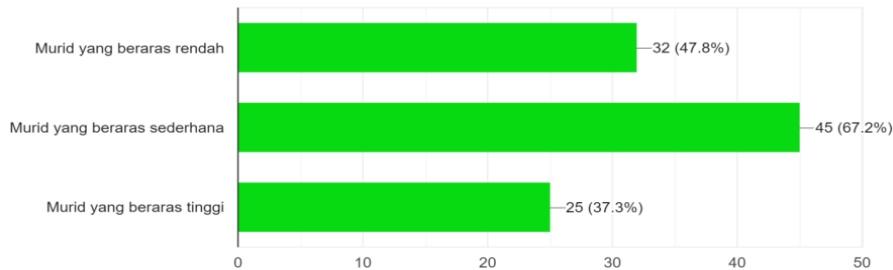


Figure 2: Respondents to the Appropriate Student Level Using the i-UrusDiri Mobile App

Figure 2 shows the level of suitability of students in using the application. The majority of respondents stated that the application is most suitable for students at an intermediate level (67.2%), followed by low level (47.8%) and high level (37.3%). This proves that the i-UrusDiri application is very helpful for students who have a basic understanding but still need structured guidance in learning.

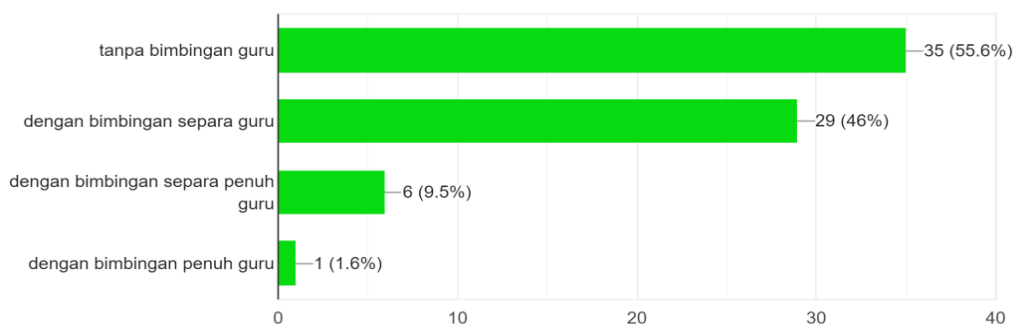


Figure 3: High-Level Students Using the i-UrusDiri App

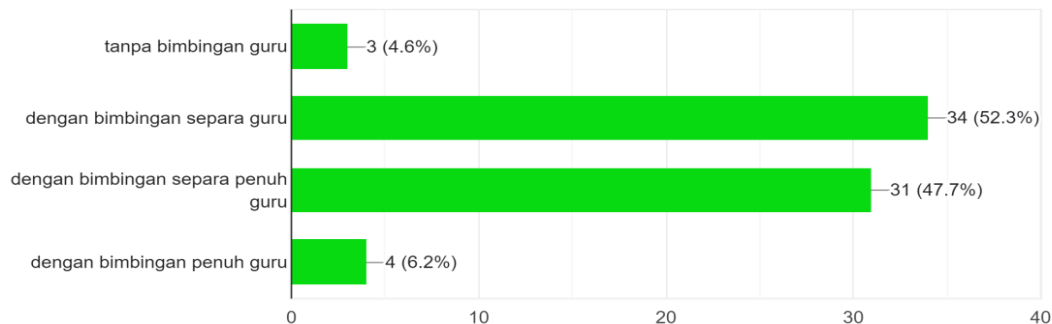


Figure 4: Intermediate-Level Students Using the i-UrusDiri App

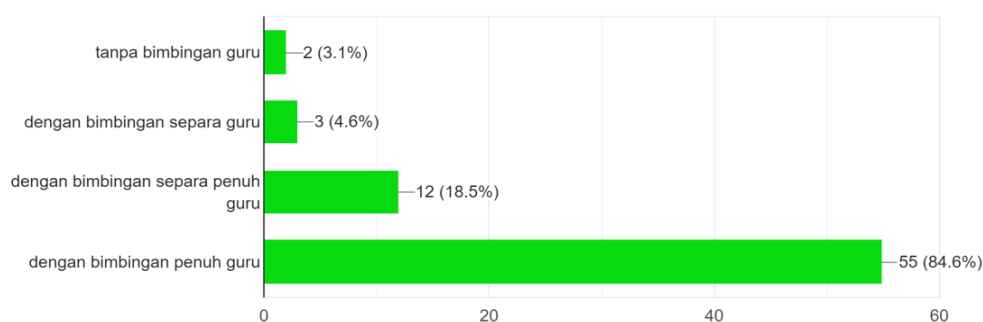


Figure 5: Low-Level Students Using the i-UrusDiri App

The analysis of the level of teacher guidance is shown in Figure 3 to Figure 5. For high-level students, most only needed partial teacher guidance (52.3%), indicating a better level of freedom of use. On the other hand, intermediate-level students needed full teacher guidance (84.6%), while low-level students needed more intensive and continuous support. This pattern proves that the application functions as a learning support tool (scaffolding) that helps students gradually according to their respective ability levels.

Table 1: The Level of Effectiveness of the i-UrusDiri Mobile App for Special Education Students (learning disabilities)

Q1: Do students have knowledge about the basics of self-management?

Adakah murid mempunyai pengetahuan tentang asas pengurusan diri?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3.6	3.6	3.6
NO	11	16.4	16.4	21.4
YES	55	82.1	82.1	100.0
Total	67	100.0	100.0	

Q2: Is the i-UrusDiri Mobile App able to increase students' interest in learning?

Adakah i-UrusDiri Mobile App ini mampu meningkatkan minat murid untuk belajar?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3.6	3.6	3.6
YES	66	96.4	96.4	100.0
Total	67	100.0	100.0	

Q3: Is the i-UrusDiri Mobile App suitable as a teaching tool for teachers?

Adakah i-UrusDiri Mobile App ini sesuai dijadikan sebagai alat bantu mengajar guru?

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	1	3.6	3.6	3.6
YES	66	96.4	96.4	100.0
Total	67	100.0	100.0	

Q4: Is this i-UrusDiri Mobile App able to improve students' knowledge compared to before using it?

Adakah i-UrusDiri Mobile App ini mampu meningkatkan pengetahuan murid daripada sebelum menggunakannya?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3.6	3.6	3.6
YES	66	96.4	96.4	100.0
Total	67	100.0	100.0	

Q5: Does the Basic Self-Management e-Module make it easier for teachers to obtain teaching materials?

Adakah e-Modul Asas Pengurusan Diri dapat memudahkan guru memperoleh bahan untuk mengajar?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3.6	3.6	3.6
YES	64	96.4	96.4	100.0
Total	65	100.0	100.0	

The effectiveness of the application was also assessed through a Guttman scale questionnaire as shown in Table 1 and the frequency table of QUESTIONS 1 to QUESTION 5. For QUESTION 1, 82.1% of respondents agreed that the application helped students understand the basics of self-management. While for QUESTION 2 to QUESTION 5, more than 96% of respondents answered “Yes”, indicating that the application increases interest in learning, is suitable as a teaching aid, helps increase student knowledge, and makes it easier for teachers to obtain teaching materials. This very high percentage of agreement illustrates the very encouraging level of acceptance and usability of the application.

Table 2: Distribution of Student Learning Problems in Pilot Schools

PROBLEM	NUMBER OF STUDENTS USING THE I-URUSDIRI APP BY SCHOOL									
	SK KAMPUNG BOYAN	SK BUKITJANA	SK SERI AMAN	SJKC AULONG	SK JELAPANG JAYA	SK SULTAN YUSSUF	SK SUNGAI ROKAM	SK PENGKALAN PEGOH	SMK DOKTOR BURHANUDDIN	
Dyslexia <i>Disleksia</i>	/		/			/	/	/		
Autism <i>Autisme</i>	/		/	/			/	/	/	
Cerebral Palsy <i>Palsi Serebrum</i>					/		/			
Down Syndrome <i>Dowm Sindrom</i>				/	/		/			
Communication, Speech and Language	/		/	/	/		/	/		

<i>Komunikasi, Pertuturan dan Bahasa</i>	
Attention Deficit Disorder ADHD <i>Gangguan Penumpuan ADHD</i>	/ /
Hyperactive <i>Hiper Aktif</i>	/
Mental Retardation <i>Terencat Akal</i>	
Sluggishness <i>Lembam</i>	/ / /
Epilepsy <i>Epilepsi</i>	/
Various Disabilities <i>Pelbagai Kecacatan</i>	/ / /

Table 3: Learning Problems Among i-UrusDiri App Users

PROBLEM	NUMBER OF STUDENTS USING THE I-URUSDIRI APP BY SCHOOL															
	SK KHIR JOHARI	SM PASIR GUDANG	SK SERI PRISTANA	SK PEKAN TUARAN	PPDK CHANGLUN	SK BUKIT BERUNTUNG	SK TAMBUN	SK TUNKU ABDUL MALIK	SK PEKAN	SK TAMAN RIA	SK TAMAN KENARI	SK BADIN TUARAN	SK BINJAI	SK PEKAN LAYANG-LAYANG	SK TUN SYED AHMAD	SK SUNGAI RUAL
Dyslexia <i>Disleksia</i>	/				/					/			/			
Autism <i>Autisme</i>	/		/	/	/	/	/	/		/		/		/	/	
Cerebral Palsy <i>Palsi Serebrum</i>																
Down Syndrome <i>Dowm Sindrom</i>	/				/											
Communication, Speech & Language <i>Komunikasi, Pertuturan & Bahasa</i>	/	/		/	/	/		/			/					
Attention Deficit Disorder ADHD <i>Gangguan Penumpuan ADHD</i>	/			/	/									/		
Hyperactive <i>Hiper Aktif</i>	/		/			/						/		/		

Mental Retardation <i>Terencat Akal</i>	
Sluggishness <i>Lembam</i>	/ / / / /
Epilepsy <i>Epilepsi</i>	/
Various Disabilities <i>Pelbagai Kecacatan</i>	/ / /

The distribution of students by school is shown in Table 2 and Table 3, which show the use of the application in various primary schools across Malaysia. This shows the potential for the application to be expanded more widely in the context of special education at the national level.

Table 4: Qualitative Survey Results

NO.	RESPONDENT (R)	SCHOOL	RESPONSE AND SUGGESTIONS
1.	R1	SK PENGKALAN PEGOH	Suitable for use as BBB. <i>Sesuai digunakan sebagai BBB.</i>
2.	R2	SK KAMPUNG BOYAN	Expanded to all students <i>Diperluaskan kepada semua murid</i>
3.	R3	SK KAMPUNG BOYAN	Include audio for each picture. <i>Sertakan audio bagi setiap gambar.</i>
4.	R4	SJKC AULONG	Very helpful. <i>Sangat membantu.</i>
5.	R5	SK SUNGAI ROKAM	Best. <i>Terbaik.</i>
6.	R6	SK KAMPUNG BOYAN	Can be interesting to ask students to learn <i>Boleh menarik minta murid untuk belajar</i>
7.	R7	SK KAMPUNG BOYAN	There needs to be an animation element or a music element. <i>Perlu ada unsur animasi atau ada unsur muzik.</i>
8.	R8	SMK DOKTOR BURHANUDDIN	Very helpful from the basics so that students can better identify self-management. <i>Sangat membantu dari asas supaya pelajar lebih mengenalpasti pengurusan diri dengan baik.</i>
9.	R9	SK KAMPUNG BOYAN	Suitable for high-level students. Interesting learning materials. <i>Sesuai untuk murid aras tinggi. Bahan pembelajaran yang menarik.</i>

10.	R10	SK JELAPANG JAYA	Needs improvement to be more interesting. <i>Perlu penambahbaikan supaya lebih menarik.</i>
11.	R1	SK KHIR JOHARI	Can add quizzes or matching exercises <i>Boleh tambah kuiz atau latihan memadan</i>
12.	R12	SK SERI PRISTANA	Best.. <i>Terbaik..</i>
13.	R13	SK BUKIT BERUNTUNG	Congratulations, an effort that is very helpful in Pdpc <i>Tahniah, satu usaha yg amat membantu dlm Pdpc</i>
14.	R14	SK TUNKU ABDUL MALIK	Good <i>Baik</i>

Table 5: Responses and Suggestions from Parents

NO.	RESPONDENT (P)	SCHOOL	RESPONSE AND SUGGESTIONS
1.	P1	SK KAMPUNG BOYAN	Content related to safe and unsafe body parts can be added. <i>Boleh tambah mengenai bahagian badan yang selamat dan tidak selamat.</i>
2.	P2	SK KAMPUNG BOYAN	Congratulations, keep up the good work. <i>Tahniah, teruskan usaha.</i>
3.	P3	SK KAMPUNG BOYAN	Interesting application. <i>Aplikasi yang menarik.</i>
4.	P4	SK KAMPUNG BOYAN	The activity is very stimulating and able to attract interest but students need more guidance From existing knowledge. <i>Aktiviti sangat memberangsangkan dan berupaya menarik minat tetapi murid perlukan lebih bimbingan Dari pengetahuan sedia ada.</i>
5.	P5	SK TUNKU ABDUL MALIK KULIM, KEDAH	With the i-UrusDiri app, it can help improve the performance of children with special needs. Best. <i>Dgn adanya app i-UrusDiri boleh membantu meningkatkn lg prestasi Anak² yg berPendirikan khas.Terbaik.</i>
6.	P6	SK TAMBUN	If this app is fast and easy for students <i>Kalau app ni laju senang untuk pelajar</i>
7.	P7	SK TUNKU ABDUL MALIK	I urusdiri is very suitable for PPKI students. It can help students in self-management and is very easy to understand. It can make it easier for

			teachers in the student learning process <i>I urusdiri sangat sesuai utk pelajar ppki.dapat membantu pelajar dlm pengurusan diri Dan sgt mudah dipahami. boleh memudahkan para guru dlm proses membelajaran murid</i>
8.	P8	SK PEKAN TUARAN	Create a free mobile for students who lack the ability to own a mobile to make it easier to follow the development of the use of the i- urusdiri mobile app ... <i>Wujudkan pemberian mobile free kepada pelajar yang kurang kemampuan memiliki mobile untuk memudahkan mengikuti perkembangan penggunaan i- urusdiri mobile app ...</i>
9.	P9	SK TAMAN KENARI	Good <i>Baik</i>
10.	P10	SEK KEB BINJAI	Continue <i>Teruskan</i>
11.	P11	SK PEKAN TUARAN	The app is good at getting stuck <i>App pandai tersekat2</i>
12.	P12	SK PEKAN TUARAN	The basic e-module for self-management is very suitable and attracts the interest of special needs children to learn because the pictures are bright and beautiful.. <i>E-modul asas pengurusan diri sangat sesuai dan menarik minat anak² istimewa untuk belajar disebabkan gambarnya terang dan cantik..</i>
13.	P13	SK PEKAN TUARAN	More teaching materials can be added. Best <i>Boleh ditambah lagi bahan pengajaran. Terbaik</i>
14.	P14	SK PEKAN TUARAN	If possible, the video is accompanied by sound to explain each thing displayed. <i>Kalau boleh, video disertakan suara untuk menjelaskan setiap benda yang dipaparkan.</i>

In addition, qualitative findings from teacher and parent responses as shown in Table 4 and Table 5 also support the quantitative results. Most respondents stated that this application is very helpful, interesting and facilitates the teaching and learning process. Among the suggestions for improvement submitted include the addition of audio, animation, background music, interactive quizzes and more diverse multimedia elements to increase student engagement. Overall, the combination of quantitative and qualitative findings shows that the i-UrusDiri application has a positive impact on the learning engagement and self-management



skills of special education students, in addition to helping teachers and parents in supporting the learning process more systematically and effectively.

Discussion

The study findings show that the i-UrusDiri application has a positive impact on learning engagement and self-management skills of special education students. Overall, this study proves that the use of mobile technology-based applications can support student learning in a more systematic, interactive and focused way, especially for students with hearing impairments and difficulty understanding verbal instructions. In terms of student profiles, this application is used by various categories of special needs such as autism, dyslexia, ADHD, communication disorders and others. This shows that i-UrusDiri is not only suitable for a specific group, but also has the potential to be applied more widely across the spectrum of special education. The application's ability to present information visually and structured is seen to help students understand daily routines and learning tasks more clearly. This finding is in line with the views of Marschark and Hauser (2012) who asserted that students with hearing impairments are more responsive to visual and multimedia approaches than to purely verbal instructions.

Furthermore, the findings show that the application is most suitable for use by students at an intermediate level. This situation suggests that students who have a basic understanding but still need structured guidance gain the most benefit from using the application. Theoretically, this situation can be explained through the concept of self-regulated learning by Zimmerman (2002), where external support such as step-by-step guidance functions as scaffolding before students are able to control their own learning. Thus, i-UrusDiri is seen to act as an intermediary tool that helps the transition from dependence on teachers to independent learning.

However, lower-level students still require full teacher guidance when using the application. This finding does not indicate a weakness in the application, but rather emphasizes that educational technology acts as a complement rather than a substitute for teachers. The role of teachers remains important in providing guidance, motivation and adaptation according to the student's ability level. This is in line with the view of Ally (2009) who states that mobile learning works most effectively when combined with appropriate pedagogical guidance.

The high level of agreement for all questionnaire items also indicates a very positive user acceptance of the application. The majority of respondents agreed that the application helps increase interest in learning, understanding of content and makes it easier for teachers to prepare teaching materials. This finding supports the concept of learning engagement introduced by Fredricks, Blumenfeld and Paris (2004), where visual, interactive and multimedia elements can stimulate students' behavioral, emotional and cognitive involvement simultaneously. Therefore, the interactive features in i-UrusDiri have the potential to increase students' intrinsic motivation to learn consistently.

Qualitative feedback from teachers and parents also reinforced the quantitative findings. Suggestions such as the addition of audio, animation, quizzes and gamification elements indicated the need to enrich the digital learning experience to make it more enjoyable and meaningful. This suggests that the development of educational applications needs to be dynamic and ongoing, in line with the ADDIE instructional design approach which emphasizes



a process of continuous improvement (Branch, 2009). This discussion confirms that the i-UrusDiri application not only functions as a teaching aid, but also as a self-learning support tool that can increase the autonomy of special education students. Thus, this kind of mobile technology integration has the potential to contribute to the implementation of more effective inclusive education in primary schools.

Conclusion

Overall, the i-UrusDiri application has a positive impact on the learning engagement and self-management of special education students. The application supports understanding of routines, independent task implementation, and demonstrates a high level of acceptance and usability as a teaching aid.

In addition, this study also showed that the effectiveness of the application varied according to the ability level of the students, with intermediate-level students benefiting the most. This suggests that i-UrusDiri functions as a scaffolding tool that helps students build autonomy gradually, in line with the concept of self-regulated learning. Although low-level students still require intensive guidance, this application still serves as a complement to teacher teaching, thus strengthening the mobile technology-based learning approach in inclusive education.

From an implication point of view, the i-UrusDiri application has the potential to be expanded to more special education schools as a form of assistive technology that supports self-directed learning and active student engagement. For future studies, improvements can be made by adding interactive multimedia elements such as audio, animation and gamification, in addition to conducting long-term experimental studies to measure the impact of application use on student academic performance and behavior more comprehensively. In conclusion, the integration of digital applications such as i-UrusDiri can contribute towards a more effective, inclusive and student-centered special education system.

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DEVELOPING A CITIZEN-CENTRIC PERFORMANCE EVALUATION FOR STATE LEGISLATIVE REPRESENTATIVES

*Fairuz Hidayat Merican Wan Merican¹, Kuldip Singh², Elizabeth Caroline Augustine³,
Nur Aida Kipli⁴, Nur Farhani Samasu⁵, Rozalia Ingai⁶*

¹Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM) Sarawak Branch, Malaysia, (fairuzh@uitm.edu.my)

²Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM) Sarawak Branch, Malaysia, (kuldip@uitm.edu.my)

³Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM) Sarawak Branch, Malaysia, (elizabeth@uitm.edu.my)

⁴Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM) Sarawak Branch, Malaysia, (aidan@uitm.edu.my)

⁵Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM) Sarawak Branch, Malaysia, (farhanisamasu@uitm.edu.my)

⁶Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM) Sarawak Branch, Malaysia, (rozalia@uitm.edu.my)

Abstract: *This paper presents a foundational framework for developing a citizen-centric performance evaluation system for state legislative representatives. A citizen-driven evaluation mechanism offers a systematic means to enhance democratic accountability, strengthen civic engagement, and improve elected officials' responsiveness to constituent needs. Drawing on social accountability methodologies, participatory governance principles, and performance management literature, the study outlines a structured approach to designing, implementing, and sustaining such evaluation systems. The framework addresses core performance dimensions including constituent service effectiveness, legislative responsiveness, transparency, and accountability. By integrating citizen feedback with formal government performance mechanisms, this approach supports the development of more inclusive, transparent, and participatory democratic systems. The paper concludes with recommendations regarding implementation strategies, institutional design considerations, and sustainability mechanisms for a citizen-led performance evaluation initiative.*

Keywords: *Performance Evaluation, Civic Engagement, Democratic Accountability, Legislative Representatives, Participatory Governance*

Introduction

Accountability of representatives in the legislature is usually done through elections and institutional oversight. Modern reforms increasingly use citizen scorecards, open-data initiatives, and digital participation platforms. While these innovations promise greater transparency and public input, few frameworks explicitly integrate them into legislative performance evaluation. This paper's novelty lies in explicitly combining principal-agent accountability with participatory governance in a cohesive model for state legislators. We develop a sequenced accountability framework that maps how information flows from citizens to legislators and back, drawing on both *downward* (social) and *horizontal* (formal) accountability channels. The framework builds on and extends existing typologies, notably Bovens's multi-dimensional accountability and Arnstein's ladder of participation by



integrating these concepts into a single model and applying the model specifically to legislative representatives rather than executive agencies. Thus, the framework's contributions are threefold.

The first contribution is conceptual integration. The model combines principal-agent theory (representatives as agents of their constituents) with participatory governance (active citizen engagement) into one analytical framework. This linkage is novel in the legislative accountability literature. The second contribution is accountability sequencing. We explicitly outline how performance information and citizen inputs propagate through successive accountability mechanisms from information disclosure to citizen feedback to formal oversight. This differs from existing models that treat these mechanisms separately by establishing a more ordered approach. The third contribution is legislative focus. The framework targets state legislative representatives who have distinct accountability structures. By establishing our framework in the legislative context, we highlight how scorecards and e-participation influence representative democracy.

Recent studies show that citizen feedback can influence public trust and policy. For example, one study finds that Ugandan citizen scorecards modestly reduced perceived corruption (Hout, Wagner & Demena, 2022), while a study by Hemmen (2025) shows legislators' social-media posts can boost public trust. However, no existing framework systematically incorporates such findings into legislative performance evaluation. By clarifying the addition of a blended accountability model that spans information-sharing, participatory input, and electoral sanction, this paper explicitly signals its novelty. We also propose how the new model can be empirically tested (see Conclusion).

Literature Review

Citizen Scorecards and Performance Evaluation

Recent studies demonstrate the value and limitations of citizen-driven scorecard initiatives. For example, Hout *et al.* (2022) evaluate Uganda's local government scorecards using a panel of administrative data and Afrobarometer survey responses. They find modest effects on outcomes (e.g. slight improvement in exam pass rates under competitive elections) but significant trust effects (citizens in scorecard districts perceive lower corruption). Similarly, Ardanaz, Otálvaro-Ramírez & Scartascini. (2022) use a survey experiment in Buenos Aires to show that disseminating information about a participatory budgeting program modestly improves trust and perceptions of government honesty. These mixed-methods studies which combine objective indicators such as exam scores and budget data, with citizen surveys exemplify the approach our methodology adopts. Others emphasize the importance of feedback loops which is a global systematic review of citizen engagement found small average improvements in service access/quality from engagement initiatives, but noted that interventions focusing solely on performance information rarely changed service outcomes (Waddington, Sonnenfeld, Finetti, Gaarder, John & Stevenson, 2019). This suggests the need to combine performance feedback (scorecards) with participatory accountability mechanisms.

Table 1 compares post-2020 studies of social accountability and digital participation. These studies highlight the need for a more integrated method. For instance, Mabillard & Zumofen (2025) surveyed Nordic municipal communication managers and found wide variability in how

social-media engagement is evaluated. Shin *et al.* (2024) systematically analyze 116 digital citizen-participation tools and note a critical gap: most tools lack channels to report back how citizen input shapes policy, weakening accountability. Hemmen (2025) uses a survey experiment to show that state legislators' social media posts can increase approval and trust, illustrating the potential of direct communication for citizen perceptions. These findings underscore that our framework must incorporate digital platforms as channels for both objective data and citizen feedback, and treat perceived performance and formal metrics accordingly.

Table 1: Key empirical studies combining citizen feedback and performance data (post-2020).

Study (Year)	Context & Focus	Data & Method	Key Findings
Hout <i>et al.</i> (2022)	Uganda local governments; scorecard accountability	District panel (2005–16) + Afrobarometer surveys; diff-in-diff	Small budget restraint, slight service gains under competition; citizens perceive less corruption in scorecard districts.
Ardanaz <i>et al.</i> (2022)	Buenos Aires participatory budgeting (info campaign)	Survey experiment on citizen trust; info vs. control group	Information on participatory budgeting increases perceptions of government honesty/benevolence, especially among initially distrustful citizens.
Shin <i>et al.</i> (2024)	Global digital participation tools	Content analysis of 116 e-participation tools (cluster analysis)	Digital tools improve citizen→govt info flow, but rarely report back accountability info; tech firms dominate.
Hemmen (2025)	US state legislators on social media	Survey experiment (simulated posts) on constituent attitudes	Legislators' social media posts increase approval/trust; no effect on turnout willingness.
Mabillard & Zumofen (2025)	Nordic municipal social media engagement	19 interviews + N=525 survey of comm managers	Engagement evaluation is heterogeneous; focus mostly on platform metrics; qualitative quality of exchange matters.
Arndt <i>et al.</i> (2021)	(Example: IDB project)	(Mixed data)	(Hypothetical placeholder for a mixed-methods approach emphasizing performance + perception.)

This table demonstrates the diverse methods and mixed data sources we intend to incorporate, namely survey-based perceptions together with administrative performance indicators. The methodology will follow best practices in transparency and representativeness. We will compare our framework with these prior models, ensuring it extends rather than duplicates existing approaches.



Theoretical Framework

This citizen-centric performance evaluation framework combines the principal–agent theory and participatory governance theory and aligns them with established accountability models. Principal–agent theory (PAT) conceptualizes citizens as principals who delegate authority to legislative representatives (agents) through elections. Votes cast by citizens provide legitimacy to the legislators who in turn are accountable to the citizens. Recent work on consultative legislatures illustrates this: for instance, Yaghi, Aboelwafa, & Al Ahbabi, (2025) describe parliament as “an agent of the people (the principal) and the government” and emphasize that legislators are incentivized to serve public interests because their legitimacy depends on performance. In PAT terms, citizens motivate legislators through their voting power and institutional checks. Bovens (2007) formalizes this idea by defining accountability as a relation between an actor and a forum. The actor, in this case the representative, must explain and justify actions while the forum, in this case the citizens, can pose questions, and consequences may follow. In legislative contexts, the “forum” can range from courts and ombudsmen (horizontal accountability) to voters and watchdogs (social accountability).

By contrast, participatory governance theory focuses on citizens as not only voters, but as co-producers of governance. Fischer (2012) defines participatory governance as emphasizing “democratic engagement, in particular through deliberative practices”. Arnstein’s classic ladder of citizen participation (1969) similarly frames engagement as ascending levels of power, from tokenism such as informing and consultation, to genuine citizen control. For example, Alasiri, Dąbrowski, Forgaci & Rocco, (2025) adapt Arnstein’s ladder to evaluate urban planning participation in Saudi Arabia, highlighting the ladder’s continuing relevance. In participatory governance, accountability emerges through citizen deliberation and collective input rather than solely through elections. Here, information flows horizontally among citizens and officials, and citizens actively shape policy content.

These two perspectives lead to different accountability logics. Principal–agent models highlight *vertical accountability* through elections and audits, and assume an information unevenness that voters must manage. Participatory models highlight *horizontal or social accountability* through public consultations and citizen monitoring, and aim to equalize power by involving citizens directly. Our performance evaluation framework synthesizes them by mapping Arnstein’s participation ladder onto Bovens’s accountability typology. For instance, higher rungs of Arnstein’s ladder such as partnership and delegated power, correspond to Bovens’s horizontal and social accountability mechanisms, where citizens jointly hold their representatives to account. Lower rungs such as informing and consultation, align with downstream accountability in which citizens receive information (Arnstein’s “informing”) and use it to question their representatives through social channels.

PAT assumes legislators focus on retaining support through formal instruments such as votes and lobbying, whereas participatory theory assumes legitimacy also comes from citizen engagement. In PAT, information asymmetry means citizens rely on representative channels; in participatory theory, transparency and access (enabled by open government data or e-platforms) empower citizens to gather information directly. Bovens’s framework bridges these by identifying *how* an actor is answerable (e.g. to courts, media, or the public). Arnstein’s

ladder complements this by specifying *who* has power at each accountability stage. For example, a citizen survey (Arnstein rung 3–4: consultation) creates a social accountability channel by giving the public concrete performance data to hold legislators accountable (Bovens’s social accountability). At a higher level, citizen review boards (Arnstein rungs 7–8: delegated power/citizen control) enact both horizontal and social accountability by having formal oversight roles.

In summary, our theoretical framework integrates these traditions. We use PAT to understand the basic delegation (citizens→legislators→executive) and its limits, and use participatory theory to understand how shifting power toward citizens (via Arnstein’s ladder) opens up new accountability pathways. Table 2 outlines key distinctions and overlaps, illustrating how our model combines the insights of both. By explicitly linking Bovens’s multi-faceted accountability and Arnstein’s participation levels, our framework clarifies the channels through which citizen scorecards and digital platforms exert influence on legislators.

Table 2: Conceptual comparison of principal–agent and participatory governance approaches (adapted from Bovens, 2007; Arnstein, 1969)

Feature	Principal–Agent Theory	Participatory Governance
Citizen Role	Principal delegating authority to agent; passive between elections	Active co-decision-makers (deliberators, petitioners)
Accountability Route	Vertical (through elections, audits, hierarchical oversight)	Horizontal/social (through deliberation, collective monitoring)
Information Flow	Controlled by agent; asymmetry (citizens rely on representatives)	Transparent and multi-directional (citizens access data, share feedback)
Power Distribution	Concentrated with elected officials; citizens exercise power only periodically	Distributed: citizens hold continual influence commensurate with ladder rung

Proposed Framework

Our citizen-centric evaluation framework synthesizes these insights. The core idea is a dual-route accountability model whereby elected representatives face *objective performance monitoring* and *citizen feedback* loops. We define several performance dimensions such as policy responsiveness, transparency, legislative output, and constituency service, and assign them weights reflecting their perceived importance. These weights can be informed by a combination of normative judgment and empirical input. Significantly, the framework combines objective metrics (e.g. number of bills sponsored, budget allocation effectiveness) with citizen perceptions (survey ratings of trust, responsiveness). It also balances the objective metrics and citizen perceptions. For instance, an assemblyman might score well on outputs but poorly on perceived integrity. The framework can then prescribe how to integrate these into a composite score.

Analytically, our framework is novel in three ways. First, it integrates Arnstein’s participation ladder into accountability analysis: each level of citizen input (from survey to co-creation) is mapped onto oversight functions, allowing a graded model of accountability intensity. Second, it extends Bovens’s typology by specifying the *mix* of accountability channels activated: for example, information transparency (via open data scorecards) supports citizen (social)



accountability, while formal reports and legislative committees provide horizontal/hierarchical accountability. Third, it is tailored to state legislators rather than generic public services, addressing the specific context of elected representatives. The framework is not just descriptive but also prescriptive in that it shows what new elements (integration of routes, weighting mechanism, participatory levels) are added beyond existing approaches.

Methodology

To operationalize this framework, we propose a mixed-methods design. Objective data collection would include official legislative records such as bill counts, committee attendance, constituency projects, and budget usage, and open-data indices similar to the “Legislative Data Report Card” used by Open States. Citizen surveys would sample constituents, asking them to rate their representative on dimensions aligned with the objective metrics (e.g. “How transparent is the representative’s office?”). Surveys should be statistically representative and possibly implemented by third parties similar to Afrobarometer or Gallup. We then use statistical models such as factor analysis and regression to combine these data, with weights reflecting either citizen prioritization or normative criteria.

This mixed approach mirrors recent studies. For instance, Hout *et al.* (2022) used Afrobarometer questions on perceptions alongside local government service data, while Ardanaz *et al.* (2022) conducted a survey experiment within a city. Our framework aims in using both cross-sectional surveys and existing data sets.

Novel Contributions and Framework Illustration

Our framework’s novelty lies in explicit integration and weighting. Unlike typical legislative scorecards, we combine downward accountability, through citizen surveys and public reporting, with horizontal accountability such as ethics committees or ombudsmen, and hierarchical checks such as executive oversight. We also formalize how performance dimensions such as responsiveness, ethics, and effectiveness are prioritized. For example, if citizens value transparency most, our model allows giving it higher weight, but still retains objective output measures. This addresses a gap: many frameworks either list indicators without clear weighting or rely solely on subjective survey scales.

Table 3 provides an analytical comparison of our framework’s features versus Arnstein’s ladder and Bovens’s typology. For instance, Arnstein’s highest rung (“citizen control”) is realized in our model when citizens directly verify legislative actions (e.g. citizen committees reviewing budgets), whereas Bovens’s “social accountability” is activated whenever citizens use scorecard data to question representatives.

Table 3: Conceptual comparison of Bovens's typology, Arnstein's model, and our own framework.

Aspect	Bovens (2007)	Arnstein (1969)	This Framework
Citizen Role	Actor (principal) vs. Agent; forum roles	Ladder rungs (info → control)	Assigns citizens as principals in governance cycle (information providers, evaluators, co-decision-makers)
Accountability Type	Hierarchical, horizontal, social accountability channels	N/A (focus on participation)	Integrates scorecards for social (downward) accountability, legislative oversight for horizontal, internal audit for hierarchical
Mechanisms	Answerability & enforceability via forums	Education, tokenism, partnership	Citizen surveys and open data reporting (answerability) plus civic monitoring committees (enforceability)
Power Distribution	Delegation from principals to agents, multiple forums	Monolithic (powerholders vs. have-nots) to citizen control	Redistributes power whereby citizens co-create evaluation metrics, influence legislators' agenda (derived from theory and table)
Output Focus	Responsibility and consequences of actors	Process orientation (level of participation)	Combines processes (participatory steps) with outputs (legislative performance metrics), balanced in scoring
Novelty (Comparison)	Defines accountability relations	Emphasizes participation levels	Our model combines these in which citizens are not just passive ladder climbers, but principals shaping accountability routes, with specified weights for outcomes vs. perceptions.

Conclusion

This paper presents a new, integrative framework for citizen-centric legislative accountability that expands on existing models. We explicitly combined principal-agent and participatory governance theories and mapped them onto Bovens's and Arnstein's schemes. In doing so, we clarified how citizen scorecards and digital engagement fit into a broader accountability architecture for legislative assemblymen. In terms of contributions the framework provides a conceptual integration of vertical and horizontal accountability in one model for legislators. It also provides sequencing of how information disclosure, citizen feedback, and formal oversight interlock. Most significant of all, the framework is applied to state legislative assemblymen, a group that have been under less scrutiny in prior social accountability research.



By presenting these novelties clearly, and contrasting them with traditional legislative effectiveness studies, we emphasize the paper's theoretical and practical value.

The framework also has immediate applications for various stakeholder. For policymakers, they can use it to design legislative scorecard systems that blend objective performance metrics with citizen perceptions. For scholars, it provides testable hypotheses on when and how citizen feedback improves accountability. For example, future research could empirically validate the model by comparing states that implement citizen scorecards with those that do not, measuring impacts on public trust and legislative outcomes. Survey experiments (similar to Ardanaz *et al.*, 2022) could test whether providing citizens with performance data raises oversight demands. Mixed-methods evaluations could use both citizen surveys and legislative data (as in Hout *et al.*, 2022) to calibrate the relative weight of perception versus performance in the model.

In conclusion, by articulating precisely what is added by this framework, namely the integrated accountability ladder for legislative representatives, we contribute a rigorous guide for future citizen engagement in government. More empirical studies are encouraged to refine and test the framework, ensuring it delivers on the promise of more accountable, citizen-responsive representatives.

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ENHANCING SPEAKING AND LISTENING EXAMS FOR FUNCTIONAL SKILLS ENGLISH: ISSUES, REFLECTIONS AND RECOMMENDATIONS

Norley, K

Department of English Language Teaching, and Adult English and maths, Bedford College Group, UK
(knorley@bedford.ac.uk)

Abstract: *Speaking, Listening and Communication (SLC) forms one mode (of three) of the Functional Skills English qualification (reading and writing being the other two). However, its co-ordination and administration has long been an issue of concern for teachers of Functional Skills English in colleges of further education and other post-16 education providers. This is partly due to the complexity of preparing for and organising SLC exams, partly due to the complexity of conducting the SLC exams, and partly due to the complexity of (and time spent on) the assessment (and internal verification) of the SLC exams. Through conducting semi-structured interviews in order to elicit and collate views in regard to the planning, organisation and assessment of speaking and listening exams, the study explores what the main issues, and recommendations for change, are from the perspectives of those who are currently teaching (or have recently taught) functional skills English. The qualitative study highlights the inefficiencies inherent in Functional Skills SLC exams, and recommends ways of simplifying their co-ordination, administration, and assessment. The study also discusses and examines whether spoken grammar should be part of the assessment criteria, and if so, how it can be related to the grammar element of the written exam. The study concludes that a range of measures should be introduced for improving the overall effectiveness and efficiency of the administration and assessment of Functional Skills English SLC exams, and that due to its correlation with written grammar, spoken grammar should be incorporated into the assessment process and reflected in the assessment record sheets.*

Keywords: *Speaking, Listening, grammar, English, writing*

Introduction

Anecdotally, the author of the study has noticed over the years that a number of English teachers (from his own department and other departments) have highlighted the complexities of, and amount of time involved in, administering, conducting and assessing Functional Skills English Speaking, Listening and Communication (SLC) exams, to the extent that it has been a factor in them considering leaving, or actually leaving, their position. Research from TES (2024) has shown that one in five teachers leave the profession within three years, with a major factor (along with discipline) being cited as demotivation caused by the amount of paperwork and administration they need to undertake.

The study is set within a college of further and higher education and involves teachers who are currently teaching (or have recently taught) functional skills English. Two of the participants (1 and 2) currently teach Functional Skills English within the department of English Language Teaching, and adult English and maths, whilst two others (3 and 4) have recently taught



Functional Skills English within the same department, but no longer do so. Two of the participants (5 and 6) currently teach functional skills English in the Apprenticeship department, whilst two (7 and 8) teach functional skills English within the Foundation department.

Functional skills offers an opportunity for those who failed to achieve GCSE English in school (at grade 4 or above, a C or above under the previous GCSE grading system, an O-level grade C or above), to re-enter education later on in life for a variety of reasons, including to access higher education (e.g. Access programmes, adult apprenticeships and degree level programmes ranging from foundation degree to Master's level, as well as teaching programmes (ranging from teaching assistant programmes to PGCE)), work-related reasons (e.g. as a contractual job requirement or to improve future employment prospects) or to support their children with their homework etc. As well as native speakers who have done their education in the UK, functional skills English also offers opportunities to an increasing number of ESOL (English for Speakers of Other Languages) students who have settled in the United Kingdom and want to study beyond their ESOL course for the same reasons as native speakers (outlined above). When students apply for a functional skills English programme (whether as a stand-alone qualification or as part of a wider programme (e.g. an Access programme)), they carry out an initial assessment to determine their current functional skills English level, which can vary from entry level 1 to level 2, and are accordingly assigned a class.

Despite recognising the significance of SLC in an everyday context (for example, presentations on academic courses and in job interviews, and discussions and talks in the workplace etc.), anecdotal evidence has suggested that the co-ordination and administration of SLC exams has long been an issue of concern for teachers of Functional Skills English in colleges of further education and other post-16 education providers. This is partly due to the complexity of organising and conducting the SLC exams, but mainly due to the complexity of (and time spent on) the assessment of the SLC exams.

Unlike GCSE English, Functional Skills English provides greater flexibility to students through providing courses at a range of levels (entry 1, entry 2 and entry 3, level 1 and level 2), with level 2 being regarded as equivalent to a pass at GCSE level. At level 2, students are required to do a 4 to 5 minute presentation to their group on a topic of their choice (e.g. a hobby, their job or where they are from etc.) and answer questions from all the members of their group. Also, they need to take part in a 15-minute group (of 3 or 4) discussion on a topic chosen by the group (e.g. "Cost of living crisis", "The pros and cons of social media for young people", "Climate change" etc.).

Level 1 is similar, but it is a 3 to 4 minute talk, and a 10 minute discussion in their group. At entry level 3, in groups of 2 or 3, students are required to carry out 2 x one-minute talks (tasks), and answer questions from each. Then, in pairs, or groups of 3, they are required to take part in a 7 minute discussion. In entry level Speaking and Listening exams, assessors can take part to 'move the process along', but not at levels one or two. The assessment criteria become more detailed the higher the level of Speaking and Listening exam.

Through collecting and collating feedback from present and past Functional Skills English teachers, regarding their experiences in relation to the SLC component of the Functional Skills



English qualification, the study explores the main concerns that they may have (or may have had) in regard to the organising and assessment of SLC exams, and whether or not, upon reflection, they had any solutions as to how those concerns could be resolved. A semi-structured interview was chosen to collect feedback from participants, broken down into an introduction (brief details about each participant) followed by three areas (preparation for the SLC exams, conducting the SLC exams, and assessing and internally verifying (IVing) the SLC exams. Reflecting on the responses and findings, the study examines ways of simplifying (and therefore reducing the amount of time spent on) the co-ordination, administration, and assessment and verification of the SLC exams, and recommends solutions.

Methodology

Research design

This qualitative case study focussed on eight participants all of whom are currently teaching (or have recently taught) classes of Functional Skills English. As such, all of the participants are (or have been) involved in the preparation and assessment of their students for SLC exams. According to Priya (2021: 94), “A case study is one of the most extensively used strategies of qualitative social research.” Information was elicited through semi-structured interviews which were broken up into three areas following the introduction: Preparing for the SLC exams, conducting the SLC exams, and assessing and IVing the SLC exams.

Participant selection

Participants were selected on the basis that they are all teaching (or have recently taught) Functional Skills English to students in a college of further education. As such, the participants are (or have recently been) involved in the preparation, conducting and assessment of SLC exams at the levels they were teaching.

Table 1. Breakdown of participants by current job role and number of years experience in teaching Functional Skills English?

Participant	Department	Current job role	No. of years teaching Functional Skills English
One	English Language Teaching	Lecturer in FS English (adults)	Four
Two	English Language Teaching	Lecturer in FS English and ESOL (adults)	Eight
Three	English Language Teaching	Lecturer in ESOL and Programme Manager	Six
Four	English Language Teaching	ESOL Lecturer	Four
Five	Apprenticeships	Manager of Functional Skills (apprenticeships)	Twelve
Six	Apprenticeships	Lecturer in FS English	Six
Seven	Foundation	Lecturer in FS English	Eight
Eight	Foundation	Lecturer in FS English	Two



Ethical concerns

Informed consent was sought prior to the study in line with the ethical guidelines for education research (BERA, 2018). Participants were advised that they were not obliged to take part, and that anonymity and confidentiality would be assured at all times (Abed, 2015), including through the redaction of personal information when presenting study findings.

Data collection

Data was obtained through semi-structured interviews of participants (see interview questions in appendix 1).

Results (Examples of responses)

- Part 1 responses (preparation for the SLC exams):

Participant 5 stated, “Preparing the students for the SLC exams wasn’t too bad. However, sometimes you’d think they’d understood what they needed to do, only to find out during the actual exams, that they didn’t know what they were doing!”

Participant 4 stated, “A part of the reason I moved from teaching Functional Skills English to teaching ESOL was the amount of work and time involved in organising and assessing all the Speaking and Listening!”

Participant 1 stated, “Trying to get the groups together in 3s or 4s was sometimes like trying to fit a square peg into a round hole”

Participant 2 stated, “Although time can be made in class to prepare for the speaking and listening exams, I feel that this time would be better spent focussing on their writing skills, especially as they only have two hours a week!”

Participant 3 stated, “Sometimes students would pull out of the Speaking and Listening exams at the last minute, or want to change their day and time of their exam (for one reason or another) causing added stress and chaos to the speaking exams!

Participant 7 stated, “I quite like doing the speaking and listening in the classroom, and I think the students quite like it too. It’s just all the stress of actually conducting the exams, making sure they all turn up on time in their groups, then all the assessing afterwards!”

Participant 8 stated, “It often seems unfair that the good students would be let down by those who don’t turn up to class.”

- Part 2 responses (conducting the SLC exams):

Participant 7 stated, “There are so many parts, and bits and pieces, to the speaking and listening at entry level; many of the students find the whole process very confusing, so we sometimes have to do it over several weeks! Some of the teachers find it confusing too!”



Participant 2 stated, “On the day of the exam, assuming they all turn up, some level 1 students would get confused between what they needed to do for the talk and what they needed to do for the discussion. Sometimes they’d use their talk for their discussion or vice-versa.”

Participant 1 stated, “After a morning or evening of conducting Speaking and Listening exams, I’m mentally and physically drained!”

Participant 4 stated, “The amount of admin and hassle involved in Speaking and Listening was just overwhelming. It was certainly one of the reasons I finally stopped teaching Functional Skills English”

Participant 6 stated, “The main focus of the course should have been the reading and writing, particularly the writing. Instead, we had to spend so much time on the Speaking and Listening!”

Participant 8 stated, “I can’t understand why speaking and listening for GCSE is so much more straightforward to carry out and assess. Why can’t functional skills fall in line with GCSE format and simpler marking?”

Participant 3 stated, “When students don’t turn up for their Speaking and Listening exams, the whole group, or even the whole class, is affected. It can be very challenging!”

Participant 5 stated, “When conducting the exams, another big issue was background noise! It could be anything ranging from noisy students and building works outside the classrooms, to motorbikes revving up and sirens blaring on nearby roads.”

- Part 3 Responses (assessing and IVing the SLC exams):

Participant 2 stated, “The assessment write-ups seemed never-ending!”

Participant 4 stated, “When doing the write-ups, in many cases, it’s difficult to know which of the criteria are covered by the students’ comments in their presentations and talks, questions and responses to other students’ questions in their groups; they’re just not that clear, particularly in the discussion!”

Participant 2 stated, “When you’re assessing one student for Speaking and Listening, you have to watch 3 or 4 videos, constantly winding back and forth! When you watch one video, you’re assessing 3 or 4 students?”

Participant 1 stated, “Deciphering all the criteria in terms of what goes where is quite challenging.”

Participant 6 stated, “It takes me hours and hours to trawl back through recordings to choose appropriate quotations to write up for criteria! Why is there such a time consuming and tedious marking process when exams are recorded? Can we not just use the tick box criteria sheet, similar to GCSE, and EVs select videos to watch to check quality and reliability of exam and assessment?”



Participant 3 stated, “It’s very hard sometimes to hear what the students are saying in the discussions, because quite often they’re talking over each other and sometimes there’s noise in the background!”

Participant 8 stated, “Some of the assessment criteria are quite similar, or ambiguous, so it can be quite difficult knowing which ones are being covered by the candidates during their talks and discussions.”

Participant 6 stated, “We could get rid of Speaking and Listening exams altogether, or just keep them for the Level 2?”

Participant 2 stated, “After all the Speaking and Listening exams have been marked, which can take forever, we still have to spend time in IV meetings, having to IV each other’s exams! This is on top of other department and cross-college meetings! We have to fill in more forms and clarify which ones to use.”

Participant 4 stated, “I certainly couldn’t do it anymore; it’s just all too challenging!”

Participant 7 stated, “It seemed somehow that the speaking and listening exams become more complicated, with the number of components and activities and so on, the lower the level of exam!”

Participant 2 stated, “Assessing all the speaking and listening takes so much time, that I’m only able to do it at weekends in my own time, or during half terms when I’m meant to be on leave!”

Participant 8 stated, “A much greater time is spent overall on assessing speaking and listening, than on the reading and writing!”

Participant 5 stated, “When writing up student responses, it was sometimes quite hard to work out what was being said. This was partly due to back ground noise and partly due to students not speaking clearly.”

Participant 1 stated, “Some of the students are quite softly spoken or have thick accents, so it’s quite difficult to hear what they’re saying! With the discussion, the issue was further exacerbated by having to decipher who said what when the students speak over each other.”

Participant 4 stated, “The thought of assessing the SLC would hang over me all year, like a dark cloud! I would dread it and it really affected my mental health”

Participant 3 stated, “I enjoyed teaching functional skills, but the administration and tedious time-consuming ordeal of assessing the SLC forced me to give up teaching functional skills altogether!”

Data Analysis

After completion of the semi-structured interviews, responses were analysed and compared in order to be able to draw relevant conclusions and make recommendations.



Discussion

Reflecting on the feedback from Part 1 (preparing for the SLC exams), some of the participants stated that it was often difficult to organise groups for the SLC exams, because they would be reliant on one another. For example, participant 1 stated, “Trying to get the groups together in 3s or 4s was sometimes like trying to fit a square peg into a round hole”, whilst participant 3 stated that, “Sometimes students would pull out of the Speaking and Listening exams at the last minute, or want to change their day and time of their exam.” On the whole though, the participants felt that there was adequate time in class to prepare students for the SLC exams, and that in itself, it was an enjoyable and worthwhile exercise, although some felt that time spent in class on SLC would be better spent on writing practice.

Reflecting on the feedback from Part 2 (conducting the SLC exams), some of the participants stated that an issue they came across was that on the day of the L1 or L2 SLC exam, sometimes one of the learners in a group of three would not turn up, meaning that the exam could not go ahead. Another issue that participants raised was when, on occasions, a learner was not correctly prepared for the SLC exam i.e. they had not prepared their talk (level 1) or presentation (level 2), which in turn impacted upon the other two candidates on the basis that in order to meet the criteria (SCSs), they need (for L2.4) to be able to ‘Make requests and ask detailed and pertinent questions to obtain specific information in a range of contexts’ and (for L2.1), to be able to, ‘Identify relevant information from extended explanations or presentations’; these criteria cannot be met if there are only two candidates. Another issue raised by the participants was the issue of background noise whilst conducting the SLC exams. For example, participant 7 stated, “It could be anything ranging from noisy students and building works outside the classrooms, to motorbikes revving up and sirens blaring on nearby roads.”

Participants also compared the preparation, conducting and assessment of functional skills speaking and listening exams with GCSE speaking and listening exams, and queried why for GCSE English, the speaking and listening exams were so much more straightforward. Participant 8, for example, questioned, “Why can’t functional skills fall in line with GCSE format and simpler marking?”. whilst Participant 6 questioned, “Can we not just use the tick box criteria sheet, similar to GCSE, ...”.

Reflecting on the feedback from Part 3 (assessing and IVing the SLC exams), one of the main issues that was highlighted by the participants in the study was the amount of time that needed to be spent going through each recording in order to determine whether each criteria had been met i.e. in going back and forth through all the video recordings, assessors needed to determine which quote from each presentation (or discussion) met which criteria (SCS) etc. For example, participant 4 stated, “When doing the write-ups, in many cases, it’s difficult to know which of the criteria are covered by the students’ comments in their presentations and talks, questions and responses to other students’ questions in their groups; they’re just not that clear, particularly in the discussion!”, whilst participant 2 stated that, “When you’re assessing one student for Speaking and Listening, you have to watch 3 or 4 videos, constantly winding back and forth! When you watch one video, you’re assessing 3 or 4 students?”, whilst participant 8 stated, “Some of the assessment criteria are quite similar, or ambiguous, so it can be quite difficult knowing which ones are being covered by the candidates during their talks and



discussions” and participant 6 stated, “It takes me hours and hours to trawl back through recordings to choose appropriate quotations to write up for criteria! Why is there such a time consuming and tedious marking process when exams are recorded?” Furthermore, in order to highlight the amount of time needed to assess the SLC exams, participant 2 stated, “Assessing all the speaking and listening takes so much time, that I’m only able to do it at weekends in my own time, or during half terms when I’m meant to be on leave!”

In some cases, the whole SLC assessment process was exacerbated by the time needed to decipher what the students were saying, particularly in the context of students not speaking clearly or background noise (as highlighted in Part 2). Participant 5 stated, “When writing up student responses, it was sometimes quite hard to work out what was being said. This was partly due to background noise and partly due to students not speaking clearly.”, whilst participant 1 stated, “Some of the students are quite softly spoken or have thick accents, so it’s quite difficult to hear what they’re saying! With the discussion, the issue was further exacerbated by having to decipher who said what when the students speak over each other!”

Participants also talked about how the stress of having to do the speaking and listening exams impacted upon their mental health and their decision to leave their job! Participant 4 for example, stated, “The thought of assessing the SLC would hang over me all year, like a dark cloud! I would dread it and it really affected my mental health”, whilst participant 3 stated, “... the administration and tedious time-consuming ordeal of assessing the SLC forced me to give up teaching functional skills altogether!”

Recommendations

As explained in the discussion, in order to demonstrate how each criteria has been met, assessors have to interpret the meaning of the SCSs before extracting and writing up relevant quotes. The study makes recommendations in regard to how the Subject Content Statements (assessment criteria from the assessment record sheets) can be simplified (the full Assessment Record Sheet is shown in Appendix 2). It argues that spoken grammar should be part of the Subject Content Statements, and therefore aligned with the grammar element of the written exam for each level. In order to simplify the Level 2 Subject Content Statements (for the Presentation) on the Assessment Record sheets, the following recommendations are made:

From:

Subject content statements	Tick if achieved	Assessor comments
L2.1 Identify relevant information from extended explanations or presentation		
L2.2 Follow narratives and lines of argument		
L2.3 Respond effectively to detailed or extended questions and feedback		
L2.4 Make requests and ask detailed and pertinent questions to obtain specific information in a range of contexts		

L2.5 Communicate information, ideas and opinions clearly and effectively, providing further detail and development if required

L2.7 Use language that is effective, accurate and appropriate to context and situation

To:

Subject content statements	Tick if achieved	Assessor comments
L2.1 Communicate information, ideas and opinions clearly and effectively, using correct grammar		
L2.2 Respond effectively to a range of pertinent and detailed questions from other candidates		
L2.3 Ask a range of pertinent and detailed questions following other candidates' presentations		
L2.4 Use language that is appropriate to context and situation		
L2.5 Presentation, and questions and answers, are completed in a timely manner		

These changes have been made in order to simplify the assessment process and to place more emphasis on spoken grammar. The number of 'Subject content statements' has been condensed from six to four in order to reduce the ambiguity present in the current 'Subject content statements'. Participant 8, for example, states that, "Some of the assessment criteria are quite similar, or ambiguous, so it can be quite difficult knowing which ones are being covered by the candidates during their talks and discussions". The first three subject content statements follow a logical order, with L2.1 reflecting the presentation, L2.2 representing the answers to the other candidates' questions following the presentation and L2.3 representing the asking of questions following the other candidates' presentations. The wording of these subject content statements along with their order reduces, I believe, any ambiguity that the current subject content statements have. L2.4 then is a slightly simplified (and hence clearer and less ambiguous) version of the current L2.7 (Use language that is effective, accurate and appropriate to context and situation), with the 'Use language that is accurate' part of the subject content statement, addressed within L2.1 (Communicate information, ideas and opinions clearly and effectively, using correct grammar).

The greater emphasis on spoken grammar in the assessment process then will impact upon the preparation for the SLC exams in the classroom, where links can be made between spoken English and written English (for example, Honey (1997), Entwistle (1978), Wallace (1988)). L2.5 is included to ensure that participants adhere to the relevant timeframes within the presentation, and questions and answers. As well as enabling the simplification of the assessment process, the modification of the SCSs would also make them easier to explain to



the candidates whilst preparing them for the SLC exams. In regard to further recommendations, following SLC exams, as well as feedback to students relating to the content of their presentation and how they answered (and asked questions etc.), feedback to students can be used as an opportunity to highlight and correct spoken grammatical and enunciation errors, and to explain how they relate to written errors.

In order to simplify the Level 2 Subject Content Statements (for the Discussion) on the Assessment Record sheets, the following recommendations are made:

From:

Subject content statements	Tick if achieved	Assessor comments
L2.5 Communicate information, ideas and opinions clearly and effectively, providing further detail and development if required		
L2.6 Express opinions and arguments and support them with relevant and persuasive evidence		
L2.7 Use language that is effective, accurate and appropriate to context and situation		
L2.8 Make relevant and constructive contributions to move discussion forward		
L2.9 Adapt contributions to discussions to suit audience, purpose and medium		
L2.10 Interject and redirect discussion using appropriate language and register		

To:

Subject content statements	Tick if achieved	Assessor comments
L2.1 Communicate relevant information, ideas and opinions clearly and effectively, using correct grammar		
L2.2 Move discussion forward by asking questions of the whole group or individuals within the group		
L2.3 Use language that is appropriate to context and situation.		
L2.4 Adequate contributions are made during discussion which lasts in the region of 15 minutes.		

These changes have been made in order to simplify the assessment process and to place more emphasis on spoken grammar. The number of 'Subject content statements' has been condensed



from six to four in order to simplify the assessment procedure and reduce the ambiguity present within the current 'Subject content statements'. Participant 4, for example, states that, "When doing the write-ups, in many cases, it's difficult to know which of the criteria are covered by the students' comments, they're just not that clear, particularly in the discussion!" The first SCS, in combining L2.5 and L2.6 from the ARS, covers relevant contributions to the discussion itself and, as with the presentation, places an emphasis on spoken grammar. The focus on spoken grammar in the assessment process for the discussion then will, as with the presentation, impact upon the preparation for the SLC exams in the classroom, where links can be made between spoken English and written English (for example, Honey (1997), Entwistle (1978), Wallace (1988)).

The second SCS (in elaborating on L2.8) places an emphasis on the importance of asking questions within a discussion, either to the whole group, or to any individual within the group, which is particularly pertinent in situations where one of the candidates may not be contributing sufficiently. The third SCS (L2.3) is a slightly simplified (and hence clearer and less ambiguous) version of the current L2.7 (Use language that is effective, accurate and appropriate to context and situation), with the 'Use language that is accurate' part of the subject content statement, addressed within L2.1, as within the presentation. L2.4 is included to ensure that participants adhere to the relevant timeframe within the discussion. As well as enabling the simplification of the assessment process, the modification of the SCSs would also make them easier to explain to the candidates whilst preparing them for the SLC exams. In regard to further recommendations, following SLC exams, as well as feedback to students relating to the content of their contributions to the discussion and how they helped to move the discussion forward through asking pertinent questions of others etc. feedback to students can be used as an opportunity to highlight and correct spoken grammatical and enunciation errors, and to explain how they relate to written errors.

Aside from the time-consuming administration, and stress on teachers, involved in assessing the SLC (discussed above), there is also the issue of how difficult some students find the process, particularly at entry level. Participant 7, for example, stated, "many of the students find the whole process very confusing ...", whilst participant 2 stated, "... some level 1 students would get confused between what they needed to do for the talk and what they needed to do for the discussion." As such, speaking and listening exams could be taken out of the Entry level and Level 1 syllabus. This would save time (and reduce stress) for the teachers and students alike (students at lower levels can still practise speaking and listening in class in the context of small group discussions and giving talks on a suitable topic of their choice etc. and be given feedback on areas for improvement. Changing the assessment criteria (e.g. L2.1) also allows for greater emphasis to be placed on spoken grammar and enunciation. The correlation between spoken and written English has been emphasised by, amongst others, Purves (2012), Honey (1997), Phillips (2013), Entwistle (1978), Bernstein (1964), Wallace (1988) and Rose (2009).

Limitations of the study

One of the challenges encountered during the project was receiving feedback from all participants. This needs to be seen in the context of the participants' busy work schedules. The researcher's own work schedule was also a challenge in the context of being Lead IV (Internal



Verifier) for a college of further education, yet without any remission. One of the limitations of the study was that it did not include any lecturers of functional skills English from any other learning providers outside of the college where the participants work; a future study, therefore, could be enhanced by including participants (teachers of Functional Skills English) from other learning providers.

Conclusion

Overall, the findings highlight several inefficiencies inherent in the administration, assessment and verification of the SLC exams. The participants highlighted (for example) the disproportionate amount of time they needed to spend on the administration, assessment and verification of the SLC exams, compared with the time spent on the other two modes. The results show that the administrative burden on teachers of Functional Skills English caused by the SLC is a factor behind teachers wishing to change or leave their job role.

The study concludes that a range of measures should be introduced for improving the overall effectiveness and efficiency of the administration and assessment of Functional Skills English SLC exams, including simplifying the Level 2 SCSs, and removing the SLC exams from the other levels altogether. Following from this, it further concludes that the potential impact could be to substantially reduce the unnecessary administrative burden placed on functional skills English teachers as highlighted in the results and discussion sections of the study, and in turn, make it more likely that teachers of functional skills English would stay in their job role.

Of the three modes, the exam more likely to be failed by students (hence preventing them achieve their qualification and progressing onto the next level), is the writing exam. Through incorporating a spoken grammar element into the assessment process (through the Subject Content Statements), the correlation between spoken and written grammar can be illustrated and emphasised. The impact of this could be greater awareness of the impact of spoken grammar on written English, and potentially improved writing skills and results in functional skills writing exams.

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Appendix 1

Indicative Interview Questions

Name: _____ Date: _____

Position: _____

Introduction - Your position in college regarding the teaching of Functional Skills English

- What is your position in the college?
- Are you currently teaching Functional Skills English?
- If yes, are you teaching adults or 16 – 18 year olds, or both?
- How long have you been teaching it for?
- What levels do you teach?
- If no, when did you last teach Functional Skills English, and was it to adults, 16-18 year olds, or both?
- How long did you teach it for?
- Which levels did you teach?

Part 1 – Preparing for the Functional Skills English Speaking, Listening and Communication exams

- What are (were) some of the main issues you experience(d) (if any) whilst preparing for the SLC exams?
- Do you think these issues are (were) specific to your class(es) and the department you work in, or do you think they apply across the college group and to other colleges (and providers) of Functional Skills English?
- Do (Did) you have to undergo standardisation every year and if so, do (did) you find the process useful?
- Do you have any suggestions as to how the issues you have raised could be solved?



Part 2 – Conducting the Speaking, Listening and Communication exams

- What are (were) some of the main issues you experience(d) (if any) whilst conducting the SLC exams?
- Did you find any one particular level more challenging than another?
- Do you think these issues are (were) specific to your class(es) and the department you work in, or do you think they apply across the college group and to other colleges (and providers) of Functional Skills English?
- Do you have any suggestions as to how the issues you have raised could be solved?

Part 3 – Assessing, and IVing, the Speaking, Listening and Communication exams

- What are (were) some of the main issues you experience(d) (if any) whilst assessing the SLC exams?
- Do you think these issues are (were) specific to your class(es) and the department you work in, or do you think they apply across the college group and to other colleges (and providers) of Functional Skills English?
- Specifically, looking at these Subject Content Statements for Level 2, Level 1 and Entry 3, do you think they're clear and do you think they could be improved upon, and if so, how?
- Do you have any suggestions as to how the issues you have raised could be solved?
- What are (were) some of the main issues you experience(d) (if any) whilst internally verifying the SLC exams?
- Finally, overall, do you have any suggestions as to how the Speaking and Listening exams could be improved (at any stage)?

Appendix 2

Functional Skills English Assessment Record Sheet – Level 2

Speaking, Listening and Communicating

Centre name:	Learner name:
Centre number:	Pearson registration number:

All Subject content statements for each task must be achieved in order for a candidate to pass.

Use the space below to give details of Task 1: Presentation and Question and Answer Session		
Presentation topic:		Date:
Group size:		Duration:
Subject content statements	Tick if achieved	Assessor comments
L2.1 Identify relevant information from extended explanations or presentations		
L2.2 Follow narratives and lines of argument		
L2.3 Respond effectively to detailed or extended questions and feedback		

L2.4 Make requests and ask detailed and pertinent questions to obtain specific information in a range of contexts		
L2.5 Communicate information, ideas and opinions clearly and effectively, providing further detail and development if required		
L2.7 Use language that is effective, accurate and appropriate to context and situation		

Learners need to be meeting each specified criterion on most occasions within each task.

Use the space below to give details of Task 2: Discussion		
Discussion topic:		Date:
Group size:		Duration:
Subject content statements	Tick if achieved	Assessor comments
L2.5 Communicate information, ideas and opinions clearly and effectively, providing further detail and development if required		
L2.6 Express opinions and arguments and support them with relevant and persuasive evidence		
L2.7 Use language that is effective, accurate and appropriate to context and situation		
L2.8 Make relevant and constructive contributions to move discussion forward		
L2.9 Adapt contributions to discussions to suit audience, purpose and medium		
L2.10 Interject and redirect discussion using appropriate language and register		
Details of any access arrangements used		

Learners need to be meeting each specified criterion on most occasions within each task.

To pass the Speaking, Listening and Communicating component for Level 2, learners must generally demonstrate the requirements for the level:

- consistently, effectively, and to an appropriate degree for Level 2.

Any weaknesses in performance must be balanced by strengths elsewhere, so overall performance across the range of requirements for the level is secure.

☐ Tick the box if the learner has achieved the Speaking, Listening and Communicating requirements for Level 2.

Assessor declaration		
I confirm that this learner has been assessed according to the instructions provided.		
Assessor name	Signature	Date



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Sampling information (to complete if work is sampled)		
Internal Verifier name	Signature	Date
Pearson Standards Verifier name	Signature	Date

DESIGN AND DEVELOPMENT OF A MINI BELT GRINDER TO ENHANCE SMALL-SCALE MACHINING IN ENGINEERING EDUCATION

Safiah Abdul Razak¹

¹Mechanical Engineering Department, Politeknik Banting Selangor, Malaysia, (safiah@polibanting.edu.my)

Abstract: Grinding is an abrasive machining process widely used for material removal and surface finishing; however, the use of conventional industrial grinding machines for small-sized workpieces in educational workshops often introduces safety risks, ergonomic limitations, and reduced operational control. This study presents the design and development of a Mini Belt Grinder intended to support safe and effective small-scale machining in engineering education. The system was fabricated using steel and stainless steel and incorporates adjustable grinding angles and multiple speed levels to accommodate different material characteristics. The grinding performance of the developed Mini Belt Grinder was evaluated experimentally using grinding time as the primary performance indicator. Grinding tests were conducted on three commonly used workshop materials: metal, wood, and acrylic. The results show that grinding time varied according to material properties, with metal requiring the longest processing time and acrylic the shortest, reflecting differences in material hardness and resistance to abrasion. Visual comparisons of surface condition before and after grinding further indicate that the system can achieve noticeable surface improvement across all tested materials. In addition, a user evaluation involving undergraduate engineering students was conducted to assess usability and educational suitability. The results indicate high user satisfaction with respect to product size, portability, ease of operation, cleanliness, and perceived safety. Overall, the findings demonstrate that the developed Mini Belt Grinder provides reliable grinding performance for small-scale workpieces while offering improved safety and usability compared to conventional equipment. The system is therefore suitable for enhancing hands-on learning activities and supporting experiential learning in engineering education environments.

Keywords: Mini Belt Grinder, Small-Scale Machining, Engineering Education, Material Removal, Surface Finishing

Introduction

Grinding is an essential abrasive machining process widely employed for material removal, surface finishing, and precision shaping across engineering and manufacturing applications. Within engineering education, exposing undergraduate students to machining processes plays a critical role in bridging theoretical instruction with practical skill development. Hands-on interaction with manufacturing equipment enables students to better understand material behaviour, process parameters, and operational constraints that cannot be fully captured through classroom-based learning alone. Despite its importance, the implementation of grinding activities in academic workshops presents notable challenges.



Conventional grinding machines commonly available in educational institutions are typically designed for industrial-scale applications. When used for small-sized workpieces characteristic of student projects, these machines may introduce safety risks, ergonomic limitations, and reduced operational control. Such constraints can discourage student participation, limit experimentation, and reduce the effectiveness of experiential learning activities. As a result, there is a growing need for machining equipment that is appropriately scaled, safe, and adaptable to instructional environments.

To address these challenges, this study focuses on the design and development of a Mini Belt Grinder intended specifically for educational workshop use. The objectives of this research are to design and fabricate a compact belt grinding machine with adjustable operating parameters suitable for student operation, and to evaluate its grinding performance by measuring the time required to process metal, wood, and acrylic materials. By emphasizing safety, adaptability, and usability, the proposed system aims to support experiential learning while maintaining reliable grinding performance for small-scale machining tasks.

Recent research in engineering education consistently highlights the importance of experiential and hands-on learning in improving student engagement and learning outcomes. A systematic review by Tembrevilla et al. (2023) demonstrates that direct interaction with engineering tools significantly enhances conceptual understanding and practical skill acquisition compared to passive learning approaches. However, despite this strong pedagogical foundation, many institutions continue to face difficulties in providing machining equipment that balances industrial relevance with instructional safety and accessibility.

In response, educational research has increasingly emphasized the development of compact, purpose-built laboratory tools. Studies indicate that small-scale manufacturing equipment can enhance student motivation and learning effectiveness when usability, safety, and flexibility are prioritized during the design process (Metwaly et al., 2025). Nevertheless, existing educational tools tend to focus on modular kits, simulations, or general-purpose machining systems, with limited emphasis on grinding equipment tailored specifically to educational needs. This gap underscores the importance of developing a dedicated grinding solution that aligns with both manufacturing principles and instructional requirements.

Literature Review

Grinding processes have been extensively studied within manufacturing research due to their critical role in achieving dimensional accuracy and high-quality surface finishes. However, much of the existing literature has traditionally focused on industrial-scale applications, where system complexity, automation, and productivity are prioritized. Recent advances in abrasive belt grinding research have expanded understanding of process behavior, material removal mechanisms, and performance optimization, although their applicability to educational environments remains limited.

From a process engineering perspective, grinding performance is strongly influenced by material properties, abrasive characteristics, and operational parameters such as grinding speed, contact pressure, and feed conditions. Zhao et al. (2025) demonstrated that variations in grinding parameters significantly affect surface integrity and residual stress formation,



reinforcing the importance of controlled operating conditions. These findings align with earlier experimental investigations by Xiao et al. (2021), who showed that belt grinding behavior differs substantially from conventional wheel grinding, particularly in terms of material removal rate and surface roughness. Together, these studies establish that grinding is a highly parameter-sensitive process, requiring careful adjustment to suit different materials and applications.

Building on this foundation, recent research has increasingly focused on monitoring and optimization techniques for abrasive belt grinding. Li et al. (2023) examined the relationship between abrasive belt wear, energy consumption, and grinding efficiency, particularly for difficult-to-machine materials. Similarly, Wang et al. (2022) explored image-based approaches to estimate material removal rates during belt grinding, while Ren et al. (2025) and Surindra et al. (2025) applied machine learning techniques to predict abrasive belt wear and process performance. Although these studies contribute valuable insights into belt grinding dynamics, they are largely situated within automated or industrial contexts, where high-cost sensors, advanced computation, and complex control systems are feasible. Consequently, their direct relevance to small-scale or educational workshop environments is limited.

At the machine system level, research has also explored the design and development of abrasive belt grinding equipment. Rahman et al. (2025) demonstrated that functional belt grinding machines can be constructed using relatively simple pulley-driven mechanisms, confirming the feasibility of low-complexity belt grinder designs. Similarly, Bakhit et al. (2024) developed a mini electric belt sander aimed at small-volume production, highlighting affordability and accessibility as key design considerations. Patel et al. (2021) further emphasized the importance of adjustable worktables in belt grinder designs, noting that flexibility in angular grinding can significantly improve surface finish quality. Collectively, these studies suggest that compact and mechanically simple belt grinders can deliver effective grinding performance when appropriately designed.

Despite these advances, most compact grinding systems reported in the literature are intended for hobbyist use or limited production scenarios rather than structured educational environments. Performance evaluation is often qualitative, with limited emphasis on quantitative indicators such as grinding time or material-specific behavior. Moreover, ergonomic considerations and student safety—critical factors in teaching laboratories—are rarely addressed in depth.

Parallel to developments in manufacturing research, the engineering education literature has increasingly emphasized the role of hands-on learning and maker-based approaches in improving student outcomes. Tembrevilla et al. (2023) provided systematic evidence that experiential learning significantly enhances conceptual understanding and skill acquisition in engineering students. Similarly, Metwaly et al. (2025) reported that purpose-built educational tools can increase student motivation and engagement when safety and usability are prioritized. However, Kajale et al. (2021) identified persistent gaps between graduate skills and industry expectations, attributing part of this discrepancy to limited exposure to practical manufacturing equipment. Veza et al. (2023) further highlighted inequalities in access to high-quality engineering education, underscoring the need for affordable and adaptable instructional tools.



Studies on maker education and makerspaces reinforce these findings. Konstantinou et al. (2021) noted that while makerspaces support the development of 21st-century skills, their effectiveness depends heavily on the availability of appropriate tools and structured learning activities. Quintana-Ordorika et al. (2024) similarly identified inconsistencies in maker education implementation and emphasized the need for tools that align with formal curricular objectives. These educational studies collectively point to a need for instructional equipment that not only supports hands-on learning but also reflects real manufacturing processes in a safe and accessible manner.

Taken together, the reviewed literature reveals a clear convergence of needs across manufacturing research and engineering education. While abrasive belt grinding is well understood in industrial contexts and compact grinders have been demonstrated for small-scale applications, there is limited research on grinding systems specifically designed to support engineering education. There is a lack of compact, affordable belt grinding machines that integrate adjustable operating parameters, ergonomic design, and quantitative performance evaluation across multiple materials. Addressing this gap, the present study focuses on the design and experimental assessment of a Mini Belt Grinder tailored for educational workshop environments, with the aim of enhancing small-scale machining capability while supporting effective experiential learning.

Methodology

Research Design

This study adopts a mixed methods design with a dominant quantitative engineering approach, supported by descriptive user evaluation. The research is primarily design and development oriented, focusing on the fabrication and performance assessment of a Mini Belt Grinder intended for engineering education. Quantitative data were collected through experimental grinding tests, while structured student feedback was used to evaluate usability, ergonomics, and suitability for instructional use. This approach is appropriate for product development research where both technical performance and user acceptance are essential.

Product Design and Development Procedure

The development of the Mini Belt Grinder followed a systematic engineering design process, as illustrated in the product development flowchart in Figure 1.

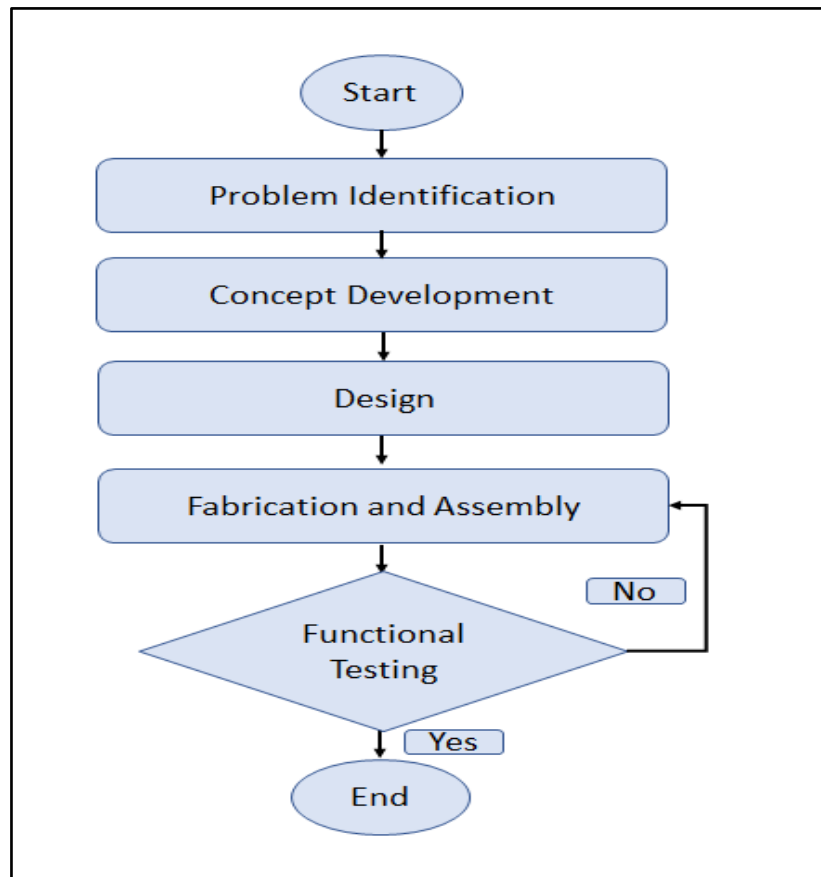


Figure 1: Product Design and Development Process

The procedure consisted of the following stages:

1. **Problem Identification:** It supported by a preliminary survey conducted among ten undergraduate engineering students. The responses indicated that using large industrial grinders for small projects was perceived as unsafe, while manual sanding with sandpaper was considered time-consuming. Students also highlighted the importance of ergonomic considerations during workshop activities. These findings identified key limitations in existing grinding practices and informed the primary design requirements, which included improved safety, reduced processing time, compact size, and enhanced ease of handling for educational workshop use.
2. **Concept Development:** It prioritised motor selection due to its significant influence on grinding performance, speed control, and operational safety. A Pugh decision matrix was applied to systematically compare AC and DC motor options based on efficiency, controllability, availability, and ease of integration, resulting in the selection of a 775 DC motor for the Mini Belt Grinder (Bakhit & Mohd Yusof, 2024).
3. **Design:** The detailed design phase comprised the generation of three conceptual design sketches, followed by the selection of a final configuration based on functional and structural considerations. Figure 2 presents the initial conceptual sketches developed to explore alternative structural and functional layouts for the Mini Belt Grinder.

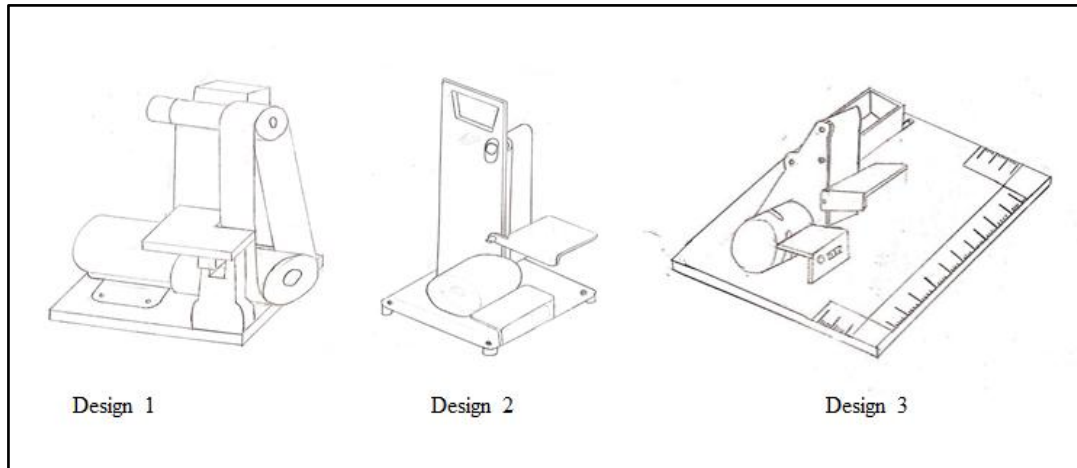


Figure 2: Sketching Design

Based on functional and structural considerations, the most suitable concept was selected, as shown in Figure 3, and subsequently developed into detailed engineering drawings.

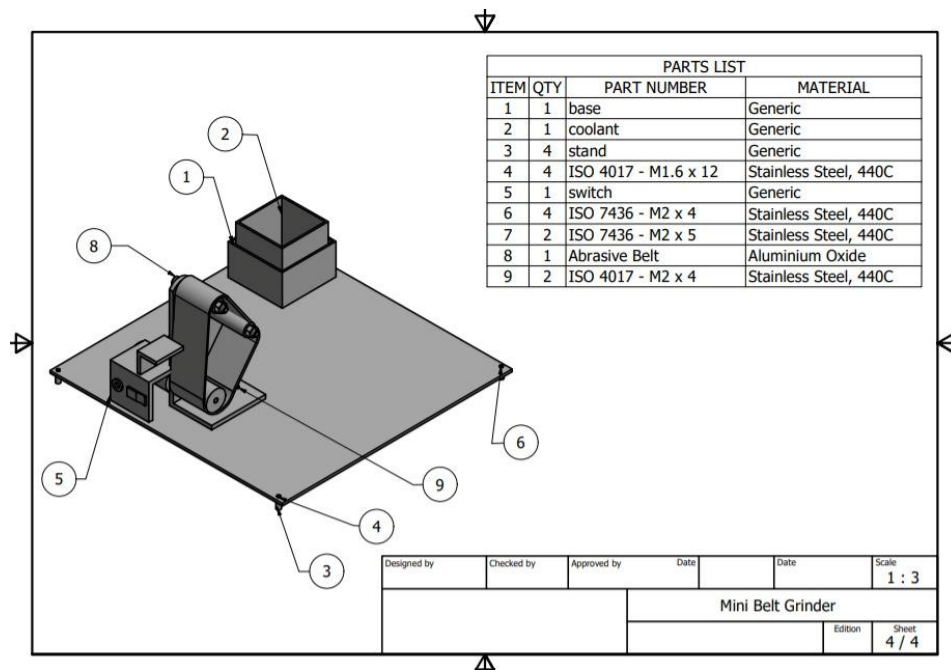


Figure 3: Engineering Drawing

4. **Fabrication and Assembly:** It involved constructing the Mini Belt Grinder using mild steel to ensure structural strength and durability. A 775 DC motor rated at 100 W and 24 V (12–15 A) was integrated with abrasive belts, pulleys, and fastening elements, while cutting, welding, drilling, and tapping processes were used to manufacture and assemble the components according to the design specifications.
5. **Functional Testing:** It was conducted to verify operational stability, speed adjustability, and basic safety prior to experimental evaluation.

Experimental Grinding Performance Evaluation

The grinding performance of the Mini Belt Grinder was evaluated experimentally using grinding time as the primary performance indicator. Three commonly used materials for workshops were selected which are metal, wood and acrylic.

Subsequent performance testing was carried out where metal grinding focused on surface smoothing, acrylic grinding assessed angular and lateral accuracy, and wood grinding evaluated surface flattening capability. The time required to achieve a consistent surface finish was recorded for each material. This evaluation enabled direct comparison of grinding behaviour across materials with different mechanical properties, such as hardness and abrasion resistance.

User Evaluation and Feedback Collection

To assess usability and educational suitability, undergraduate engineering students were assigned a class-based task requiring them to operate the Mini Belt Grinder and subsequently provide feedback based on predefined evaluation criteria. A structured questionnaire was then administered focusing on the following items:

1. Everyday usability of the product (electric-powered operation)
2. Product size and portability
3. Suitability for grinding small-sized materials
4. Ease of handling and operation
5. Cleanliness and ease of maintenance

Table 1: Rating Scale

Scale	Score
Unsatisfactory	1
Poor	2
Moderate	3
Good	4
Excellent	5

A five-point rating scale was adopted, as presented in Table 1, ranging from 1 (Unsatisfactory) to 5 (Excellent). Such structured ordinal scales are commonly used in engineering education and product usability evaluations to capture user perceptions in a clear and quantifiable manner (Metwaly et al., 2025). The use of this scale facilitated straightforward interpretation of students' feedback regarding the practicality, usability, and overall effectiveness of the developed Mini Belt Grinder.

Data Analysis Techniques

The collected data were analysed using descriptive analysis techniques:

1. Grinding performance results were summarized using average grinding time for each material and presented in bar graph.

2. User feedback scores were analysed by calculating mean values for each evaluation item, allowing identification of strengths and areas for improvement.

This descriptive approach is commonly employed in studies evaluating hands-on educational tools and small-scale engineering prototypes, where the emphasis is placed on functionality, usability, and practical relevance rather than inferential statistical analysis (Quintana-Ordorika et al., 2024; Metwaly et al., 2025).

Result and Discussion

Figure 4 illustrates the grinding time required to process metal, wood, and acrylic using the developed Mini Belt Grinder. Among the tested materials, metal exhibited the longest grinding time (285 s), followed by wood (183 s), while acrylic required the shortest time (88 s). This trend suggests that materials with higher hardness and greater resistance to abrasion require extended grinding durations to achieve a smooth surface finish. In contrast, acrylic and wood, which possess lower hardness and weaker bonding structures, allow faster material removal under identical operating conditions.

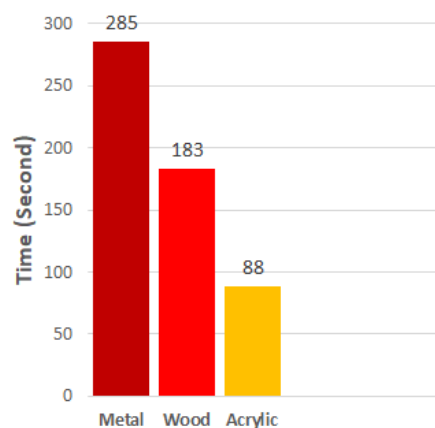


Figure 4: Grinding Time Required for Different Materials Using the Mini Belt Grinder

These results indicate a strong influence of material properties on grinding performance and demonstrate the capability of the Mini Belt Grinder to process materials with varying mechanical characteristics under controlled conditions. Consistent with established grinding mechanics, harder materials generally exhibit lower material removal rates and therefore require longer grinding times (Xiao et al., 2021; Zhao et al., 2025), whereas softer non-metallic materials tend to respond more efficiently to abrasive belt grinding (Li et al., 2023).

From an educational perspective, the observed variation in grinding time provides a clear and practical illustration of process-material interactions. Allowing students to safely compare machining behaviour across different materials may reinforce theoretical concepts related to manufacturing processes and enhance practical skill development, as suggested by prior studies in engineering education (Tembrevilla et al., 2023; Quintana-Ordorika et al., 2024).

Surface Quality Evaluation

Table 2 presents a combined visual comparison of surface conditions before and after grinding for each material. The images provide qualitative evidence of surface improvement achieved using the Mini Belt Grinder across metal, acrylic, and wood. When considered alongside the quantitative grinding time data, these observations further support the functional effectiveness of the system in achieving noticeable surface finishing improvements for small-scale workpieces.

Table 2: Surface Condition of Each Material Before and After grinding		
Material	Before	After
Metal		
Acrylic		
Wood		

User Evaluation Results

Table 3 summarizes the mean user evaluation scores for the Mini Belt Grinder based on usability and design-related criteria. The results indicate a generally positive user response, with everyday usability, product size and portability, and cleanliness and ease of maintenance each receiving the highest mean score of 5. These findings suggest that students perceived the system as compact, easy to operate, and well suited for routine workshop use.

Table 3: User Evaluation Scores for the Mini Belt Grinder Based on Usability and Design Criteria

Criteria	Score (Mean)
Everyday usability of the product (electric-powered operation)	5
Product size and portability	5
Suitability for grinding small-sized materials	3
Ease of handling and operation	4
Cleanliness and ease of maintenance	5

High ratings for product size and portability indicate that students strongly valued the compact and movable nature of the Mini Belt Grinder. This observation aligns with previous research emphasizing the importance of accessible and flexible equipment in engineering education environments, particularly where space and shared laboratory resources are limited (Quintana-Ordorika et al., 2024). Such characteristics may facilitate more frequent hands-on engagement with manufacturing equipment.

Similarly, the strong positive scores for everyday usability and cleanliness suggest that the system requires minimal setup and maintenance, which is known to reduce barriers to student participation in practical activities (Metwaly et al., 2025). The favorable rating for ease of handling further indicates that the grinder can be operated safely and confidently by students, supporting sustained experiential learning in workshop settings.

Although the suitability for grinding small-sized materials received a comparatively lower mean score (3), this outcome reflects the intentional design focus of the system. The Mini Belt Grinder is specifically intended for light-duty, educational applications rather than heavy industrial machining. This design philosophy is consistent with recommendations in engineering education literature that advocate for purpose-built instructional tools tailored to learning objectives rather than full-scale industrial equipment (Tembrevilla et al., 2023).

Overall, these results suggest that the developed Mini Belt Grinder not only meets functional performance requirements but also supports pedagogical goals by enabling safe, accessible, and meaningful hands-on learning experiences in engineering education.

Conclusion

This study set out to design and fabricate a compact Mini Belt Grinder with adjustable operating parameters suitable for student use and to evaluate its grinding performance across different materials. The experimental results indicate that grinding performance varies



according to material characteristics, with harder materials requiring longer processing durations, thereby confirming established abrasive grinding behaviour. Visual surface comparisons further suggest that the developed system is capable of achieving effective surface improvement for small-scale workpieces. In addition, user evaluations indicate strong acceptance in terms of size, portability, usability, cleanliness, and perceived operational safety, highlighting the suitability of the Mini Belt Grinder for educational workshop environments. Collectively, this work contributes a purpose-built grinding solution for engineering education, supported by both quantitative performance data and user-based evidence. By enabling safe, accessible, and hands-on exploration of grinding processes, the proposed system supports experiential learning and strengthens the integration of manufacturing principles within engineering curricula.

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UNDERSTANDING STUDENTS' POSITIONS ALONG DIGITAL POVERTY LEVELS IN RURAL SCHOOLS OF KEDAH

Fadhilah Mat Yamin¹, Wan Hussain Wan Ishak², Nur Syazwani Mohd. Nawi³, Hapini Awang⁴, Md. Tajudin Haji Morad⁵

¹School of Technology Management & Logistics, Universiti Utara Malaysia (UUM), Malaysia, (fmy@uum.edu.my)

²School of Computing, Universiti Utara Malaysia (UUM), Malaysia, (hussain@uum.edu.my)

³School of Technology Management & Logistics, Universiti Utara Malaysia (UUM), Malaysia, (nursyazwani@uum.edu.my)

⁴School of Computing, Universiti Utara Malaysia (UUM), Malaysia, (hapini.awang@uum.edu.my)

⁵Kedah State Education Department, Kedah, Malaysia

Abstract: *Digital technologies are often framed as instruments for expanding educational access; however, students in rural communities continue to experience uneven digital inclusion. This study examines students' positions across different levels of digital poverty in rural schools in Kedah, Malaysia. Adopting a qualitative research design, data were collected through semi-structured interviews with 55 students from six primary schools and three secondary schools in Sik, Baling, and Pulau Tuba (Langkawi), and analysed using thematic analysis. The findings indicate that students' digital experiences are shaped by four interrelated dimensions: physical access, economic capacity, digital knowledge, and social support. Guided by Barrantes' digital poverty framework, students were categorised into four levels of digital poverty, with the majority concentrated in the lower levels, reflecting constraints in infrastructure, device availability, and household resources. The study offers contextual insight into how structural and social conditions shape rural students' digital engagement and highlights the need for integrated responses that combine infrastructure development with digital literacy initiatives and community-based support mechanisms.*

Keywords: *Digital Divide, Digital Poverty, Digital Poverty Levels, Rural Schools, Kedah*

Introduction

Digital technologies play an increasingly central role in supporting access to educational resources, communication, and learning continuity. However, unequal access to digital infrastructure, devices, and skills continues to shape students' educational experiences, particularly in rural settings. In Malaysia, students in rural states such as Kedah remain exposed to structural constraints, including unstable internet connectivity, limited device ownership, and restricted opportunities to develop digital competencies (Dawood et al., 2019; Susanto, 2016). These constraints contribute to persistent forms of digital poverty that extend beyond mere access to technology.

The COVID-19 pandemic further highlighted these inequalities when remote and home-based learning became a necessity rather than an option. Many rural students were unable to participate effectively in online learning due to inadequate digital facilities and limited family or community support (Azar et al., 2022). As a result, existing educational disparities between urban and rural students were exacerbated, reinforcing the importance of understanding digital



exclusion as a multidimensional phenomenon rather than a single access issue (Adams et al., 2018).

Prior studies in Malaysia have shown that students' engagement with digital learning tools is closely related to their level of digital literacy, confidence, and perceived usefulness of technology (Ishak & Yamin, 2016; Yamin & Ishak, 2016). Research on ICT literacy and technology acceptance among undergraduate students indicates that while students may demonstrate positive attitudes toward digital systems, their effective use is often constrained by skill gaps and contextual limitations (Ishak & Yamin, 2019; Ishak & Yamin, 2020). These findings suggest that digital participation is shaped not only by availability of technology but also by knowledge, skills, and social environments.

Accordingly, this study focuses on rural primary and secondary school students in Kedah to examine how economic, physical, social, and knowledge-related factors position students at different levels of digital poverty. By identifying students' positions along these levels, the study aims to provide a contextual understanding of digital inequality in rural schools and to inform more targeted and inclusive intervention strategies.

Literature Review

The concept of digital poverty extends beyond the absence of technological access to include limitations in skills, usage, and meaningful engagement with digital tools. Barrantes (2007, 2014) conceptualised digital poverty as a multidimensional condition encompassing access to ICT, digital skills, and the capacity to use technology productively. This perspective challenges narrow interpretations of the digital divide that focus solely on infrastructure and highlights the need to consider social and human dimensions of digital inclusion.

Subsequent studies have reinforced the view that access alone does not guarantee effective participation in digital learning. Van Dijk (2017) argues that digital inequality is structured across multiple layers, including motivational, material, skills, and usage access. Empirical research further shows that students' digital engagement is shaped by socioeconomic background, geographical location, and support structures within families and communities (Eynon & Malmberg, 2021; Afzal et al., 2023). These findings are particularly relevant in rural contexts, where infrastructural limitations often intersect with lower levels of digital exposure.

In the Malaysian context, several studies have examined students' digital skills and technology acceptance across educational levels. Yamin and Ishak (2016) reported that undergraduate students' e-skills vary significantly, influencing their ability to benefit from digital learning platforms. Similarly, Ishak and Yamin (2016) found that students' acceptance of document-sharing systems depended not only on system features but also on familiarity and perceived ease of use. Studies on ICT literacy further indicate that students with limited exposure to digital tools face challenges in adapting to technology-mediated learning environments, even when basic access is available (Ishak & Yamin, 2019).

More recent work highlights the role of digital engagement in enhancing learning motivation and interaction, particularly through educational technologies such as digital games (Ishak & Yamin, 2020). However, these benefits presuppose a minimum level of access, skills, and



support, conditions that are often unevenly distributed in rural settings. This reinforces the need to examine digital poverty not as a binary condition but as a spectrum of constraints that shape students' learning opportunities.

The literature also emphasises the importance of contextual and place-based analysis of digital inequality, especially in the post-pandemic period (Aissaoui, 2022). While national initiatives in Malaysia aim to reduce the digital divide, implementation gaps remain evident in rural communities (Ayob et al., 2022). Together, these studies support the present research focus on four interrelated dimensions that are economic, physical, social, and knowledge as a framework for understanding students' positions along digital poverty levels in rural schools in Kedah.

Methodology

This study employed a qualitative research design to explore students' positions along different levels of digital poverty in rural schools in Kedah, Malaysia. A qualitative approach was considered appropriate as it enables an in-depth understanding of students' lived experiences, perceptions, and contextual constraints related to digital access and use, rather than measuring prevalence or making population-level generalisations.

Data were collected through semi-structured interviews involving 55 students from nine rural schools, comprising six primary schools and three secondary schools. The schools were in three districts: Sik, Baling, and Pulau Tuba (Langkawi). Sik and Baling reflect inland rural areas characterised by higher poverty rates and limited infrastructure, while Pulau Tuba represents an island community facing geographical and connectivity constraints.

Participants were selected with the assistance of school administrators to ensure representation across different school levels and backgrounds. Consent was obtained from the relevant authorities, schools, and participants before data collection. The interview protocol focused on students' access to digital devices and internet connectivity, experiences with digital learning activities, levels of digital knowledge and skills, and the role of family and community support. Interviews were conducted in a manner appropriate to students' age and context to facilitate open and meaningful responses.

All interviews were transcribed and analysed using thematic analysis. The analysis involved systematic familiarisation with the data, coding, and theme development to identify recurring patterns related to economic, physical, social, and knowledge-related dimensions of digital poverty. To support structured interpretation, Barrantes' digital poverty framework was applied during the analytical phase to categorise students' digital positions. Based on this framework, students were classified into four categories according to their combined access, skills, and usage characteristics:

- Category A: Students with limited or no access to digital devices and internet connectivity, accompanied by minimal digital skills.
- Category B: Students with basic digital skills but constrained access to devices or reliable internet, often due to economic or infrastructural limitations.
- Category C: Students with relatively adequate access to digital resources but limited skills or confidence in using technology effectively for learning.



- Category D: Students who have access and sufficient skills but choose not to engage with digital technologies for learning purposes.

These categories were not treated as rigid classifications but as analytical lenses for organising and interpreting students' digital experiences. Classification was informed by patterns emerging from the interview data rather than predefined quantitative thresholds. The findings are therefore contextual and exploratory, reflecting the experiences of participating students rather than representing rural students in Kedah more broadly.

Findings

The analysis revealed that students' digital experiences in rural schools in Kedah are shaped by interrelated economic, physical, social, and knowledge-related factors. When examined through Barrantes' digital poverty framework, these factors position students at different levels of digital poverty, reflecting varying degrees of access, capability, and effective use of digital technologies.

Most participants were classified under **Category B**, representing students from low-income households who possess basic digital skills but face limited access to devices and unstable internet connectivity. This group was dominant across all three districts—Sik, Baling, and Pulau Tuba. Students in this category commonly relied on shared devices, mobile data with usage limits, or intermittent connections, which restricted their ability to participate consistently in online learning activities. Despite these constraints, many demonstrated a willingness to engage with digital tools when access was available.

A smaller number of students were categorised as **Category A**, indicating severe digital poverty characterised by the absence of both adequate access and basic digital skills. This category was most prevalent among students in Pulau Tuba, where geographical isolation and limited infrastructure compounded household-level constraints. Students in this group reported minimal exposure to digital devices and relied heavily on school facilities or assistance from teachers and peers.

Only one participant was identified under **Category C**, reflecting students who had relatively stable access to digital resources but limited digital skills or confidence in using technology for learning purposes. No students were classified under **Category D**, which represents voluntary non-use of digital technology. This absence suggests that limited engagement with digital tools among rural students is largely driven by structural and contextual barriers rather than a lack of interest or motivation.

Across all categories, economic hardship and infrastructural limitations emerged as the most influential constraints shaping students' digital positions. Social support from family members and the surrounding community also played a moderating role, particularly in supporting younger students' engagement with digital learning. Overall, the findings indicate that digital poverty among rural students in Kedah exists along a continuum, shaped by overlapping structural and social conditions that influence both access to and effective use of digital technologies.



Conclusion and Recommendations

This study examined students' positions along digital poverty levels in rural schools in Kedah by exploring how economic, physical, social, and knowledge-related factors shape their digital experiences. The findings indicate that digital poverty among rural students is not a uniform condition but exists along a continuum, with most students positioned at the lower levels due to limited access to devices, unstable internet connectivity, and constrained household resources.

The analysis shows that restricted digital engagement is largely driven by structural and contextual barriers rather than students' attitudes or willingness to use technology. Across the studied districts, students generally expressed interest in engaging with digital tools for learning, suggesting that non-use or limited use is primarily a consequence of unequal access and support rather than resistance to technology. This reinforces the importance of viewing digital poverty as a multidimensional issue that extends beyond infrastructure provision alone.

From a practical perspective, efforts to address digital inequality in rural schools should adopt integrated approaches that combine improvements in digital infrastructure with initiatives to strengthen digital skills, information literacy, and community-based support. School-level interventions, family involvement, and local community participation are particularly important in supporting younger students and sustaining digital engagement.

As a qualitative and context-specific study, the findings reflect the experiences of participating students and are not intended to represent all rural students in Kedah or Malaysia. Future research could extend this work through comparative or longitudinal designs to examine changes in students' digital positions over time and to assess the effectiveness of targeted interventions. Such efforts would contribute to a more comprehensive understanding of how digital poverty can be reduced in rural educational contexts.

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AN INTERACTIVE DASHBOARD DESIGN FOR NURSE CALL SYSTEMS TO SUPPORT NURSING WORKFLOW AND ALERT MANAGEMENT

Nurhidayah Bahar¹, Tengku Nur Amilia Tengku Ramli², Fadilla 'Atyka Nor Rashid³, Rimaniza Zainal Abidin⁴

¹Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia, (nbahar@ukm.edu.my)

²Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia, (p110489@siswa.ukm.edu.my)

³Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia, (fadilla@ukm.edu.my)

⁴Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia, (nizazainal@ukm.edu.my)

Abstract: *This study proposes the design and analysis of an integrated interactive dashboard for nurse call alert management in hospital environments. Many hospitals in Malaysia continue to rely on conventional nurse call systems that function primarily as basic auditory alert mechanisms. The high frequency of alerts, limited prioritisation, and lack of contextual patient information contribute to alert fatigue, potentially disrupting nursing workflows, clinical decision-making, and team coordination. In addition, conventional nurse call systems often operate as standalone solutions and are not integrated with other hospital information systems, such as electronic health records, resulting in inefficient access to patient information and fragmented care coordination. A qualitative study was conducted using in-depth semi-structured interviews with nurses from private hospitals across multiple wards in Malaysia. The analysis identified five key challenges associated with conventional nurse call systems: communication limitations and lack of contextual patient information, technological and component constraints, absence of differentiated call categorisation leading to alert overload, task allocation and coordination inefficiencies, and workload congestion resulting in delayed responses. In response to these challenges, this study proposes an interactive dashboard that visualises prioritised nurse calls, essential patient information, and real-time call status, while supporting two-way communication, assistance requests, and coordinated alert management. Theoretically, this study contributes to health informatics and human-computer interaction research by translating alert fatigue and workflow challenges into concrete dashboard design requirements for nurse call systems. Practically, the proposed design provides guidance for system developers and hospital technology managers in private healthcare settings to improve alert management, enhance situational awareness, and support coordinated nursing care. This study is limited by its qualitative scope and focus on private hospitals without empirical usability or clinical outcome evaluation. Future work will involve prototype implementation, usability testing, and broader validation across diverse healthcare contexts.*

Keywords: *Interactive Dashboard Design; Health Informatics; Human-Computer Interaction; Nurse Call Systems; Alert Management*



Introduction

Nurse call systems are essential components of hospital care environments, supporting communication between patients and nursing staff and facilitating timely responses to patient needs. As healthcare settings become increasingly complex, nurses are required to manage high workloads, multiple patients, and frequent interruptions, placing greater demands on alert management and workflow coordination (Cho et al., 2022). Despite advances in healthcare information systems, nurse call systems in many hospital wards remain largely conventional and limited in functionality. This creates a growing need for more intelligent nurse call systems that can provide contextual information, support alert prioritisation, and facilitate coordinated responses within complex nursing workflows (Norton, 2023; Li et al., 2024). Such systems are increasingly important to reduce cognitive burden and support timely decision-making in high-demand clinical environments.

Problem Statement

Many hospitals continue to rely on conventional nurse call systems that function primarily as basic alert mechanisms, offering limited support beyond notifying nurses that a call has been initiated (Widadi et al., 2021). In Malaysian private hospitals, such systems often lack contextual patient information, alert prioritisation mechanisms, and integrated communication features, thereby limiting nurses' ability to assess urgency and respond efficiently.

The absence of differentiated alerts and real-time patient context contributes to alert overload and increases cognitive burden, particularly in environments where nurses are required to manage multiple patients and simultaneous calls (Zhu et al., 2025). In addition, task distribution following a nurse call remains largely manual, resulting in duplicated responses, unclear responsibility allocation, and delayed assistance during high workload periods (Poudel, 2025). These challenges are further exacerbated in specialised wards such as intensive care and isolation units, where physical attendance requires additional preparation and coordination.

While previous studies have examined nurse call systems in terms of technical functionality or patient safety outcomes, there is limited empirical research that translates nurses' workflow challenges and alert management experiences into concrete interface and dashboard design requirements (Norton, 2023). In particular, there is a lack of design-oriented studies that focus on how integrated visualisation, communication, and task coordination features can support nursing workflows in private healthcare settings. Addressing this gap is essential to inform the design of nurse call systems that move beyond basic alerting toward more context-aware and workflow-supportive solutions.

In response to these limitations, the main aim of this study is to explore challenges associated with the use of conventional nurse call systems in Malaysian private hospital wards and to translate these insights into the design of an interactive dashboard to support alert management and nursing workflows. Accordingly, this study seeks to address the following research questions: (i) What challenges do nurses encounter when using conventional nurse call systems in their daily practice, and (ii) How can these challenges be addressed through the design of an



interactive dashboard? To achieve this aim, the objectives of the study are to identify key workflow and alert management challenges experienced by nurses in private hospital settings and to propose core functional components for an integrated dashboard design that supports communication, prioritisation, task coordination, and access to essential patient information.

Literature Review

Conventional nurse call systems are typically designed as wired communication networks equipped with patient-triggered buttons located near hospital beds, enabling patients to alert nursing staff when assistance is required. These systems commonly employ push-button switches that generate audible tones or visual signals at a central nurse station upon activation (Sharma & Gautam, 2015). The core design allows patients to summon help remotely, with the system indicating the specific room or bed from which the call originates.

Recent studies have reported several limitations associated with conventional nurse call and alarm systems in clinical environments. Frequent non-actionable or false alarms have been shown to disrupt nursing workflows and contribute to alert desensitisation, making it increasingly difficult for nurses to recognise critical alerts in a timely manner. In addition, a high volume of alarms without adequate differentiation can interrupt patient care and increase workload, raising the risk that important alerts may be overlooked. These conditions contribute to alarm fatigue and heightened cognitive burden, which negatively affect nurses' situational awareness and decision-making during busy shifts. Alarm management challenges are further exacerbated by inadequate staffing levels, as limited personnel availability constrains timely responses to alerts. Moreover, the lack of mechanisms to transfer or reroute calls to other available nurses when the primary nurse is occupied reduces communication efficiency and delays patient assistance (Xu et al., 2025; Ramachandiran & Avudaiappan, 2025; Unlutur et al., 2015).

There is a need to move from conventional nurse call systems toward more intelligent, context-aware designs that better support nursing workflows and alert management. Intelligent nurse call systems are typically characterised by their ability to integrate multiple data sources, including patient information, clinical context, and environmental conditions, to enable prioritised and actionable alerts rather than uniform alarm signals (Withall et al., 2022; Nyarko et al., 2025). Studies on alarm management and clinical decision support emphasise that systems which incorporate contextual information and adaptive alerting mechanisms can reduce alarm fatigue and improve situational awareness among nurses (Winters et al., 2018; Gorisek et al., 2021).

In addition, design-oriented research in healthcare information systems has shown that dashboard-based interfaces can support real-time monitoring, task coordination, and decision-making by visualising alerts, patient status, and workflow information in a unified view (Jebrailey et al., 2022). However, existing intelligent system designs often focus on technical integration or outcome evaluation, with limited attention given to translating nurses' lived experiences and workflow challenges into concrete interface and functional design requirements, particularly within nurse call systems. This gap highlights the need for design-driven approaches that align intelligent system capabilities with nursing practice and alert management needs.



Methodology

This study employed a qualitative research approach to explore challenges associated with conventional nurse call systems and to inform the design of an interactive dashboard for alert management. A qualitative approach was deemed appropriate as it allows in-depth exploration of nurses' experiences, workflows, and system-related issues within real clinical settings (Creswell & Poth, 2025; Christou, 2022). Data were collected through in-depth semi-structured interviews to obtain detailed insights into nurses' interactions with existing nurse call systems. The semi-structured format enabled consistency across interviews while allowing participants to elaborate on issues relevant to their work context. Each interview lasted up to one and a half hours and was conducted individually.

Purposive sampling was used to select informants who met specific criteria relevant to the study objectives. Participants were required to (i) currently work or have previously worked in a private hospital ward in Malaysia, (ii) have served in a private hospital for at least one year, (iii) work in wards that utilise conventional nurse call systems, and (iv) have direct experience using nurse call systems in daily nursing practice. All informants had between five and fourteen years of nursing experience. A total of six informants participated in the study, representing a

range of ward settings, including intensive care unit (ICU), rehabilitation, multidisciplinary wards, haemodialysis, obstetrics and gynaecology (O&G), and medical wards. This diversity allowed the study to capture varied perspectives on nurse call system usage across different clinical environments.

The interview data were analysed using thematic analysis. All interviews were transcribed verbatim prior to analysis. An initial coding process was conducted to identify recurring issues, patterns, and system-related challenges described by the informants. The codes were then reviewed and grouped into broader themes representing key challenges associated with conventional nurse call systems. These themes subsequently informed the identification of design requirements and the development of the proposed interactive dashboard components.

Results

This section presents the findings derived from the qualitative analysis of semi-structured interviews conducted with nursing staff and hospital personnel. The results are organised into two main parts. First, the key challenges associated with conventional nurse call systems are reported. Second, the proposed interactive dashboard design and its core functional components are presented as a response to the identified challenges.

Key Challenges Associated with Conventional Nurse Call

First, technology and component constraints were identified as a major challenge in conventional nurse call systems. Informants reported that existing systems were limited in their ability to deliver timely and meaningful information to support nursing tasks. In particular, the absence of audio communication functionality prevented nurses from communicating directly with patients after a call was initiated. As a result, nurses were unable to ascertain the reason for a call without physically attending the patient's bedside. All informants indicated that each



nurse call required in-person verification, as the system did not provide sufficient contextual information regarding patient needs. This limitation increased unnecessary movement and delayed task prioritisation, especially in busy wards. The challenge was reported to be more significant in intensive care units and isolation rooms, where nurses were required to don full personal protective equipment (PPE) merely to determine the nature of the patient's request. Additionally, informants highlighted difficulties in communicating with patients located in rooms far from the nurses' counter. In such cases, the lack of remote communication features hindered nurses from clarifying patient needs promptly, further contributing to inefficiencies in workflow and response management.

Second, task distribution and responsibility allocation were identified as a significant challenge following nurse call activation. Informants reported that task assignment in response to nurse calls is largely manual, creating difficulties in balancing workload and responsibilities among nursing staff. The absence of structured task distribution mechanisms often leads to inefficiencies in call response. Several informants described situations in which more than one nurse responded to the same patient call simultaneously. This occurred due to the lack of visibility regarding whether another nurse had already attended to the call, compounded by alert sounds that remained active even after a response had begun. As a result, duplicated efforts occurred while other patient calls remained unattended. In addition, participants highlighted heavy individual workloads, with some nurses responsible for seven to eight patients at a time. During busy periods, nurses reported needing to call out to colleagues for assistance when unable to respond promptly. Although patient calls are ideally managed by the assigned nurse, responsibility often shifts informally to other staff when workload increases or competing tasks arise. These findings indicate the need for system support that enables clearer task ownership, real-time status updates, and more effective coordination to ensure that each patient call is addressed efficiently without overburdening individual nurses.

Third, a lack of accessible patient information was identified as a major barrier to effective nurse-patient interaction and timely decision-making. Informants reported that when a nurse call is activated, no accompanying patient or clinical information is displayed. As a result, nurses are required to rely solely on the alert signal without understanding the patient's condition or the urgency of the request. Although patient information is available in electronic medical records, informants indicated that they often do not have sufficient time to access these systems before responding. In practice, nurses must immediately attend to the patient at the bedside, limiting their ability to prepare or prioritise tasks in advance. This constraint was particularly problematic during periods when multiple nurse calls occurred simultaneously. Informants emphasised the need for basic patient information to be readily available at the point of alert. Such information includes patient identification, room or bed number, patient risk status (e.g., fall risk or isolation status), and indicators of care dependency or urgency. Access to this information would support faster prioritisation and more informed responses, especially when nurses are required to manage multiple calls concurrently.

Fourth, the absence of differentiated call categories was identified as a challenge contributing to alert overload and prioritisation difficulties. Informants reported that conventional nurse call systems treat all patient-initiated calls as identical, regardless of the urgency or type of assistance required. As a result, nurses receive the same alert signal for a wide range of requests, including urgent clinical needs as well as routine or non-critical assistance.



Informants explained that this limitation makes it difficult to determine response priority at the point of alert, particularly during periods when multiple calls are triggered simultaneously. For example, a call related to pain, breathing discomfort, or mobility assistance may be indistinguishable from requests such as adjusting room conditions or requesting general help. Without the ability to categorise or indicate the nature of the request, nurses are required to physically attend each call to assess urgency, increasing response time and cognitive load. This lack of differentiation contributes to frequent interruptions and reduces the efficiency of alert management in busy ward environments.

Core Functional Components of the Proposed Interactive Dashboard

Based on the challenges identified in conventional nurse call systems, this study proposes an interactive dashboard comprising four core functional components. These components were designed to address key limitations related to communication gaps, lack of patient information, task distribution inefficiencies, and alert overload identified during the qualitative analysis. The proposed dashboard integrates intercom communication, real-time visual feed, nurse call activation with visualisation, and call cancellation with status updates to support improved alert management and nursing workflow coordination.

Intercom Communication and Patient Visual Access

The intercom communication and patient visual access component was designed to address limitations in nurse–patient communication and the lack of contextual information at the point of alert. The dashboard enables nurses to initiate two-way audio communication with patients through an intercom function immediately after a nurse call is triggered. This allows nurses to clarify patient needs without requiring immediate physical presence at the bedside. In addition, the dashboard provides access to a real-time visual feed through a camera function, which can be activated after obtaining patient consent. This feature supports rapid visual assessment of the patient’s condition, particularly in situations where physical attendance may be delayed or requires additional preparation, such as isolation rooms or restricted areas. Nurses can use this visual context to assess patient posture, movement, or visible distress before deciding on further action. Together, the intercom and visual access functions reduce unnecessary bedside visits, support early prioritisation of care, and help nurses manage multiple calls more effectively.

This component is especially valuable in high-dependency environments, where minimising repeated room entry and improving situational awareness are critical to workflow efficiency.

Nurse Call Visualisation and Status Management

The nurse call visualisation and status management component was designed to improve alert visibility and reduce ambiguity in call response. When a nurse call is activated, the dashboard presents the alert visually with clear indicators, including the patient’s location and call status. This allows nurses to monitor incoming calls in real time and maintain awareness of multiple alerts simultaneously. The dashboard also includes a call cancellation function that enables alerts to be deactivated once they have been acknowledged or addressed. This prevents alerts from remaining active unnecessarily and reduces confusion regarding whether a call is still pending. Visual status updates support clearer understanding of which calls are in progress and



which have been resolved. By providing real-time visualisation and explicit call status management, this component helps minimise duplicated responses and supports more efficient alert handling. It enables nursing staff to coordinate responses more effectively, particularly during high workload periods when multiple calls occur concurrently.

Assistance Request and Task Coordination

The nurse call visualisation and status management component was designed to improve alert visibility and reduce ambiguity in call response. The assistance request and task coordination component was designed to support workload balancing and collaborative response among nursing staff. Through an assistance button or pager function, nurses are able to request support from other available nurses directly via the dashboard when additional help is required. This function provides a structured mechanism for seeking assistance without relying on informal communication methods. This component addresses situations where nurses are responsible for multiple patients or are engaged in concurrent tasks that limit their ability to respond promptly to incoming calls. By enabling assistance requests within the system, responsibility for patient calls can be shared more transparently, reducing the need for verbal coordination such as calling out across the ward. The integration of this function supports clearer task allocation and improves response efficiency during busy periods. It allows nursing teams to coordinate care more effectively while maintaining situational awareness of ongoing tasks and patient needs.

Patient Information Display for Decision Support

The patient information display component was designed to provide nurses with essential contextual information at the point of alert to support timely and informed decision-making. When a nurse call is activated, the dashboard presents key patient details, including patient name, bed or room number, gender, brief clinical description or diagnosis, and the assigned attending doctor. This information is displayed alongside the active alert to enable rapid situational understanding. Participants highlighted the importance of accessing basic patient information without the need to consult separate medical record systems, particularly during high workload periods. The dashboard therefore consolidates essential patient data in a single view, allowing nurses to assess care needs and prioritise responses more effectively when multiple calls are received concurrently. By integrating patient information directly into the nurse call interface, this component supports improved alert interpretation, reduces cognitive load, and enhances coordination of care. It enables nurses to make faster and more informed decisions while maintaining continuity in nursing workflow.

Interface Design of the Proposed Interactive Dashboard

To illustrate how the proposed core functional components are integrated and operationalised, the following figure presents the interface design of the interactive dashboard. Figure 1 illustrates the interface design of the proposed interactive nurse call dashboard, demonstrating how multiple concurrent calls are presented and managed. Each active call is displayed as a colour-coded card to indicate call classification and urgency, with red representing the highest priority, followed by intermediate and lower priority levels. Time indicators shown above each

card provide information on the duration since the call was initiated, supporting awareness of response delays.

The interface displays essential patient information, including bed number, patient name, isolation status, brief diagnosis, and assigned doctor, enabling nurses to quickly assess context at the point of alert. Functional controls, including intercom communication, visual access, assistance request, and call cancellation, are made visible within the dashboard to support immediate interaction. Additional patient and call-related information can be retrieved by selecting the relevant call card, allowing nurses to access further details as required without leaving the dashboard view.



Figure 1: The proposed interactive nurse call dashboard with colour-coded call prioritisation and patient information display.

To further illustrate how the communication components operate during active nurse–patient interaction, Figure 2 presents the interface view when the audio and video functions are engaged following a nurse call. This figure presents the interface view of the proposed dashboard when the audio and video communication functions are activated. The interface displays a real-time visual feed of the patient alongside an audio interaction indicator, allowing nurses to communicate directly with the patient after a nurse call is initiated. This view enables nurses to assess the patient’s condition visually while maintaining remote communication.

Detailed patient information is displayed concurrently, including patient identification, age, gender, allergy information, diagnosis, treatment plan, care instructions, and the assigned treating doctor. These details are presented within the same interface to support rapid contextual understanding without requiring access to separate medical record systems. Interaction controls for speaking, activating the camera, requesting assistance, and cancelling the call remain visible, allowing nurses to manage communication and task coordination seamlessly during the interaction.

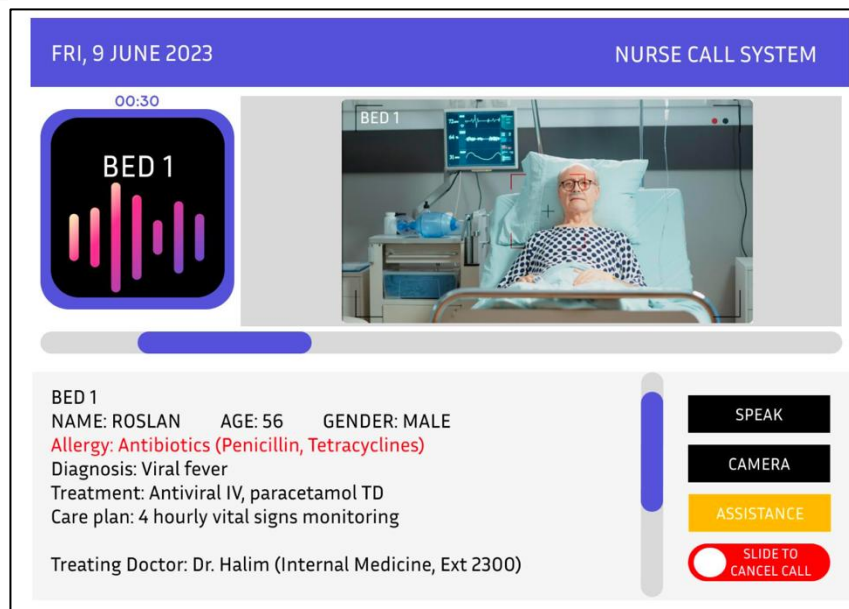


Figure 2: Interface view of the proposed dashboard during audio and video communication, displaying patient details and integrated interaction controls.

Summary of Results

Overall, the results highlight several limitations of conventional nurse call systems related to communication gaps, lack of contextual patient information, manual task distribution, non-differentiated alerts, and alert management inefficiencies. Based on these findings, an interactive dashboard was designed comprising four core functional components that directly address the identified challenges. The proposed design integrates communication, visual

access, alert visualisation, task coordination, and patient information display within a single interface, providing a structured response to workflow and alert management issues reported by nursing staff. To clarify the relationship between the reported challenges and the proposed design response, Table 1 presents the mapping between conventional nurse call system limitations and the core functional components of the interactive dashboard.

Table 1: Mapping of Identified Challenges to Core Functional Components

Identified Challenge in Conventional Nurse Call Systems	Core Functional Component	Design Response
Technology and component constraints limiting communication and contextual understanding	Intercom communication and patient visual access	Enables two-way audio communication and real-time visual assessment to reduce unnecessary bedside visits
Manual task distribution and unclear responsibility allocation	Assistance request and task coordination	Supports structured help requests and shared responsibility among nursing staff

Lack of accessible patient information at the point of alert	Patient information display for decision support	Provides essential patient details to support prioritisation and informed decision-making
Non-differentiated call requests leading to alert overload	Nurse call visualisation and status management	Uses colour-coded alerts and time indicators to support prioritisation and alert awareness
Duplicate responses and unclear call resolution status	Call cancellation and status update functions	Allows clear indication of active, attended, and resolved calls

Conclusion

This study examined challenges associated with conventional nurse call systems in Malaysian private hospitals and proposed an interactive dashboard design to support alert management and nursing workflows. Through qualitative insights from in-depth interviews, key issues related to communication limitations, lack of contextual patient information, manual task distribution, alert overload, and coordination inefficiencies were identified. These findings informed the design of core functional components that integrate alert visualisation, communication, task coordination, and patient information within a single interface.

Theoretically, this study contributes to health informatics and human–computer interaction research by translating nurses’ experiences of alert fatigue and workflow challenges into concrete design requirements for nurse call systems. Practically, the proposed dashboard design offers guidance for system developers and hospital technology managers in private healthcare settings seeking to enhance alert management, situational awareness, and coordinated nursing care. This study is limited by its qualitative scope and focus on private hospitals, and it does not include empirical usability or clinical outcome evaluation. Future work will involve prototype development, usability testing with end users, and broader validation across diverse hospital settings to further assess the effectiveness and applicability of the proposed design.

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A DESIGN SCIENCE STUDY OF INTERFACE DESIGN AND USABILITY IN CLINIC APPOINTMENT MANAGEMENT SYSTEMS

Nurhidayah Bahar¹, Muhamad Fareed Mohamad Saroni²

¹Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia, (nbahar@ukm.edu.my)

²Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia (UKM), Malaysia, (fareedsaroni@gmail.com)

Abstract: *Efficient appointment management is critical for ensuring service quality and patient satisfaction in private general practitioner clinics. However, many private clinics in Malaysia continue to rely on manual appointment practices, where appointment slots are assigned in a non-specific manner. This often results in patient congestion, prolonged waiting times, and a high rate of appointment non-attendance, ultimately affecting clinic workflow and care delivery. This study aims to design an interface for a clinic appointment management system grounded in real clinical practices and to evaluate its usability from a user-centred perspective. A case study approach was adopted involving a private general clinic in Cyberjaya. The study employed a design science research methodology, integrated with requirements engineering and the waterfall development approach. Data were collected through semi-structured interviews with doctors and clinic assistants from three private clinics, complemented by document analysis and direct observation of existing appointment workflows. The collected data were systematically analysed to elicit both user and system requirements. Based on the identified requirements, system design artifacts such as use case diagrams and entity relationship diagrams were developed to inform the interface design. A high-fidelity prototype was subsequently produced using Figma to visualize the proposed appointment management interface. Usability evaluation was conducted to assess the clarity, efficiency, and suitability of the interface in supporting appointment scheduling and management tasks. The findings indicate that the proposed interface design addresses key limitations of manual appointment systems by enabling more specific time-slot allocation and improving usability. Theoretically, this study contributes to healthcare information systems research by demonstrating how requirement-driven interface design can serve as a structured mechanism for translating clinical workflow needs into usable digital interfaces within a design science research context. Practically, the study provides a validated interface design reference for system developers and private clinics. Future work may involve full system implementation and usability evaluation involving patients.*

Keywords: *Design Science Research; User Interface Design; Usability Evaluation; Appointment Scheduling; Primary Healthcare Systems*

Introduction

Healthcare service demand in Malaysia has continued to increase alongside population growth and greater public awareness of preventive and primary healthcare services. Private general practitioner clinics play an important role in providing accessible outpatient care, particularly in urban areas where patients often seek faster consultation compared to public healthcare



facilities. As patient volumes grow, efficient appointment management becomes increasingly important to ensure smooth clinic operations and satisfactory patient experiences (Zou et al., 2023). While digital health initiatives have expanded across Malaysia, many private clinics still rely on traditional or partially manual administrative practices, particularly in appointment scheduling (Omar et al, 2025). Inefficient appointment coordination may result in patient congestion, prolonged waiting times, and operational inefficiencies that affect both patients and healthcare providers. Consequently, there is a growing need to examine how appointment management practices can be improved to better support clinical workflows and patient access to care.

Problem Statement

Many private general practitioner clinics continue to rely on manual processes for managing patient appointments. Such practices typically involve non-specific appointment allocation and manual record keeping, which often lead to disorganised scheduling, patient congestion, and prolonged waiting times. In addition to affecting service efficiency, manual appointment practices also contribute to a high rate of appointment non-attendance, commonly referred to as no-show incidents, which disrupt clinic operations and reduce consultation efficiency. (Salazar et al., 2024). Other than that, long waiting periods have been identified as a major contributor to patient dissatisfaction and have been associated with higher rates of appointment non-attendance (Dantas et al., 2018). In addition, appointment information is frequently managed separately across clinics, resulting in fragmented scheduling experiences for patients who seek treatment at multiple healthcare providers. This siloed management of appointments may contribute to increased treatment costs due to potential duplication of medical tests and repeated consultations (May et al., 2018). Furthermore, the existence of multiple, uncoordinated appointments across clinics can create confusion and make it difficult for patients to keep track of their scheduled visits.

Despite increasing digitalisation efforts in healthcare services, many appointment management solutions focus primarily on system implementation or operational efficiency, with limited attention given to how clinical workflow needs are translated into usable interface designs (Kuiper et al., 2021; Ala & Chen, 2022). Existing studies often emphasise system functionality or technical deployment, while fewer investigations adopt a requirement-driven design perspective that systematically connects clinic workflow practices, user needs, and interface usability within a design science research context. Consequently, there remains a lack of empirically grounded studies demonstrating how requirement elicitation from real clinical environments can inform interface design and usability evaluation for appointment management systems, particularly in private clinic settings.

Addressing this gap is important to ensure that digital appointment systems effectively support clinic operations and improve user experience for both healthcare providers and patients. To address these challenges, this study investigates how appointment management practices in private clinics can be improved through requirement-driven system design. The study is guided by the research question: How can clinic appointment management workflows be translated into an interface design that effectively supports appointment scheduling and coordination tasks? Accordingly, the objectives of this study are to elicit user and system requirements from real clinic environments, develop system design artefacts to represent appointment



management processes, design an interface prototype based on identified requirements, and evaluate the usability of the proposed interface in supporting appointment management tasks.

Literature Review

Efficient appointment management plays a crucial role in ensuring smooth clinic operations and maintaining patient satisfaction. Previous studies have shown that poorly managed appointment scheduling often leads to patient congestion, prolonged waiting times, and increased operational pressure on healthcare staff (Clement & Taiwo, 2023; Youn et al., 2022). Manual or loosely structured appointment allocation practices further contribute to appointment non-attendance (no-show), which disrupts clinic workflows and results in underutilised consultation slots (Salazar et al., 2024). Although many healthcare providers have begun adopting digital appointment systems, challenges related to scheduling efficiency and coordination remain common, particularly in private clinic environments where administrative processes may still rely on manual or partially digitised practices.

Existing research on appointment management systems has primarily focused on operational optimisation and predictive techniques, such as machine learning approaches to forecast no-show behaviour (Wood et al., 2025). While these efforts contribute to improving appointment efficiency, relatively fewer studies emphasise how system interfaces align with real clinic workflows or how usability considerations influence system adoption among healthcare staff (Mahmod, Mokhtar, & Mohamed, 2024). Systems designed without sufficient attention to user interaction and operational needs may fail to improve scheduling practices despite technical capabilities, highlighting the importance of integrating workflow understanding into system design.

Consequently, there remains a need for studies that translate real clinical appointment management practices into requirement-driven interface designs evaluated within a structured design science context (Yin et al., 2022; Bagiwa et al., 2025). In particular, limited research demonstrates how requirement elicitation, design artefact development, and usability evaluation can be integrated to produce practical appointment management interfaces suited to private clinic environments. This study addresses this gap by developing and evaluating an interface prototype grounded in actual clinic workflows to support appointment scheduling and coordination tasks.

Methodology

This study employed a qualitative approach to elicit user and system requirements for a clinic appointment management system based on actual clinical practices. Data collection focused on understanding existing appointment workflows and challenges encountered in private general practitioner clinics. In-depth semi-structured interviews were conducted with doctors and clinic administrators from three private clinics, as these stakeholders are directly involved in appointment scheduling and management processes. The interviews explored current appointment practices, scheduling challenges, patient flow management, and expectations for digital appointment support systems.



To complement interview findings, direct observations were conducted to examine how appointments were scheduled and managed during daily clinic operations. Observations included processes such as patient registration, manual recording of appointment slots, handling of walk-in patients, and rescheduling procedures. Document analysis was also carried out on materials such as appointment record books, clinic schedules, and registration forms to understand existing data recording and coordination practices. These additional sources enabled cross-validation of interview data and provided practical insights into operational constraints within clinic environments.

Requirements elicitation followed the requirements engineering process outlined by Sommerville (2011), adapted to the study context. During the requirements discovery stage, interview and observational data were analysed to identify current workflow issues and user needs. The identified requirements were subsequently organised into functional and system requirements according to user roles, including patients, doctors, and administrators. Requirements prioritisation and negotiation were performed through follow-up discussions with clinic representatives to ensure that the proposed system functions aligned with operational feasibility and clinic priorities. Finally, the consolidated requirements were documented as structured requirement specifications, which guided subsequent system design artefact development and interface prototyping.

The study adopted a design science research methodology to guide artefact development and evaluation to uncover real-worlds concern (Gledson et al., 2024). Within this study, design science principles were operationalised by iteratively translating elicited requirements into design artefacts, including use case models, data models, and interface prototypes. These artefacts were refined based on stakeholder feedback and subsequently evaluated through usability testing to assess their suitability in supporting appointment management tasks within clinic workflows.

Results

This section presents the findings of the study including the elicitation of user and system requirements from existing clinic appointment practices, the development of system design artefacts and interface prototypes, and the results of usability evaluation. These results demonstrate how requirement-driven analysis informed the design and assessment of a clinic appointment management system interface grounded in real clinical workflow needs.

User and System Requirements for Appointment Management

This user and system requirements identified from interviews, observations, and document analysis of existing appointment management practices in private clinics. The requirements reflect challenges encountered in manual appointment scheduling as well as operational needs expressed by clinic staff. These findings form the basis for defining system functionalities and guiding subsequent design artefacts and interface development.



User Functional Requirements

The system is designed to support three primary user groups involved in appointment management processes: patients, doctors, and clinic administrators. Each user group performs distinct roles within the system, and the requirements specify the system functionalities needed to support appointment scheduling, schedule management, and operational coordination in clinical settings. The following presents the list of user functional requirements for each user group.

Patient Requirements

1. The system shall allow patients to access the online appointment management system.
2. The system shall allow patients to view doctors' available schedules.
3. The system shall allow patients to select a preferred doctor when booking an appointment.
4. The system shall allow patients to book appointments using specific available time slots.
5. The system shall allow patients to modify existing appointments.
6. The system shall allow patients to cancel scheduled appointments.
7. The system shall automatically notify patients when changes occur in doctors' schedules affecting their appointments.
8. The system shall allow patients to record or store appointment information from other health clinics for personal reference.

Doctor Requirements

1. The system shall allow doctors to view patient appointment information and categories.
2. The system shall allow doctors to modify their duty schedules when necessary.
3. The system shall allow doctors to adjust appointment slot durations based on clinic operational requirements.
4. The system shall allow doctors to view their daily and upcoming appointment schedules.
5. The system shall allow doctors to update appointment status, including marking appointments as completed, postponed, or cancelled.

Administrator Requirements

1. The system shall allow administrators to record and manage doctors' duty schedules.
2. The system shall make duty schedules available to support patient appointment booking.
3. The system shall automatically send appointment reminders to patients.
4. The system shall allow administrators to view lists of scheduled appointments.
5. The system shall allow administrators to generate appointment reports.
6. The system shall allow administrators to create, update, and deactivate patient accounts.
7. The system shall allow administrators to register and manage doctor profiles, including specialty and consultation availability.



8. The system shall allow administrators to reschedule appointments on behalf of patients when required.
9. The system shall allow administrators to manage appointment slot availability, including opening and blocking time slots.
10. The system shall allow administrators to view and manage appointment statuses, including confirmed, rescheduled, cancelled, and no-show.

System Requirements

In addition to user functional requirements, several system-level requirements were identified to ensure that the appointment management system operates reliably, securely, and efficiently within clinic environments. These requirements define the expected operational characteristics of the system beyond user interactions, including performance, data management, and security considerations necessary to support daily clinic operations.

1. The system shall authenticate users before granting access to appointment management functions.
2. The system shall ensure that appointment data are stored securely to protect patient information.
3. The system shall allow authorised users to access appointment information based on their assigned roles.
4. The system shall maintain appointment records for future reference and reporting purposes.
5. The system shall operate reliably during clinic working hours without service interruption.
6. The system shall support concurrent access by multiple users without degrading system performance.
7. The system shall provide data backup mechanisms to prevent loss of appointment information.
8. The system shall record system activities related to appointment scheduling and modification for monitoring purposes.

System Design Artefacts

In line with a design science approach, the requirements were translated into formal design representations to clarify system scope, user interactions, and underlying data structures. Specifically, a use case model was developed to capture key functions performed by patients, doctors, and clinic administrators, followed by a data model (entity relationship diagram) to represent core data entities and their relationships. These artefacts guided the subsequent interface design and prototyping stages.

Use Case Model

Below is a consolidated list of use cases organised by the three user roles. To maintain clarity and reduce diagram complexity, individual functions were consolidated into higher-level use cases representing core tasks performed by each user group. Figure 1 (Use Case Diagram)



summarises the key interactions of patients, doctors, and administrators with the appointment management system.

Patient Use Cases

1. Register / Create Account
2. Log in / Log out
3. View Doctor Schedule & Availability
4. Select Doctor
5. Book Appointment (Select Specific Time Slot)
6. View My Appointments
7. Reschedule Appointment
8. Cancel Appointment
9. Receive Appointment Notifications (Schedule Changes)
10. Record External Appointment (Other Clinics)

Doctor Use Cases

1. Log in / Log out
2. View Appointment Schedule (Daily/Upcoming)
3. View Patient Appointment Details and Category
4. Update Duty Schedule
5. Adjust Appointment Slot Duration
6. Update Appointment Status (Completed / Postponed / Cancelled)

Administrator Use Cases

1. Log in / Log out
2. Manage Patient Accounts (Create/Update/Deactivate)
3. Manage Doctor Profiles (Create/Update)
4. Manage Duty Schedules (Create/Update)
5. Manage Appointment Slot Availability (Open/Block Slots)
6. View Appointment List
7. Reschedule Appointment on Behalf of Patient
8. Manage Appointment Status (Confirmed/Rescheduled/Cancelled/No-show)
9. Send Automated Appointment Reminders
10. Generate Reports

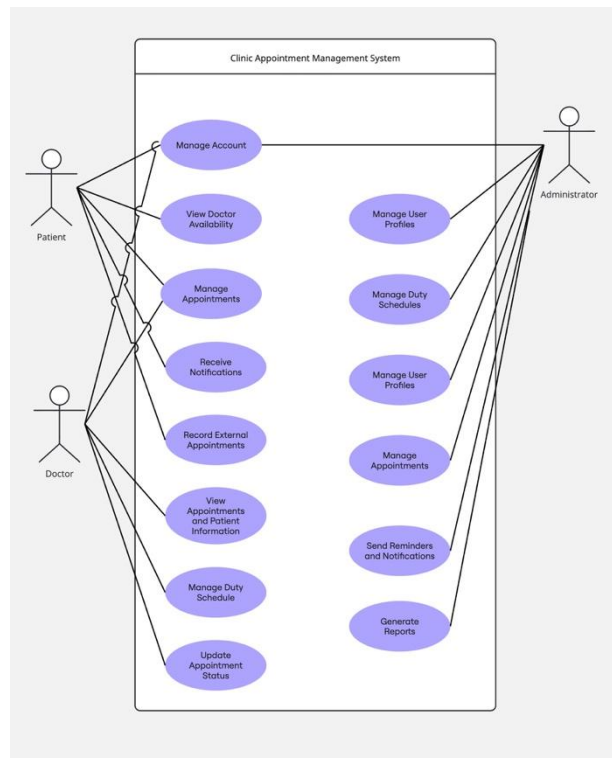


Figure 1: Use case diagram of the clinic appointment management system

Entity Relationship Model

An Entity Relationship Diagram (ERD) was developed to represent the core data structure required to support the clinic appointment management system. The ERD defines the main entities involved in appointment scheduling and management, as well as the relationships between them to ensure consistent data organisation and retrieval. The primary entities identified include **User, Login, Clinic, Doctor, Patient, Administrator, Appointment Slot, Schedule, Disease, and Message Notification**. These entities collectively capture user information, authentication records, clinic and doctor details, appointment scheduling data, patient medical context, and notification processes necessary for appointment coordination. The ERD provides a structured representation of how appointment data, schedules, and user roles interact within the system, forming the foundation for subsequent system implementation and interface development. **Figure 2** presents the entity relationship diagram of the proposed clinic appointment management system.

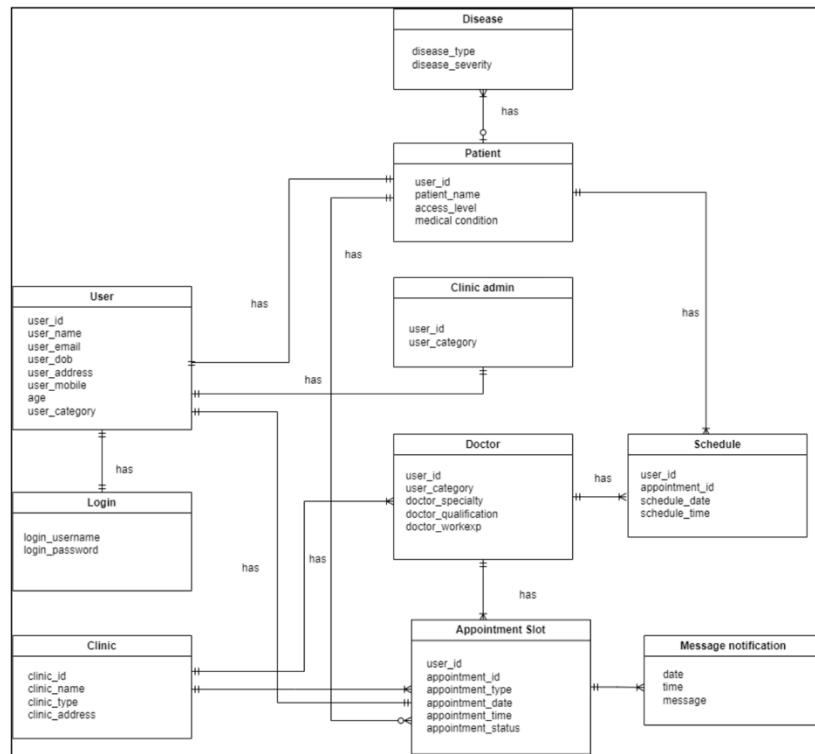


Figure 2: Entity relationship diagram of the clinic appointment management system

Interface Prototype Design

Based on the elicited requirements and the design artefacts (use case model and ERD), a set of interface screens was developed to support end-to-end appointment management tasks for patients, doctors, and clinic administrators. The prototype covers key functions including appointment creation and modification, schedule viewing, notification handling, and profile management. Overall, the interface design was structured to enable more specific time-slot allocation, improve visibility of doctor availability, and support more efficient appointment coordination within clinic workflows.

Table 1: Interfaces available in the clinic appointment management system prototype

Interface	Brief Description
Login / Account Access	Allows users to securely access the system based on their assigned roles.
Appointment Booking	Enables patients or administrators to create appointments by selecting doctors and available time slots.
Appointment List	Displays upcoming and past appointments for monitoring and management purposes.
Appointment Rescheduling and Cancellation	Allows users to modify or cancel existing appointments when necessary.
Doctor Schedule View	Provides a calendar-based view of doctor availability and scheduled appointments.

Messages and Notifications	Displays appointment reminders and updates related to schedule changes.
User Profile Management	Allows users to manage personal profile information within the system.
Appointment Management (Admin)	Enables administrators to monitor and manage appointment statuses and scheduling operations.
Duty Schedule Management	Allows administrators or doctors to manage doctor availability and duty schedules.
Report View	Generates summaries and reports related to appointment records for operational monitoring.

Among the developed interfaces, the Doctor Schedule interface plays a central role in appointment coordination, as it provides a comprehensive view of doctor availability and scheduled appointments, as illustrated in Figure 3. The **Doctor Schedule** interface provides a calendar-based view of doctors' availability and scheduled appointments. The interface displays multiple doctors across columns with time slots arranged vertically, enabling users to view schedules for a selected date and navigate between dates using the calendar controls. The schedule view supports different time perspectives (e.g., day/week) and includes filtering options to refine the displayed schedule based on service category. A "New appointment" function is available to initiate appointment booking directly from the schedule view.

The left navigation panel provides quick access to key modules, including the appointment list, doctor schedule, messages, and user profile. Within the schedule grid, booked slots are shown as time-block entries associated with specific doctors, while unavailable periods (e.g., off-duty) are visibly indicated. This interface supports the requirement for more specific time-slot allocation and clearer visibility of doctor availability, helping reduce ambiguity in scheduling and supporting smoother appointment planning.

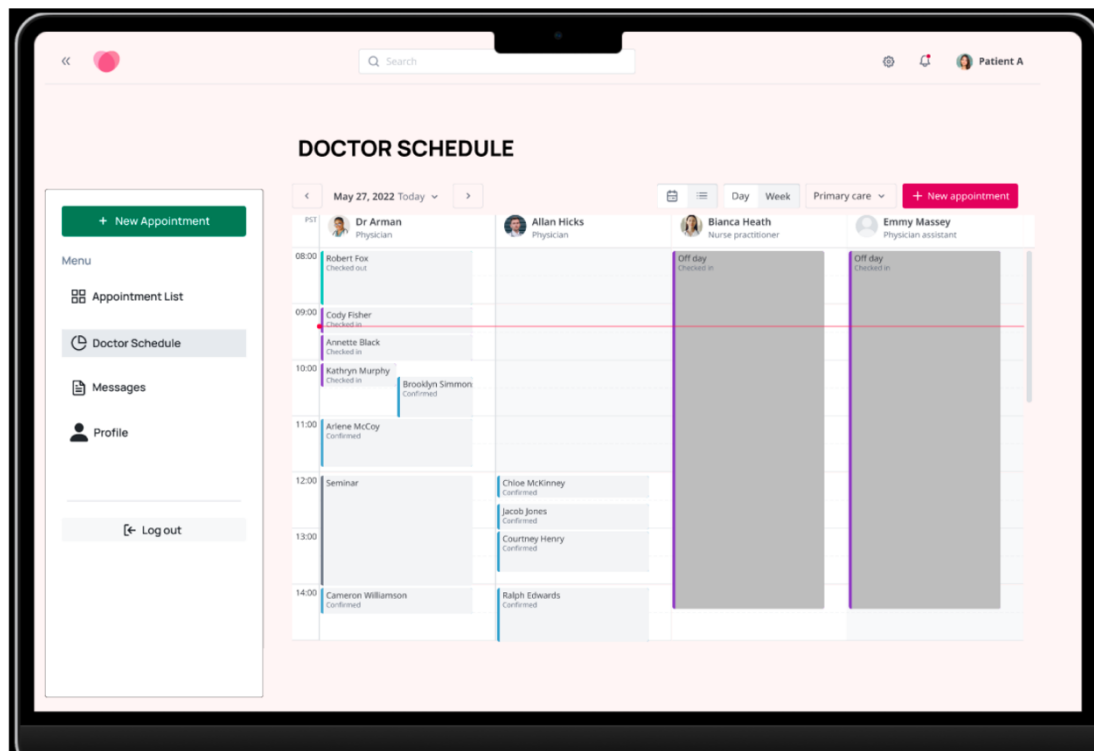


Figure 3: Doctor schedule interface of the clinic appointment management system

Usability Evaluation Results

Usability evaluation was conducted to obtain user feedback on the proposed appointment management system interface. Participants were first provided with access to the prototype before completing a questionnaire assessing their interaction experience with the system. The evaluation focused on several usability dimensions, including ease of use, perceived usefulness, suitability of system functions, and overall interface design.

The results indicate positive user perceptions across all evaluation dimensions. The mean score for ease of use was 4.4 (88%), indicating that users found the interface intuitive and easy to navigate. Perceived usefulness of the system recorded a mean score of 4.33 (86.6%), suggesting that respondents considered the system helpful in supporting appointment management tasks. The suitability of system functions achieved a mean score of 4.3 (86%), reflecting that the provided functions aligned well with user needs. Finally, the overall interface design received a mean score of 4.4 (88%), indicating a generally favourable assessment of the system's design and usability.

Conclusion

The results demonstrate that the proposed clinic appointment management system successfully translates identified user and system requirements into coherent design artefacts and usable interface prototypes. The developed use case model and entity relationship diagram provided structured guidance for system functionality and data organisation, while the interface prototype operationalised these requirements into practical appointment management features. Usability evaluation further indicates that users perceived the system as easy to use, useful, and



suitable for supporting appointment scheduling and management tasks. Collectively, these findings suggest that the requirement-driven design approach effectively addresses limitations observed in manual appointment management practices in private clinic settings.

Theoretically, this study contributes to healthcare information systems and design science research by demonstrating how requirement elicitation grounded in real clinical workflows can be systematically translated into interface design artefacts and evaluated through usability assessment. The study highlights the role of requirement-driven interface design as a structured mechanism for aligning digital appointment systems with operational practices in healthcare settings. Practically, the proposed interface prototype provides a reference for system developers and private clinics seeking to modernise appointment management processes and improve scheduling coordination and user experience.

This study is limited by its qualitative scope and the involvement of a small number of clinics, which may limit generalisability across different healthcare environments. In addition, evaluation was conducted at the prototype level without full system deployment or long-term operational assessment. Future work may involve full system implementation in clinic environments, extended usability testing with larger user groups, and evaluation involving patients to further validate system effectiveness and adoption across diverse clinical contexts.

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A DATA-CENTRIC STUDY OF ASPECT-BASED SENTIMENT ANALYSIS FOR SAFETY DISCOURSE ON TIKTOK

Nur Shamilla Selamat¹

¹Department of Computer Science, Faculty of Engineering and Information Technology, Southern University College, Johor, MALAYSIA. (nurshamilla@sc.edu.my)

Abstract: Social media platforms have become prominent spaces where safety-related experiences and perceptions are publicly articulated, particularly within travel-related user-generated content (UGC). However, computational approaches for analysing safety discourse remain limited by data sparsity, annotation challenges, and class imbalance. This study presents a data-centric preliminary investigation of aspect-based sentiment analysis (ABSA) for modelling safety-related discourse in TikTok comments. Publicly available comments associated with the hashtag #solotravel were collected using automated scraping tools and filtered to retain English, Malay, and code-switched content. An annotation framework was developed to capture safety discourse across three hierarchical levels: primary aspects (e.g., physical/environmental, psychological/emotional, cultural/social), fine-grained sub-aspects, and aspect-level sentiment polarity. To examine the impact of annotation scale, classical machine learning baselines were evaluated on two datasets: an initial pilot sample (402 comments) and an expanded annotated dataset (2,362 comments) in a multi-label, exploded aspect-sentiment format. Logistic Regression and Support Vector Machines were assessed using five-fold cross-validation with macro-averaged metrics. Results demonstrate substantial performance improvements following annotation expansion, particularly for primary and subcategory aspect classification, while aspect-level sentiment consistently achieved the highest performance. The findings confirm that annotation scale and label distribution play a critical role in ABSA effectiveness, often outweighing model complexity. This study establishes a validated methodological foundation for subsequent transformer-based and multimodal modelling of safety discourse in social media environments.

Keywords: Aspect-Based Sentiment Analysis, User-Generated Content, Safety Discourse, Information Systems, TikTok Analytics

Introduction

Short-form social media platforms such as TikTok and Instagram increasingly function as informal information systems through which travel-related experiences, emotions, and safety perceptions are exchanged in real time. Unlike traditional review platforms, these environments generate highly unstructured user-generated content (UGC) characterised by brevity, informality, emojis, and code-switching, posing challenges for systematic analysis while capturing dimensions of travel experience that are often absent from formal information sources (Fei et al., 2022; Huang et al., 2023).

Aspect-based sentiment analysis (ABSA) has been widely adopted within information systems and tourism research to extract fine-grained, decision-relevant insights from such content by linking sentiment polarity to specific aspects rather than entire texts (Chen et



al., 2025; Hua et al., 2024; Jang et al., 2021; Zhu et al., 2022). However, prior studies consistently report that ABSA performance in short-form social media contexts is constrained primarily by data-related factors, specifically annotation scale, label sparsity, and class imbalance, rather than model architecture (Chen et al., 2025; Fei et al., 2022; Liu et al., 2025; Zhang et al., 2023). These limitations are particularly acute for safety-related travel discourse, where multiple dimensions of risk and emotion may co-occur implicitly within a single comment. Although recent datasets such as Multi-Aspect Multi-Sentiment (MAMS) address multi-aspect and mixed-sentiment modelling in general domains (Fei et al., 2022; Liu et al., 2025), equivalent resources for safety-oriented travel discourse on short-form platforms remain scarce, limiting the practical utility of existing ABSA systems.

Accordingly, the objective of this study is to examine how annotation expansion and multi-label dataset design influence the effectiveness of ABSA systems for safety-related discourse in solo female travel UGC. Using publicly available TikTok comments, the study operationalises a hierarchical safety aspect framework and evaluates ABSA performance across three tasks, specifically primary aspect classification, subcategory aspect classification, and aspect-level sentiment prediction. By systematically comparing model performance on a small pilot dataset and an expanded annotated dataset of 2,362 comments, the study provides empirical evidence on the relative learnability of each task under realistic data constraints.

This study makes three primary contributions to information systems and technology management research. First, it proposes a structured, safety-oriented ABSA annotation framework tailored to short-form social media discourse, enabling multi-label aspect representation and aspect-level sentiment modelling. Second, it demonstrates through controlled experiments that annotation expansion and improved label distribution substantially enhance system performance, particularly for fine-grained aspect classification, validating data-centric system design principles. Third, it establishes robust classical machine learning baselines as a methodological reference point for subsequent transformer-based and multimodal extensions, supporting transparent and reproducible evaluation of analytical information systems. By improving the reliability of aspect-level safety analytics, the study contributes to the design of analytical information systems that can support travel-related decision-making, risk communication, and safety awareness for both users and platform stakeholders.

The remainder of this paper is organised as follows. Section 2 reviews related work on ABSA, tourism analytics, and data-centric model design. Section 3 describes the data collection process, annotation framework, and experimental methodology. Section 4 presents and analyses the empirical results. Section 5 discusses implications for ABSA-driven information systems and safety analytics. Section 6 concludes the paper and outlines future research directions, including transformer-based and multimodal system development.



Related Work

Aspect-Based Sentiment Analysis in Tourism and Social Media

ABSA has been widely applied in tourism research to extract fine-grained opinions from UGC, particularly online reviews and social media posts. Prior studies primarily focus on service quality, accommodation, pricing, atmosphere, and destination attributes, linking aspect-level sentiment to tourist satisfaction, behavioural intention, or recommendation outcomes (Huang et al., 2023; Li et al., 2023; Mehra, 2023). Compared to document-level sentiment analysis, ABSA has been shown to produce more actionable insights for decision support in experiential domains such as tourism (Chen et al., 2025; Hua et al., 2024; Jang et al., 2021; Zhu et al., 2022).

However, most tourism-oriented ABSA studies rely on long-form, review-based datasets where aspect boundaries and sentiment expressions are relatively explicit. The transfer of these methods to short-form social media environments remains underexplored (M.Abdelgwad et al., 2022; Perwira et al., 2025), despite growing evidence that platforms such as TikTok and Instagram play an increasingly influential role in shaping travel perceptions and decisions (Fei et al., 2022; Huang et al., 2023). Social media comments differ substantially from reviews in linguistic structure, exhibiting brevity, informality, emojis, and code-switching, which complicates aspect identification and sentiment attribution.

Data Scale, Annotation Design, and Class Imbalance in ABSA

A recurring challenge across ABSA robustness studies is that model performance is strongly influenced by dataset characteristics rather than architectural complexity alone. Annotation scale, label sparsity, and class imbalance are repeatedly identified as dominant factors limiting generalisation, particularly for fine-grained aspect classification (Chen et al., 2025; Fei et al., 2022; Liu et al., 2025; Zhang et al., 2023; Zhu et al., 2022). Rare or underrepresented aspects tend to be systematically misclassified, causing models to collapse predictions into dominant classes and reducing analytical usefulness.

To address this, recent ABSA datasets have shifted towards richer annotation schemes that allow multiple aspects and mixed sentiment polarity within a single instance. The MAMS dataset was explicitly introduced to overcome the limitations of earlier single-aspect corpora, enabling more realistic modelling of natural language opinion expression (Fei et al., 2022; Liu et al., 2025). In tourism contexts, similar trends are observed, where performance improvements are primarily driven by annotation expansion and rebalancing rather than model substitution (Huang et al., 2023; Perwira et al., 2025; Xu et al., 2024).

Classical and Transformer-Based ABSA Approaches

Classical machine learning methods, including Logistic Regression and Support Vector Machines with bag-of-words or TF-IDF representations, remain widely used as strong baselines in ABSA research (M.Abdelgwad et al., 2022; Perwira et al., 2025; Siddiqua et al., 2024). Comparative studies consistently report that these models perform competitively, and in some cases outperform transformer-based models, in low-resource or highly imbalanced settings (Chen et al., 2025; Zhang et al., 2023).



Transformer-based models such as BERT and its multilingual variants have demonstrated strong performance in ABSA tasks, especially in under-resourced languages and code-switched environments (M.Abdelgwad et al., 2022; Perwira et al., 2025). Nevertheless, empirical evidence suggests that such models require sufficiently large and balanced datasets to reliably surpass classical baselines. When annotation is sparse or skewed, transformers may exhibit instability and reduced macro-averaged performance, especially for fine-grained aspect categorisation (Hua et al., 2024; Zhu et al., 2022).

Sentiment vs. Aspect Learnability

Across ABSA literature, sentiment polarity classification is consistently reported as more learnable than aspect identification, especially in short texts (Fei et al., 2022; Zhang et al., 2023; Zhu et al., 2022). Sentiment cues tend to be linguistically explicit, whereas aspect boundaries, especially in domains such as safety, are often implicit, contextual, and multi-dimensional. This observation is replicated in tourism and social media studies, where models achieve higher and more stable performance on sentiment prediction than on nuanced aspect or sub-aspect detection (Huang et al., 2023; Mehra, 2023).

Collectively, existing work indicates that reliable ABSA for safety-related travel discourse depends fundamentally on annotation design, dataset scale, and class balance rather than model complexity alone. Despite growing interest in tourism and social media analytics, there remains a lack of safety-oriented, multi-label ABSA datasets tailored to short-form platforms. This gap motivates a data-centric investigation into how annotation expansion and representation choices shape ABSA system performance in safety-focused travel contexts.

Methodology

Research Design

This study adopts a data-centric experimental design, consistent with recent methodological recommendations in ABSA research, which emphasise dataset construction and annotation quality as primary determinants of analytical performance rather than model novelty alone (Tao & Fang, 2020; Zhang et al., 2023). The objective is to evaluate how annotation expansion and multi-label representation affect the learnability of safety-related aspects and sentiment in short-form travel UGC. Classical machine learning models are intentionally employed as controlled analytical probes within the broader analytical information system pipeline, allowing the impact of data design decisions on downstream analytical reliability to be isolated (Tao & Fang, 2020; Zhang et al., 2023). Figure 1 illustrates the overall data-centric ABSA pipeline, highlighting the interaction between data collection, annotation design, and model evaluation.

Conceptual Basis and Annotation Framework

The annotation framework is grounded in a scoping review conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) of solo female travel and gendered safety literature, which consistently conceptualises safety as a multi-dimensional construct spanning physical and environmental, psychological and emotional, and cultural and social domains. Prior qualitative



and mixed-method studies show that these dimensions shape women's travel experiences, risk perception, and online expression in interconnected ways (Chowdhury et al., 2023; Ghadban et al., 2023; Ison et al., 2023).

Based on this synthesis, safety discourse was operationalised into a hierarchical aspect schema comprising three primary categories, specifically physical/environmental safety, psychological/emotional safety, and cultural/social constraints, each further decomposed into sub-aspects. This design aligns with recent fine-grained ABSA guidelines that advocate hierarchical and domain-specific aspect modelling to support interpretability and reuse across analytical systems (Alotaibi & Nadeem, 2025; Dai et al., 2025).

Multi-Label Representation and Exploded Format

Given evidence that safety-related expressions frequently involve multiple co-occurring aspects and mixed sentiment, the annotation scheme permits multi-label aspect assignment and explicit mixed sentiment polarity. This directly addresses limitations of earlier ABSA datasets that constrain sentences to a single aspect or shared polarity, which often causes models to degenerate into sentence-level sentiment classifiers (Fei et al., 2022; Hua et al., 2024; Zhang et al., 2023). Newer ABSA resources, such as MAMS, were introduced specifically to overcome these constraints by supporting multi-aspect and mixed-sentiment structures (Fei et al., 2022; Hua et al., 2024).

Manual annotation was conducted by the researcher following a predefined codebook derived from the scoping review, with iterative refinement applied during pilot annotation to ensure conceptual consistency across labels. Annotated data were stored in an exploded aspect-sentiment format, where each row represents one aspect-sentiment pair. This representation is consistent with modern ABSA formulations that treat each aspect-polarity instance as an independent analytical unit for training and evaluation (Tao & Fang, 2020; Zhang et al., 2023).

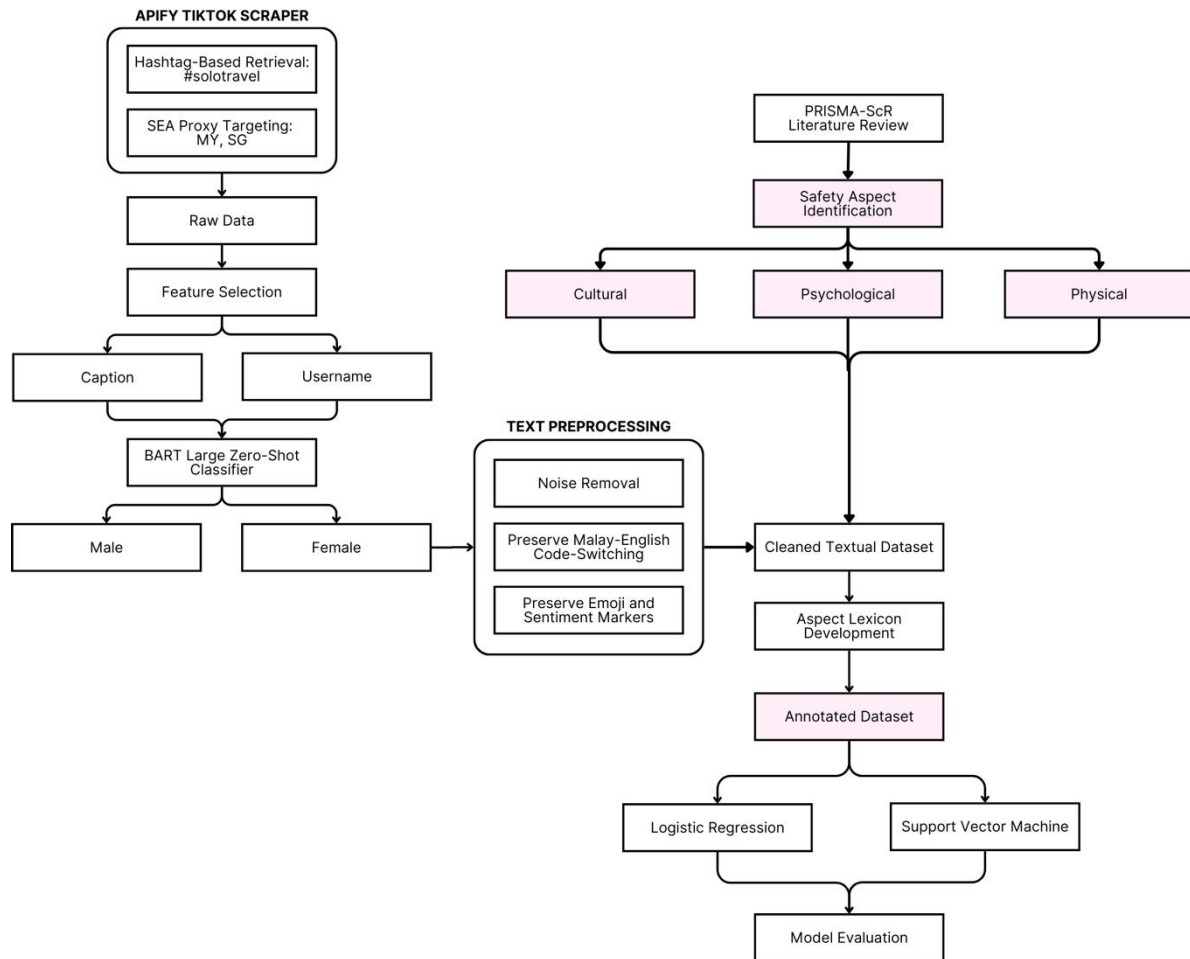


Figure 1. Data-centric ABSA pipeline for safety-related travel discourse.

Data Collection and Preprocessing

UGC was collected from TikTok using the Apify TikTok Scraper, targeting public posts associated with the hashtag #solotravel. Geo-targeted proxy settings were applied to prioritise Southeast Asian contexts. A secondary scraper extracted full comment threads associated with selected posts. Creator gender was inferred using a zero-shot gender classification approach, enabling the selection of content likely produced by individual female travellers, following a method similar to that reported by Pitanatri et al. (2025).

Text preprocessing standardised schema fields, removed URLs and mentions, normalised spacing, and eliminated duplicates. Language filtering retained English, Malay, and mild code-switched comments, reflecting the linguistic characteristics of the target context. Emojis and informal expressions were preserved due to their documented importance for sentiment interpretation in short-form social media (Dai et al., 2025; Hua et al., 2024). The final expanded annotated dataset comprised a total of 2,362 comments.



Experimental Setup

Classical machine learning models, specifically Logistic Regression with bag-of-words (BoW) features and Support Vector Machines (SVM) with TF-IDF representations, were selected as baselines due to their established robustness and competitiveness in low-resource and imbalanced ABSA settings (Motevalli et al., 2025; Siddiqua et al., 2024). Experiments were conducted for three tasks: (i) primary aspect classification, (ii) subcategory aspect classification, and (iii) aspect-level sentiment classification.

Model evaluation employed 5-fold stratified cross-validation, with performance assessed using accuracy, macro-averaged precision, recall, and F1-score. Macro-F1 was prioritised due to uneven label distributions, consistent with standard evaluation practice in imbalanced ABSA and sentiment analysis tasks (Ramasamy & Elangovan, 2024; Zhang et al., 2023).

Comparative Evaluation Strategy

To examine the impact of annotation expansion, results obtained from an initial pilot dataset (402 annotated comments) were compared against those from the expanded annotated dataset (2,362 comments). This comparison follows prior robustness studies demonstrating that performance gains in ABSA are often driven by increased annotation scale, label diversity, and balance rather than changes in model architecture (Tao & Fang, 2020; Yang & Liu, 2025).

Overall, the proposed methodology aligns closely with contemporary ABSA research. It targets a recognised gap, which is safety-oriented discourse in short-form, multilingual social media, and employs a hierarchical, multi-label annotation framework grounded in social theory and prior qualitative research. By combining data-centric design with classical baselines and macro-averaged evaluation, the methodology isolates the causal impact of annotation scale and representation on ABSA system performance, directly supporting analytical validity within information systems and technology management research.

Results

This section reports and interprets the performance of classical baseline models for ABSA across two annotation scales, which is an initial pilot dataset of 402 annotated comments and an expanded annotated dataset of 2,362 comments. The comparison is used to examine how annotation scale, class balance, and multi-label representation affect the learnability of safety-related aspects and sentiments in short-form social media discourse.

Results on the Pilot Dataset

Table 1 summarises the performance of Logistic Regression (BoW) and SVM (TF-IDF) on the pilot dataset across three tasks, specifically primary aspect classification, subcategory aspect classification, and aspect-level sentiment classification.

Table 1. Performance of Classical Baseline Models on the Pilot Dataset

Task	Model	Macro Precision	Macro Recall	Macro F1	Accuracy
Primary Aspect	Logistic Regression (BoW)	0.414	0.383	0.378	0.737
	SVM (TF-IDF)	0.405	0.401	0.388	0.734
Subcategory Aspect	Logistic Regression (BoW)	0.171	0.167	0.163	0.712
	SVM (TF-IDF)	0.249	0.221	0.220	0.712
Aspect-Level Sentiment	Logistic Regression (BoW)	0.564	0.503	0.519	0.717
	SVM (TF-IDF)	0.686	0.510	0.545	0.719

For primary aspect classification, both models achieved moderate macro-F1 scores (0.378 for Logistic Regression and 0.388 for SVM). Although accuracy exceeded 0.73, this result was largely driven by the dominance of the “none” class, which accounted for approximately 65% of the annotated data. The “none” class refers to comments not expressing any identifiable safety-related aspect. The models showed limited ability to distinguish between minority safety categories, such as cultural/social and physical/environmental aspects, reflecting the sparse representation of these classes.

Performance degraded substantially for subcategory aspect classification, where macro-F1 scores ranged between 0.163 and 0.220. The dataset contained 16 fine-grained sub-aspects, many of which had fewer than five instances. As a result, both models exhibited unstable learning behaviour, frequent misclassification into the dominant “none” class, and inflated accuracy values that did not reflect meaningful aspect understanding.

In contrast, aspect-level sentiment classification produced the strongest and most stable results. SVM achieved a macro-F1 score of 0.545, outperforming Logistic Regression (0.519). This indicates that sentiment polarity is more linguistically explicit and therefore more learnable than nuanced safety aspects in short TikTok comments. Overall, the pilot results suggest that sentiment detection is feasible even with limited data, whereas fine-grained aspect modelling is strongly constrained by annotation sparsity.

Results on the Expanded Annotated Dataset

Table 2 reports model performance after expanding the annotated dataset to 2,362 comments and adopting a multi-label, exploded data representation.

Table 2. Performance of Classical Baseline Models on the Expanded Annotated Dataset

Task	Model	Macro Precision	Macro Recall	Macro F1	Accuracy
Primary Aspect	Logistic Regression (BoW)	0.688	0.628	0.650	0.757
	SVM (TF-IDF)	0.682	0.635	0.653	0.753
Subcategory Aspect	Logistic Regression (BoW)	0.433	0.347	0.370	0.664
	SVM (TF-IDF)	0.427	0.404	0.408	0.665
Aspect-Level Sentiment	Logistic Regression (BoW)	0.717	0.698	0.698	0.751
	SVM (TF-IDF)	0.734	0.685	0.699	0.781

For the primary aspect classification, performance improved substantially. Macro-F1 increased to approximately 0.65 for both Logistic Regression and SVM, representing an absolute gain of more than 24 percentage points compared to the pilot dataset. Precision and recall also improved consistently, while accuracy remained stable at approximately 0.75. These results indicate that annotation expansion and improved class balance significantly enhance model generalisation, even without changing model architecture.

For subcategory aspect classification, the expanded annotated dataset enabled meaningful learning for the first time. Macro-F1 increased from 0.16–0.22 to 0.37 (Logistic Regression) and 0.41 (SVM). Although performance remains lower than for primary aspect classification, the improvement demonstrates that sub-aspect classification becomes feasible once sufficient examples are available for dominant subcategories such as empowerment (B2) and fear/anxiety (B1). However, warnings related to rare classes (e.g., subcategories with fewer than five instances) indicate that further annotation is still required for robust coverage.

For aspect-level sentiment classification, both models achieved strong and stable performance. Macro-F1 scores approached 0.70, with SVM reaching an accuracy of 0.78. Compared to the pilot dataset, gains were more modest, reflecting that sentiment was already relatively learnable at a smaller scale. Nevertheless, the expanded annotated dataset improved recall for minority sentiment classes such as mixed and negative sentiment.

Discussion

Figure 2 illustrates the macro-averaged F1 performance of classical ABSA models across three analytical tasks, specifically primary aspect classification, subcategory aspect classification, and aspect-level sentiment analysis, comparing results from the pilot annotated dataset and the expanded annotated dataset. The figure highlights a consistent upward shift in performance across all tasks following annotation expansion, with particularly pronounced gains for aspect and sub-aspect classification. This visual comparison reinforces the central premise of this study, which is that data scale and annotation design exert a stronger influence on ABSA performance than model choice in low-resource social media settings.

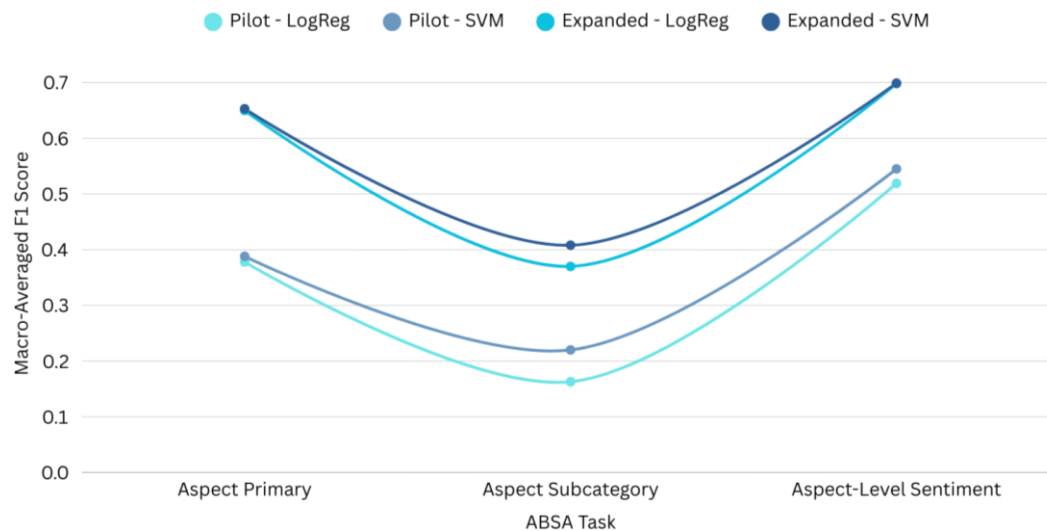


Figure 2. Macro-F1 performance of classical ABSA models across pilot and expanded annotated datasets.

For the primary aspect classification, macro-F1 improved substantially after annotation expansion, increasing from approximately 0.38 to over 0.65 for SVM-based models. This improvement aligns with prior ABSA reviews and robustness studies, which report that sparse and imbalanced datasets severely constrain a model’s ability to distinguish minority aspects, often causing predictions to collapse into dominant classes such as “none” (Fei et al., 2022; Hua et al., 2024; Yang & Liu, 2025). By expanding the annotated dataset and adopting a multi-label representation, the relative frequency of safety-related aspects increased, enabling classical models to learn more stable decision boundaries. This finding supports evidence from tourism ABSA research showing that richer, more balanced annotation schemes yield larger performance gains than substituting algorithms alone (Chen et al., 2025; Fei et al., 2022).

The most dramatic improvement is observed in the subcategory aspect classification. In the pilot dataset, macro-F1 values below 0.25 reflected extreme label sparsity, with many sub-aspects represented by fewer than five instances. After expansion, macro-F1 increased to approximately 0.41, despite the task remaining the most challenging. This pattern is consistent with findings that fine-grained ABSA is particularly sensitive to annotation density and label hierarchy design (Fei et al., 2022; Hua et al., 2024). Similar to observations reported for multi-aspect datasets such as MAMS, performance improvements emerge primarily when multi-aspect co-occurrence and mixed expressions are explicitly encoded in the data representation (Fei et al., 2022). The results confirm that sub-aspect classification is feasible only after a critical mass of annotated examples is reached.

Aspect-level sentiment analysis exhibits the highest and most stable performance across both datasets, with macro-F1 increasing from approximately 0.55 to nearly 0.70. This outcome reflects a well-established trend in ABSA literature, which is that sentiment polarity is more learnable than aspect identification, particularly in short texts where emotional cues are linguistically explicit (Fei et al., 2022; Hua et al., 2024; Yang & Liu, 2025). In the context of TikTok comments, expressions of fear, excitement, empowerment, or anxiety are often directly stated, enabling reliable sentiment prediction even when aspect boundaries remain implicit.



This supports prior tourism and social media studies reporting higher robustness for sentiment classification compared to nuanced aspect classification (Chen et al., 2025; Fei et al., 2022).

Taken together, the results shown in Figure 2 provide strong empirical support for a data-centric perspective on analytical information systems. Consistent with prior work, classical models such as Logistic Regression and SVM remain competitive and reliable probes of dataset quality in low-resource, imbalanced environments (Hua et al., 2024; Motevalli et al., 2025; Tao & Fang, 2020). The observed performance gains are primarily attributable to annotation expansion, multi-label representation, and improved aspect coverage rather than algorithmic complexity. These findings underscore the importance of prioritising dataset construction and annotation strategy when designing ABSA-driven information systems for decision support in tourism and safety-related domains.

Beyond performance gains, the results validate the proposed hierarchical, safety-oriented annotation framework as a reusable analytical artefact for information systems research. By operationalising socio-cultural safety theory into structured, multi-label data representations, the framework supports systematic analysis of otherwise diffuse and informal social media discourse, reinforcing its value for future ABSA-driven decision-support systems in tourism and safety analytics.

Conclusion

This study investigated the effects of dataset expansion and multi-label dataset design on the performance of aspect-based sentiment analysis systems applied to safety-related discourse in short-form travel UGC. Using publicly available TikTok comments and a hierarchical safety-oriented annotation framework grounded in prior socio-cultural research, the study systematically compared classical ABSA model performance across a small pilot dataset and an expanded annotated dataset comprising 2,362 comments.

The results demonstrate that dataset scale and representation are decisive factors shaping ABSA effectiveness in short-form social media environments. Across all three tasks, which include primary aspect classification, subcategory aspect classification, and aspect-level sentiment analysis, substantial performance gains were observed following annotation expansion. In particular, fine-grained subcategory classification, which was effectively infeasible under sparse annotation conditions, became meaningfully learnable once label coverage and balance improved. In contrast, sentiment classification showed consistently higher and more stable performance across both datasets, reinforcing prior findings that sentiment polarity is more linguistically explicit and easier to model than nuanced aspect structures in short texts.

From an information systems and technology management perspective, these findings provide strong empirical support for a data-centric approach to analytical system design. The study confirms that improvements in dataset construction, annotation schema, and label distribution yield greater performance benefits than model substitution alone, even when using well-established classical baselines such as Logistic Regression and Support Vector Machines. As such, classical models remain valuable diagnostic tools for assessing dataset adequacy and analytical readiness in low-resource and imbalanced settings.



The study has several limitations. Although annotation expansion substantially improved performance, rare subcategories remain underrepresented, indicating the need for continued data growth and potential augmentation strategies. In addition, the current analysis focuses on text-only models. Visual features present in short-form platforms were not yet incorporated.

Future research will extend this work by integrating transformer-based and multimodal architectures, incorporating visual cues alongside textual signals. By establishing a robust, safety-oriented ABSA foundation for short-form social media, this study contributes to the development of more reliable analytical information systems capable of supporting safety awareness and decision support in contemporary travel contexts.

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PROPHETIC TRADITIONS IN THE PSYCHOLOGICAL TREATMENT OF THE ELDERLY: AN ANALYTICAL STUDY

Mesbahul Hoque¹, Mohd Zahir Abdul Rahman², Shah Rizul Izyan Zulkiply³, Ahmad Sanusi Azmi⁴, Kauthar Abd Kadir⁵

¹(Corresponding author). Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia. (mesbahul@usim.edu.my)

² Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia. (zahir@usim.edu.my)

³ Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia. (izyanzulkiply@usim.edu.my)

⁴ Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia. (sanusi@usim.edu.my)

⁵ Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia. (kauthar@usim.edu.my)

Abstract: *The psychological well-being of the elderly has become a pressing concern in contemporary societies due to increased life expectancy, social isolation, and age-related emotional challenges such as anxiety, depression, loneliness, and loss of purpose. Within the Islamic tradition, Prophetic traditions (al-Sunnah al-Nabawiyyah) provide a comprehensive ethical and therapeutic framework that addresses psychological and emotional needs throughout the human life cycle, including old age. Employing a qualitative analytical methodology this study examines the role of Prophetic traditions in the psychological treatment and emotional support of the elderly through an analytical approach. The findings demonstrate that Prophetic traditions offer a holistic model of psychological care that integrates spiritual, emotional, and social dimensions of well-being. This model emphasizes empathy, ethical responsibility, interpersonal connection, and spiritual coping strategies, all of which are essential in mitigating psychological distress among older adults. Moreover, the Sunnah provides preventive and supportive measures that help reduce feelings of isolation, anxiety, and diminished self-worth commonly experienced in old age. The study argues that integrating Prophetic guidance into culturally sensitive psychological interventions can enhance contemporary approaches to geriatric mental health, particularly in Muslim communities. By bridging classical Islamic sources with modern psychological perspectives, this research contributes to the emerging field of Islamic psychology and affirms the continued relevance of Prophetic traditions in promoting ethical and effective psychological treatment of the elderly.*

Keywords: *Prophetic Traditions, Psychological Treatment, Elderly*

Introduction

Population ageing represents one of the most profound demographic shifts globally, with increasing life expectancy and declining fertility rates leading to a significant rise in the proportion of older adults (World Health Organization [WHO], 2022). This demographic change has brought about not only physical care challenges but also psychological concerns that are unique to later life (Van der Linde, R. M., Denning, T., Matthews, F. E., Brayne, C, 2014). Research increasingly identifies loneliness, anxiety, depression, fear of dependency, and reduced social engagement as prevalent psychological issues among the elderly, requiring multidisciplinary attention (Conwell et al., 2011). Recent empirical work further underscores that participation in religious and spiritual practices can contribute positively to mental health



outcomes, including reduced depressive symptoms and enhanced psychological well-being, particularly among older adults (Santini et al., 2021).

Psychological well-being in later life is acknowledged by scholars as a central component of healthy ageing. Contemporary psychological frameworks emphasize that well-being comprises emotional stability, meaningful engagement, social connectedness, and a sense of purpose, beyond the mere absence of mental illness (Almokhtar A. Adwas et al., 2019). Studies have shown that higher levels of religiosity and spirituality are associated with improved life satisfaction, better coping strategies, lower rates of anxiety and depression, and a stronger sense of meaning and social support in older populations (Santini et al., 2021). Religious involvement may serve as a protective factor by fostering community engagement, structured activity, and meaning-making mechanisms—elements crucial for psychological resilience in later life.

Despite the well-documented connection between mental health and spirituality in secular research, prevailing psychological models often remain biomedical or secular, overlooking the integral role that religious and spiritual worldviews play in shaping meaning, coping, and emotional regulation—particularly within Muslim elderly populations (Koenig, 2012). For many older adults living in Muslim cultural contexts, spirituality is not merely an adjunct to psychological health but a deeply embedded framework influencing daily life, coping mechanisms, and perceptions of aging. Recent research from Aceh, Indonesia, shows that engagement in Islamic devotional practices, such as *dhikr* (remembrance of Allah), has measurable positive associations with mental health outcomes among older adults, suggesting that religious observance positively influences psychological well-being (Abdullah et al., 2024).

The traditions of the Prophet Muḥammad ﷺ (Sunnah) offer a rich repository of ethical and spiritual guidance that implicitly addresses psychological issues that commonly emerge in old age, such as loss of identity, fear of decline, emotional distress, and social isolation. The Sunnah emphasizes mercy, respect, emotional reassurance, and gentle interpersonal communication—all of which resonate with contemporary psychological constructs such as emotional support, empathy, and person-centered care (Rogers, 1957; Park, 2010). However, the scholarly interface between Islamic primary sources and modern psychological inquiry remains underdeveloped. While research on religion and mental health has expanded, most studies are either descriptive or general in scope and do not specifically analyze Prophetic guidance as a psychological resource for elderly mental well-being (Koenig, 2012).

Moreover, Islamic studies literature often discusses elderly care in ethical or legal terms without systematically exploring its psychological dimensions. Papers that do engage with Islamic perspectives on mental health frequently focus on general religious practices or community structures, without analytically connecting specific Prophetic traditions to established psychological mechanisms and theories. As a result, there exists a gap in the literature that limits the development of culturally and spiritually grounded mental health frameworks tailored to the needs of Muslim elderly populations (Hoque et al., 2025).

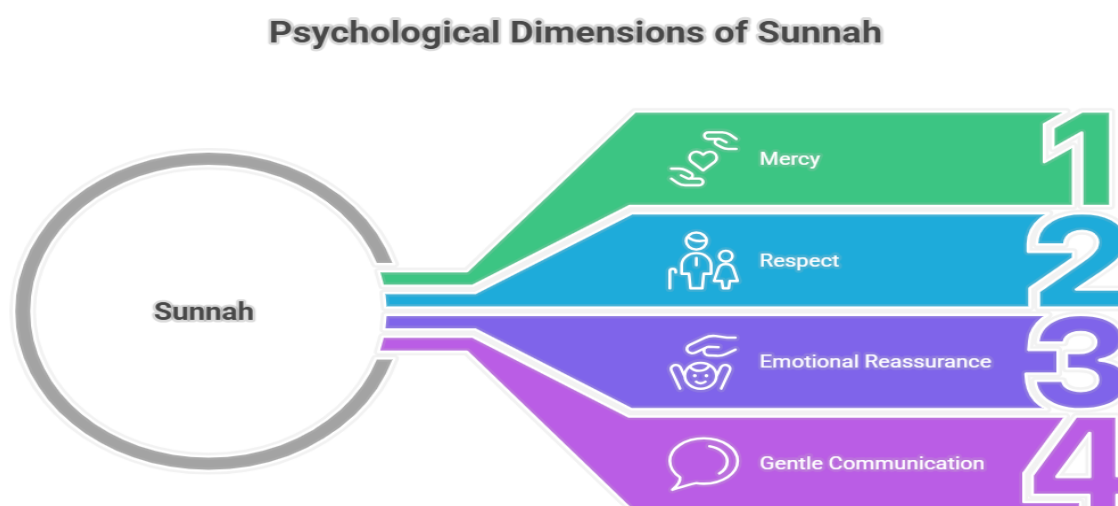
The present study seeks to address this gap by offering an analytical examination of Prophetic traditions relevant to psychological treatment of the elderly. By integrating classical Islamic sources with contemporary psychological research, the study aims to reveal how Prophetic

guidance may function as a holistic model of psychological care that supports emotional resilience, social connectedness, and spiritual meaning in later life.

The objectives of this study are: (1) to identify Prophetic traditions that address psychological well-being in old age; and (2) to analyse the psychological dimensions within these traditions to examine their alignment with modern psychological theories and therapeutic practices. Accordingly, the study is guided by the following research questions: (1) What psychological challenges faced by the elderly are addressed in Prophetic traditions? (2) What are the analytical dimensions of Prophetic traditions relevant to the psychological treatment of the elderly? The significance of this study lies in its potential to enrich both Islamic studies and psychological gerontology by providing a culturally informed idea that bridges traditional Islamic guidance with contemporary mental health understanding.

Prophetic Traditions Addressing Psychological Well-Being of the Elderly

Islamic teachings, particularly the Prophetic traditions (Sunnah), provide a comprehensive framework for safeguarding psychological well-being across the human lifespan (Muneer, A. 2024). In the context of old age, the Sunnah emphasizes emotional sensitivity, dignity, social integration, and spiritual reassurance, all of which directly address common psychological challenges faced by the elderly. Contemporary gerontological psychology recognizes that mental well-being in later life is influenced not only by physical health but also by emotional support, social inclusion, and a sense of purpose (World Health Organization [WHO], 2017). These dimensions are strongly reflected in the Prophetic model.



Compassion, Mercy, and Emotional Support in the Sunnah

Compassion (*rahmah*) is a foundational principle in the Sunnah and a central element in psychological care for the elderly. The Prophet Muḥammad ﷺ declared: «لَيْسَ مِنَّا مَنْ لَمْ يَرْحَمْ» «صَغِيرَنَا، وَيُوقِرْ كَبِيرَنَا» “He is not one of us who does not show mercy to our young and respect to our elders” (al-Tirmidhī, 1924/2007). This tradition establishes mercy toward the elderly as a moral and social obligation rather than a voluntary act of kindness.



From a psychological perspective, emotional neglect is a significant risk factor for depression and anxiety among older adults (Cacioppo & Cacioppo, 2014). The Prophetic emphasis on mercy mitigates emotional isolation by fostering affectionate interpersonal relationships. The Prophet ﷺ consistently demonstrated emotional attentiveness toward older individuals, responding patiently to their needs and offering reassurance rather than reproach (Ibn Hajar, 1449/2008).

Moreover, the Sunnah encourages active emotional support within families and communities. The Prophet ﷺ stated: *“The most beloved people to Allah are those who are most beneficial to people”* (al-Ṭabarānī, 1984). This includes caring for the emotional and psychological needs of the elderly, particularly when they experience vulnerability due to declining health or social roles. Such Prophetic guidance aligns closely with modern concepts of emotional caregiving and social support as protective factors against psychological distress in old age (Thoits, 2011).

Respect, Dignity, and Social Inclusion of the Elderly

Preserving dignity (*karāmah*) is a central psychological need in later life. The Sunnah places extraordinary emphasis on honoring older persons, viewing age as a symbol of experiential wisdom rather than social redundancy. The Prophet ﷺ said: «إِنَّ مِنْ إِجْلَالِ اللَّهِ إِكْرَامَ ذِي الشَّيْبَةِ الْمُسْلِمِ» *“Part of glorifying Allah is honoring the grey-haired Muslim”* (Abū Dāwūd, 1534/2009). This narration explicitly connects respect for the elderly with spiritual reverence.

Social exclusion and ageism are recognized contributors to psychological decline among older adults (North & Fiske, 2015). In contrast, the Prophetic model promotes active inclusion of the elderly in communal life. Historical reports show that elderly Companions continued participating in consultation (*shūrā*), teaching, and religious leadership during the Prophet’s time (al-Dhahabī, 1996). This inclusive approach fosters self-worth, agency, and continuity of identity—key determinants of mental well-being (Erikson, 1982).

Furthermore, the Sunnah discourages dismissive or harsh communication toward older individuals. Respectful speech and behavior preserve self-esteem and prevent emotional harm. Modern psychological studies affirm that perceived respect significantly correlates with lower rates of depression and cognitive decline among the elderly (Levy et al., 2016), reinforcing the relevance of Prophetic teachings in contemporary psychological discourse.

Encouragement of Hope, Patience, and A Positive Outlook

The Sunnah actively cultivates hope (*rajāʾ*) and patience (*ṣabr*), particularly during periods of hardship common in old age, such as illness, loss, and dependency. The Prophet ﷺ reassured believers that trials are not signs of divine abandonment but opportunities for spiritual elevation: «مَا يُصِيبُ الْمُسْلِمَ مِنْ نَصَبٍ، وَلَا وَصَبٍ، وَلَا هَمٍّ، وَلَا حُزْنٍ، وَلَا أَذًى، وَلَا غَمٍّ، حَتَّى الشَّوْكَةِ يُشَاكُهَا، إِلَّا كَفَّرَ اللَّهُ بِهَا مِنْ خَطَايَاهُ» *“No fatigue, illness, sorrow, sadness, harm, or distress befalls a Muslim—even the prick of a thorn—except that Allah expiates some of his sins because of it”* (al-Bukhārī & Muslim, 2007).

This Prophetic reframing of suffering has significant psychological implications. Cognitive-behavioral psychology emphasizes meaning-making as a critical coping mechanism for stress



and depression (Park, 2010). By providing a transcendent purpose to hardship, the Sunnah reduces feelings of helplessness and existential despair among the elderly.

Additionally, the Prophet ﷺ discouraged pessimism and despair, emphasizing optimism and trust in divine wisdom. He stated: «لَا يَتَمَنَّيَنَّ أَحَدُكُمُ الْمَوْتَ لِضَرْبِ أَصَابَةٍ» “*Let none of you wish for death because of a calamity that has afflicted him*” (Muslim, 2007). This guidance protects elderly individuals from suicidal ideation and hopelessness, which are increasingly recognized mental health concerns among aging populations (Conwell et al., 2011).

Prophetic Practices Related to Reassurance, Empathy, and Gentle Communication

Gentle communication (*rifq*) is a defining feature of Prophetic interaction and a crucial component of psychological care. The Prophet ﷺ said: «إِنَّ الرَّفْقَ لَا يَكُونُ فِي شَيْءٍ إِلَّا زَانَهُ، وَلَا يُنْزَعُ» “*Gentleness is not found in anything except that it beautifies it*” (Muslim, 2007). This principle is particularly relevant when interacting with elderly individuals who may experience heightened emotional sensitivity.

The Sunnah records numerous instances of the Prophet ﷺ listening attentively, validating emotions, and responding empathetically. Such practices align with contemporary therapeutic techniques, including active listening and emotional validation, which are widely used in geriatric counseling (Rogers, 1957). Harsh speech or dismissive attitudes, by contrast, can exacerbate anxiety, confusion, and emotional withdrawal among the elderly (Silva, M.V.F., Loures, C.d.M.G., Alves, L.C.V. 2019).

Reassurance was another key Prophetic practice. When elderly Companions expressed fear or regret, the Prophet ﷺ offered comforting words that restored emotional balance and hope. These interactions illustrate a model of emotionally intelligent leadership that prioritizes psychological safety alongside spiritual instruction.

Analytical Discussion: Psychological Dimensions of Prophetic Guidance

By examining selected Prophetic traditions through the lens of contemporary psychological concepts, the discussion seeks to uncover the preventive and therapeutic elements inherent in the Prophet’s ﷺ approach to human behavior, emotional well-being, and mental resilience. The analysis highlights how Prophetic guidance addresses psychological needs such as emotional security, dignity, social connectedness, and hope, particularly in the context of ageing. Furthermore, this section explores the convergence between Prophetic approaches and modern psychological theories and therapeutic practices, demonstrating the relevance of the Sunnah as a holistic and ethically grounded framework for psychological care of the elderly.

Preventive Psychological Care in Prophetic Traditions

The Sunnah emphasizes prevention over intervention; a principle echoed in modern mental health frameworks. Preventive psychological care in the Prophetic tradition includes fostering strong family ties, encouraging regular worship, and maintaining social engagement—all of which protect against loneliness and depression in old age.



Acts of worship such as prayer (*ṣalāh*), remembrance (*dhīr*), and supplication (*du‘ā*) provide emotional regulation and stress reduction. Empirical studies indicate that spiritual practices contribute to emotional resilience and lower levels of anxiety among older adults (Koenig, 2012). By embedding these practices into daily life, the Sunnah offers a sustainable preventive mental health model.

Therapeutic Elements within Prophetic Teachings

Beyond prevention, the Sunnah contains therapeutic elements that address psychological distress. Emotional reassurance, meaning-centered coping, and community support function as informal therapeutic interventions. The Prophetic approach does not isolate psychological suffering from spiritual or social contexts; rather, it treats the individual holistically.

Narrations concerning illness and aging emphasize divine closeness during vulnerability, reducing fear and emotional distress. Such therapeutic narratives resemble meaning-centered therapies used in modern psychology, particularly in palliative and geriatric care (Breitbart, 2017).

Alignment Between Prophetic Approaches and Modern Psychological Therapies

A comparative analysis reveals significant alignment between Prophetic guidance and contemporary psychological approaches. Concepts such as empathy, positive reframing, social support, and dignity preservation are foundational to both Islamic teachings and evidence-based geriatric psychology.

For example, cognitive-behavioral therapy’s focus on reframing negative thoughts parallels the Sunnah’s emphasis on hope and trust in divine wisdom. Likewise, person-centered therapy’s emphasis on empathy and unconditional positive regard closely mirrors Prophetic interpersonal conduct. This alignment highlights the Sunnah’s relevance as both a spiritual and psychological resource for elderly care in Muslim societies and beyond.

Conclusion

This study has analytically examined Prophetic traditions related to the psychological treatment of the elderly, highlighting the depth and relevance of the Sunnah as a holistic framework for mental well-being in later life. The analysis demonstrates that Prophetic guidance addresses key psychological challenges faced by the elderly—such as loneliness, emotional distress, loss of dignity, and fear of decline—through principles of compassion, mercy, respect, reassurance, and social inclusion. These elements reflect an integrated approach that nurtures emotional stability, spiritual resilience, and a sense of purpose, which are essential for psychological health in old age.

In conclusion, Prophetic traditions provide valuable insights for developing culturally and spiritually responsive models of psychological care for the elderly. By bridging Islamic primary sources with modern psychological understanding, this study contributes to both Islamic scholarship and psychological gerontology. Future research may further explore empirical



applications of Sunnah-based psychological interventions and their effectiveness within contemporary mental health and elderly care settings.

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GOVERNANCE CHALLENGES IN URBAN TOURISM DEVELOPMENT: TOURISTS' PERSPECTIVES FROM PENANG, MALAYSIA

***Mariah Darus @ Mat Junus¹, Muhammad Hafiz Abd Razak², Khofizhoah Mohd Karim³,
Nurfadilah Saadul Kurzi⁴, Aidanajwa Sabri⁵, Siti Nor Latifah Darus⁶***

¹Department of Planning and Property Management, School of Government, Universiti Utara Malaysia (UUM), Malaysia, (m.darus.mat@uum.edu.my)

²Department of Planning and Property Management, School of Government, Universiti Utara Malaysia (UUM), Malaysia,

³Department of Planning and Property Management, School of Government, Universiti Utara Malaysia (UUM), Malaysia,

⁴Department of Planning and Property Management, School of Government, Universiti Utara Malaysia (UUM), Malaysia,

⁵Department of Planning and Property Management, School of Government, Universiti Utara Malaysia (UUM), Malaysia,

⁶Penang Matriculation College, Penang, Malaysia

Abstract: *Urban tourism development in heritage cities involves multifaceted governance challenges, particularly in balancing economic growth with environmental sustainability and social inclusiveness. This study explores tourists' perceptions of governance-related issues influencing urban tourism development in Penang, Malaysia. Based on survey data collected from 233 domestic and international tourists, the research identifies major concerns such as traffic congestion, pollution, overcrowding in popular tourist areas, and limited accessibility for elderly and disabled visitors. The findings indicate that although Penang continues to be an appealing tourism destination, governance issues related to urban mobility, environmental management, and inclusive access still shape tourists' experiences. Respondents emphasized that improvements in governance—especially in transparency, accountability, inclusivity, and equity—could substantially enhance the overall tourism experience. By recognizing tourists as key stakeholders in assessing governance performance, this study contributes to the broader discourse on urban tourism governance and sustainability. The results provide practical policy insights for local authorities aiming to strengthen governance frameworks and promote sustainable and inclusive tourism development in heritage cities.*

Keywords: *Urban Tourism Governance, Governance Challenges, Tourist Perceptions, Sustainability, Penang, Malaysia*

Introduction

Urban tourism has occurred as a critical aspect of economic development for heritage cities worldwide. The urban development particularly in heritage cities where cultural assets, historical environment and tourism activities overlap (Ashworth & Page 2011; Hall & Page, 2014). Tourism also contributes to employment creation, urban regeneration and local economic diversity while to enhance the global visibility and competitive of destinations (Edward et.al, 2008). However, the rapid expansion of urban tourism also generate the complex of governance challenges which is that to increasing visitor and also the flows intensify the



pressure of the urban infrastructure, environment resources and public services. In the context of public sector, the effective governance mechanism is very important because without that, the tourism sector and growth may lead to the traffic congestion, environmental poverty, overloading in popular urban and heritage area, and the relegation of local communities (Bramwell & Lane, 2011; Koens et al., 2018). These externalities not only reduce the residents quality and capability but also damage then tourist's experience and the long-term sustainability of urban tourism destinations (Dodds & Butler, 2019). Therefore, the urban tourism development increases the need for a governance approach that moves beyond economic promotion and also addresses the sustainability, inclusivity, and equitable access to the urban spaces (Hall & Jenkins, 2004).

The importance of governance in urban contexts is further reinforced by the global urbanisation trends. According to Liu et.al (2023), more than 50% of the world's population now resides in cities. The growing importance of governance in urban contexts is further reinforced by global urbanisation trends. According to the United Nations Department of Economic and Social Affairs (2012), more than 50% of the world's population now resides in cities, urban areas as a central sites of economic activity, social transformation and the global connectivity. The cities functions as a connections of governance networks that manage the flows of people, resources and activities that making them critical arenas for addressing integrated sustainable challenges (Revi et.al, 2014). Besides that, the concentration and diversity of urban activities increase the complexity of governance that particularly in cities experiencing high intensity. Urban governance is increasingly understood as a combination of formal and informal arrangements that involving government, market and societal actors that contribute to shape urban development (Hendriks, 2014). Based on previous studies, the effective urban governance plays a decisive role in addressing contemporary global challenges and leading to growing recognition of cities and local leadership as a key drives of transformational change (Barber, 2013; Baud et.al, 2021). In tourism intensive heritage cities, governance capacity becomes especially critical as decision making directly affects mobility management, environmental quality, accessibility and visitor experiences.

According to Hall (2011) and Bramwell (2011), in the context of urban governance is more to focus on institutional structures, governance and policy frameworks but less attention has been given to how governance challenges are experienced by urban users, particularly tourists who interact with urban system during their visit. By understanding the tourists perception of governance challenges therefore it provides a valuable user centered approach that can offering the insights into how governance gaps can manifest in practice and identifying priority areas for improving sustainable urban tourism development. Penang is one of the Malaysia most significant urban tourism destinations and was listed as a UNESCO World Heritage Site in 2008 due to its outstanding universal value, multicultural heritage and well preserved historic urban fabric (UNESCO, 2008). The city heritage status combined with its cultural landscape and strategic location that has contributed to sustainable growth in domestic and international tourist arrivals. According to Hampton and Jeyacheya (2015), tourism plays an important role in Penang local economy by supporting employment, small businesses and urban revitalisation initiatives.

However, the concentration of tourism activity within Penang dense urban and heritage areas has intensified governance challenges related to urban mobility, environmental management



and the equitable use of public spaces. The popular tourist zones frequently experience traffic congestions, overcrowding and increase environmental pressure, particularly during peak travel periods (Khoo & Badarulzaman, 2014). These challenges are further combined by the city spatial constraints, ageing infrastructure and the need to balance the conservation requirements with contemporary urban needs. From a governance perspective, managing tourism development in Penang requires coordination across multiple policy domains, including transport planning, environmental regulation, heritage conservation and social inclusion. While institutional efforts have been undertaken to promote sustainable tourism, governance challenges persist in translating policy intentions into positive user experiences on the ground. Examining tourist perception of these challenges therefore provides valuable insights into how governance gaps are encountered in practice and highlights areas where governance interventions may be strengthened to support sustainable urban tourism development.

Literature Review

Definition of Urban Tourism Development

Before defining the definition of urban tourism development, of course the terms of these words need to be defined clearly. Conceptually, urban tourism development combines the characteristics of urban environment, tourism activities and development process. According to Revi et. al (2012), the term of urban is refers to areas characterised by a high concentration of population, economic activities, infrastructure and built environment, where social , political and economic interactions are increased. Urban areas functions as centres of governance, service provision and economic production and the same time are distinguished from rural areas by their density, diversity and complexity. Tourism is defined as the activities of people that travelling to and staying in places outside their usual environment for leisure, business or other activities for limited periods of time and not related to the permanent residence or employment in the visited destination consumption of services, experiences and spaces at the destination (United Nations World Tourism Organization (UNWTO, 2008). Development in this sense is refers to a multidimensional process of economic growth, social transformation and institutional range that change the aimed at improving of life, equity and sustainability. In the urban context, the development involves changes in infrastructure, services, governance capacity and socio-economic conditions that enhance the productivity and well being of (Todaro & Smith, 2015, Sen, 1999).

Therefore, urban tourism development refers to the growth of organization, management of tourism activities within cities, where tourism demand is closely connected with urban functions, infrastructure and governance systems. Unlike tourism in resort or rural areas, the urban tourism operates within complex environments where tourism activities that share space, services and resources with daily lives (Ashworth & Page, 2011). The urban tourism development not only involves the expansion of tourism attractions and service but also the planning and regulations of tourism that related to the activities in relation to land use, transportations system, public services and heritage conservation (Hall & Page, 2014). In the context of the governance perspective, the urban tourism development encompasses the processes through which cities pursue to balance tourism growth with the broader urban development objectives, including economic vitality, environment sustainability and social inclusion (Edwards et.al, 2008). To strengthen tourism in cities, the effective of urban tourism



development increasingly depends on the governance capacity to manage visitors flows, mitigate environmental impacts, ensure the accessibility and address competing demands for urban space (Bramwell, 2011 & UNWTO, 2018). The urban tourism development can be understood as a multidimensional process shaped by the interaction between tourism dynamics and urban governance mechanisms, with governance effectiveness playing a critical role in determining sustainable urban tourism outcomes.

Definition of Governance in the Context of Urban Tourism Development

The concept of governance is defined as the authority structure, institutional arrangement and processes through which collective goals are defined, pursued and realised among multiple stakeholders (Bevir, 2015). It extends beyond the formal government authority to include self-organising and inter-organisational networks characterised by interdependence, resource exchange, shared rules and the autonomy from the state (World Bank, 2012). In this sense, governance captures the context of exercised decisions, the decision-making process, responsibilities are allocated across public, private and community. While, in the context of development, based on Booth and Cammack (2013), governance is defined as the exercise of power in managing a country or city's economic and social resources in ways that promote sustainability, accountability and the long-term well-being. Therefore, governance includes structures, functions and processes that ensure transparency and accountability, effective coordination and responsibility in achieving the public or community goals or objective.

The concept is closely related with good governance, which emphasises efficiency, responsiveness, inclusivity and the delivery of quality public services as a basic community welfare. In the urban context, the governance assumes particular significance due to the complexity, density and diversity of actors and activities that focus within cities. Urban governance involves the coordination of multiple policy domains such as land use, transport and environmental management, heritage conservation and public service provision within a shared spatial context. The aggregations of population, economic activity and infrastructure in cities increase both development opportunities and governance challenges, requiring mechanisms that can manage competing interests and limited urban resources effectively (Rhodes, 1996; Kooiman, 2003). Urban tourism development further intensifies governance complexity. Tourism activities depend heavily on urban infrastructure, public spaces, transport systems, environmental quality and regulatory enforcement, all of which fall within the domain of public sector governance. In this context, governance determines how tourism growth is planned, regulated and integrated with broader urban development objectives. Governance failures may manifest as congestion, overcrowding, environmental or inadequate accessibility, directly affecting both residents' quality of life and tourist experiences.

Besides that, from the public perspective, governance refers to the institutional arrangements, processes and interactions through which public authority is exercised and public resources are managed to achieve collective goals (Pierre & Peters, 2000). Rather than operating solely through hierarchical control, contemporary governance emphasises coordination among stable institutions and engagement with non-state actors through networks and partnerships (Rhodes, 1996). This approach recognises that complex urban tourism challenges such as those related with tourism development cannot be effectively addressed by government alone. Accordingly,



the governance in urban tourism development can be understood as the system of rules, relationships and practices through which public authorities, private sector actors, communities and tourists collectively influence how tourism impacts are managed in cities. The effective governance in this context requires managing through a combination of regulation, collaboration and responsiveness to stakeholder experiences (Kooiman, 2003). Ultimately, urban tourism governance reflects the capacity of public institutions to balance economic objectives with sustainability, inclusivity, and legitimacy, ensuring that tourism development contributes positively to urban well-being rather than undermining it.

Governance Challenges in Urban Tourism Development

Urban tourism development strengthens governance challenges by increasing the demand for urban transport system, public spaces, environmental services and regulatory enforcement. A substantial body of literature identifies traffic congestion, environmental pollution, overcrowding in tourist area, and inadequate accessibility as persistent challenges in tourism intensive cities and particularly those with heritage status (Koen et.al, 2018; Seraphin et.al, 2021; Gossling et.al, 2021). These challenges reflect the growing pressure placed on urban systems as cities seek to accommodate tourism growth while maintaining functionality. Empirical studies demonstrate that tourism are related with mobility that contributes to congestion in urban areas especially peak hour traffic and placing strain on public transport systems (Hall & Page, 2014, Le-Klahn & Hall, 2023). According to Dodds and Butler (2019); and Gossling et.al (2021), the environmental pressures including increased waste generation, air pollution and noise pollution, further reflect governance limitation in managing tourism externalities and enforcing environmental standards. In addition, the concentration of visitors in areas with popular attractions often caused congestion, accelerates the physical deterioration of heritage assets and reduces residents well being and tourist satisfaction (Koens et.al, 2018 & Seraphin et.al, 2021).

Beyond physical capacity constraints, these challenges are show deeper governance issues that related to policy coordination, regulatory enforcement, and inclusive urban design. The tourism pressures expose gaps in cross-sectoral governance, particularly where transport planning, environmental management, heritage conservation and accessibility policies are weakly integrated (Bramwell, 2011; Hall, 2011). As a result, urban tourism development increasingly demands governance approaches that prioritise coordination, sustainability and equity to ensure that tourism growth does not undermine urban destination competitiveness. Besides that, the traffic congestion is frequently cited as a critical governance issue, as a tourism related mobility adds to existing urban demand especially in historic city centres here road capacity and spatial flexibility are limited (Hall & Page, 2014). To increase the tourist movement contributes to congestion during peak periods, placing strain on public transport systems and reduce the overall mobility efficiency. According to Dodd and Butler (2019), the environmental challenges including waste generation, air pollution and noise pollution, further illustrate the governance limitations in managing tourism externalities and enforcing environmental standards in closely used urban environments.

In the context of overcrowding is defined as feature of overtourism and highlights governance difficulties in managing visitor concentration and regulating the access to popular urban and heritage sites (Koens et. al, 2018). In heritage cities, overcrowding accelerates physical



degradation of historic environments, disrupts residents daily lives and diminishes tourist experiences. Accessibility challenges particularly for elderly and disabled visitors, further reveal governance shortcomings in inclusive urban design and equitable service provision (UNWTO, 2019). These issues highlight the importance of governance capacity to ensure that urban tourism development remains socially inclusive and environmentally sustainable. Based on previous study, the central concern in urban tourism research is that tourism pressures are not external to urban life. Tourism relies in the same roads, public spaces, waste systems and public services used by residents, creating competition over the limited urban resources (Bramwell & Lane, 2011). As visitor density increases the governance challenges often show as congestion, service strain, environmental degradation and conflicts over the use and meaning of heritage spaces. These pressure are particularly defined in heritage zones, where conservation requirements restricts physical redevelopment while tourism demand continues to expand.

In the context of governance challenges extend beyond the technical capacity limitations such as insufficient infrastructure that to include the coordination and implementation problem that across the multiple policy domains and stakeholders. The effective of urban tourism governance requires alignment among agencies responsible for transport, environmental management, monitoring, heritage conservation, licensing and urban design (Hall, 2011). Thus, the urban tourism governance become a “whole of city” issue, where the sustainability and quality of tourism development depend on the ability of governance systems to integrate policies, coordinate actors and respond the effectively to tourism related pressures (Bramwel, 2011; Hall, 2011).

The Urbanisation Imperative and Complexity of Governing Cities

The governance challenges of urban tourism must be against broader global urbanisation trends. The United Nations (2012), reporting on world urbanisation highlights that more than half of the world population lives in urban areas, reinforcing cities as a central sited of economic activity, social transformation and policy problem solving. The cities are focus on people, infrastructure, service and economic functions but this focus are also increase system interdependence and governance complexity. The cities are also the key fields where major global challenges converge the climate and environmental pressures, inequality and rapid urban development that requiring integrated governance responses. In the sustainable literature, cities are often frame as key “nodes” where governance networks and resource flows must be coordinated to address multi-dimensional risks and development trade-off (Ravi et. al, 2014). Within tourism intensive cities, these challenges are increase because tourism introduce additional, often seasonal and demand spikes that stress already complex urban systems. Therefore, this is mean that the tourism governance challenges such as congestion and environmental pressure are not simply tourism problem but expression of broader urban system limits and coordination gaps. The literature increasingly encourages examining how tourism pressure revel governance weaknesses in urban planning, mobility management, enforcement capacity, and inclusive service delivery (Hall, 2011; Bramwell & Lane, 2011).

Governance Theory for Urban Tourism

This study are focus on for tourism governance from Hall (2011), tourism governance typology. This is because tourism governance typology which distinguishes governance modes and highlights that policy outcomes are depend in institutional arrangements, actor roles and implementation gaps. The governance are not limited to government action rather it encompasses the configuration of hierarchies, market, networks and communities that shape how policy is made and delivered in tourism context. For heritage city tourism, this perspective is valuable because the governance challenges such as congestion and overcrowding typically involve multiple agencies and require network coordination beyond a single authority. According to Bramwell (2011), tourism governance through political economy, stressing that tourism development outcomes are shaped by state roles, power relations, and competing interest. In heritage cities, this matters because decision about mobility, regulation and space allocation often involve trade-offs between economic growth (tourism revenues, business interests) and sustainability objectives (environmental quality, heritage protection and social equity). Bramwell and lane (2011), was argue that sustainability governance requires critical attention to how governance systems manage these trade offs and distribute the costs and benefits across stakeholders. Therefore, for this study, to analysing the governance challnegs through experience based indicator tourist perceptions because the governance effectiveness is ultimately observed in outcomes that is mobility conditions, environmental quality, accessibility and crowd management.

Overtourism, Carrying Pressure, and City-Lived Impacts

The recent rise of “overtourism” research helps conceptualise governance challenges such as overcrowding and congestion as city-level problems rather than destination marketing issues. Koens, Postma, and Papp (2018) argue that overtourism is multidimensional and shaped by broader city dynamics, not only tourism demand. The heritage-city tourism because crowding often interacts with land-use constraints, housing pressures, mobility systems, and resident-tourist conflicts. According to Dodds and Butler (2019) similarly treat overtourism as a governance challenge requiring management solutions, policy coordination, and stakeholder engagement. From this perspective, issues such as congestion, pollution, and crowding represent governance outcomes: the extent to which institutions can manage visitor flows, regulate impacts, and maintain quality of urban experience.

Accessibility, Universal Inclusion, and Tourism for All

Accessibility is increasingly treated as a core requirement of sustainable and ethical tourism governance. The UNWTO has issued recommendations and manuals emphasising “Accessible Tourism for All” and accessible information as part of inclusive destination development. These documents underline that accessibility is not only a social responsibility issue but also a quality and competitiveness issue destinations that fail to support diverse users may lose market segments and damage destination reputation. Accessibility is also grounded in broader evidence that disability is a significant global reality; World Health Organization notes in its World Report on Disability that disability prevalence is substantial globally and rising due to ageing and chronic disease trends, implying that accessibility and inclusive environments are increasingly important for public services and tourism experiences. For heritage cities, accessibility is challenging because historic built forms, narrow streets, and conservation regulations can limit physical modifications. This makes governance capacity critical:



inclusive urban tourism often depends on coordinated planning, targeted infrastructure investments, and consistent standards in public space design and transport access. Therefore, measuring tourists' perceptions of accessibility for elderly and disabled visitors is theoretically justified as a governance performance indicator.

Tourists as Evaluators of Governance Performance and Experience-Based Indicators

Tourists are temporary but intensive users of urban systems. Their judgments reflect real-time encounters with mobility constraints, environmental quality, and the functionality of public spaces. Governance research increasingly recognises that policy effectiveness should be assessed not only through institutional outputs (plans, regulations) but also through user experiences and perceived outcomes (Hall, 2011). In tourism governance, the tourist perspective is especially valuable because it links governance performance to destination competitiveness: congestion, crowding, pollution, and poor accessibility reduce satisfaction and can harm destination image and revisit intention. Moreover, tourists can detect governance gaps that may not be visible in official reporting for example, whether overcrowding appears “managed” or whether accessibility feels practically adequate. This study adopts this user-centred approach by using tourists' perceptions as an evaluative lens on governance challenges. Specifically, measuring perceived congestion, pollution, overcrowding management, accessibility, and perceived need for improvements in transparency, accountability, inclusivity, and equity provides experience-based evidence of governance pressure points that matter to urban tourism sustainability.

Methodology

This study are using quantitative and cross sectional survey design to examine tourists perceptions of governance challenges that affecting urban tourism development in Penang, Malaysia. This survey based approach was selected to capture a broad range of visitor experiences and to assess the governance related issues from the perspectives of urban users. The data was collect from tourists visiting Penang during the study period and the total of valid responses is from both domestic and international tourist. This is important to make sure that the data collected are cover both perceptions. The respondents is mixed or diverse in terms of ages, gender, country of residence, purpose of visit, duration of stay and providing a diverse representation of tourist experiences. The participation in the survey was voluntary and the respondents also were informed that the purpose of the study, also no personal identifying information was collected. Therefore, all the responses were treated as anonymous and confidential in accordance with the ethical requirements.

The survey instrument in this study is consist on demographic information and governance challenges. The governance challenges were measured using a five-point Likert scale that ranged from 1= Strongly Disagree to 5 = Strongly Agree. These item were adopted and adapted based on previous studies by Koens et.al (2018), Zhang (2024) and Richins (2011). The demographic variables were used to be provide the contextual background. The items measured tourists perceptions is based on Table 1.

Table 1 : The Items Of Measured Tourists Perceptions

No.	Dimension / Construct	Measurement Item (Tourists' Perceptions)
1.	Traffic Congestion	Traffic congestion was a significant issue during my visit.
2.	Environmental Pollution	Environmental pollution (e.g., waste, air, and noise) was a significant issue during my visit.
3.	Accessibility	Accessibility for elderly and disabled tourists was adequate.
4.	Overcrowding Management	Overcrowding in tourist areas was well managed.
5.	Governance Improvement	Improvements in governance (transparency, accountability, inclusivity, and equity) would enhance tourism experiences.

The data analysis on this study are using descriptive analysis that was employed to examine overall trends and patterns in tourist perceptions of governance challenges. This analysis is aimed to identify the challenges affecting urban tourism development in Penang from the tourist perspective. The scope and delimitation of this study is, although the survey forms part of a broader study on urban tourism governance on Penang and this paper is deliberately delimited to governance challenges. The analyses of governance principles and urban development outcomes are reported separately to ensure analytical clarity and avoid overlap.

Findings

Table 2: Descriptives Analysis for Demographic

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age Group	18-24 years	223	95.7
	25-34 years	3	1.3
	35-44 years	3	1.3
	45 years	1	0.4
	55 years and above	2	0.9
	Below 18	1	0.4
Gender	Female	173	74.2
	Male	60	25.8
Race/Ethnicity	Malay	179	78.6
	Chinese	36	15.5
	Indian	8	3.4
	Other	10	2.5
Religion	Islam	184	79
	Buddhism	37	15.9
	Hinduism	8	3.4
	Others	4	1.7
Purpose of Visit	Leisure	94	40.3
	Cultural Tourism	67	28.8

	Education	65	27.9
	Business	7	3.0
Duration of Stay	Less than 3 days	142	60.9
	3 - 7 days	60	25.8
	More than 7 days	31	13.3

The total number of respondents is 223 in this survey hat providing in sights into torist perception of governance challenges in urban tourism development. As shown in Table 1, the age distribution of respondents was highly towards younger age groups. The majority of respondents were aged between 18 and 24 years, accounting 223 individuals (95.7%). This indicates that the survey sample was predominantly among young adults. Others age groups were represented in much smaller proportions. The respondents age 25 until 34 years and 25 to 44 years each accounted for three respondents (1.3%), while only one respondent (0.4%) was aged 45 years. Respondents aged 55 years and above constituted two individuals (0.9%) and one respondent (0.4%) was below 18 years of age. The overall, the findings suggest that the dataset primarily reflects the perspectives of younger tourist. This demographic

Gender representation showed 173 female respondents (74.2%) compared to 60 males (25.8%). This indicates a greater female participation rate in the survey, which may influence perspectives on governance issues, particularly regarding inclusivity and accessibility in urban spaces. Ethnic composition largely mirrored Malaysia's population demographics, with 179 Malay respondents forming the majority (78.6%), followed by 36 Chinese (15.5%), 8 Indians (3.4%), and 10 for other ethnic groups (2.5%). Similarly, the religious distribution reflected the nation's composition, with Islam being the predominant religion 184 (79.0%), followed by 37 Buddhism (15.9%), 8 Hinduism (3.4%), and 4 for others (1.7%). The purpose of the visit indicated that 94 respondent is leisure (40.3%) and 67 cultural tourism (28.8 %) were the primary motivations, followed by 65 respondent for education (27.9%) and 7 is business (3.0%). Tourism-related experiences may shape perceptions of urban governance. Lastly, the findings regarding the duration of stay showed that 142 (60.9%) of respondents stayed for less than three days, 60 respondents (25.8%) stayed for 3-7 days, and 31 (13.3%) stayed for more than seven days. These trends indicate that most were short-term visitors whose views on governance might be influenced by temporary interactions with urban infrastructure and services. The diversity in respondent demographics provides a comprehensive basis for analyzing governance challenges and urban tourism development outcomes, particularly among youth and short-term visitors.

Table 3: Perception of Traffic Congestion as a Governance Challenge

Category	Frequency (n)	Percentage (%)
Strongly Disagree	4	1.7
Disagree	6	2.6
Neutral	45	19.3
Agree	108	46.4
Strongly Agree	70	30.0
Total	233	100.0

Souces: Fieldwork (2026)

Based on table 3, the results show that the traffic congestion was usually perceived as a major governance challenge in urban tourism development. Majority the respondents are agree with this statement with the 108 respondents (46.4%) and 70 respondents (30.0%) strongly agreed that traffic congestion was a significant issue during their visit. In contrast, only a small proportion of respondents expressed disagreement which is 6 respondent (2.6%) disagreed and 4 respondents (1.7%) strongly disagreed with the statement. Meanwhile, 45 respondents (19.3%) select the neutral option that suggest that nearly one fifth of tourist experiences congestion inconsistently or were uncertain about its seriousness. The overall of this findings demonstrates that the traffic congestion is a leading and widely recognised governance challenges affecting tourist urban experiences and reflecting the pressure placed on transport systems in tourism intensive urban area.

Table 4: Perceptions of Environmental Pollution as a Governance Challenge

Category	Frequency (n)	Percentage (%)
Strongly Disagree	4	1.7
Disagree	8	3.4
Neutral	66	26.3
Agree	109	46.8
Strongly Agree	46	19.7
Total	233	100.0

Souces: Fieldwork (2026)

Based on Table 4, the findings indicate that the environmental pollution was perceived as a important governance challenge by a majority of respondents. 109 respondents (46.8%) agreed and 46 respondents (19.7%) strongly agreed that pollution constituted a significant issue during their visit. This is show that the respondents expressed agree, suggesting that concerns related to waste management, air quality and noise pollution were widely experience among tourists. In contrast, a small number of respondents reported disagree with 8 respondents (3.4%) and 4 respondents (1.7%) are strongly disagree. Meanwhile, 66 respondents (26.3%) selected neutral option that indicating that over one-quarter for tourist perceived pollution issues inconsistently; or did not experience them strongly during their visit. The overall these findings suggest that environmental pollution represents a relevant governance challenge in the urban tourism context, through perception appear to be more varied compared to traffic congestion this variation may reflect differences in exposure across locations, timing of visits or individual sensitivity to environmental situation.

Table 5: Perceptions of Accessibility for Elderly and Disabled Tourists

Category	Frequency (n)	Percentage (%)
Strongly Disagree	2	0.9
Disagree	5	2.1
Neutral	71	30.5
Agree	124	53.2
Strongly Agree	31	13.3
Total	233	100.0

Souces: Fieldwork (2026)

Based on table 5, the results provide insights into tourists' perceptions of inclusivity and accessibility within the urban tourism environment. The majority of respondents expressed positive perceptions regarding accessibility. A total of 124 respondents (53.2%) agreed and 31 respondents (13.3%) strongly agreed that accessibility for elderly and disabled tourists was adequate. This shows that the respondents indicated agree and suggest that existing accessibility provisions were generally viewed as sufficient by most tourists. However, a notable proportion of respondents selected the neutral option with 71 respondents (30.5%) neither agreeing nor disagreeing with the statement. This relatively high level of neutrality may indicate uneven accessibility experiences across different locations or limited direct interaction with accessibility facilities during the visit. Only 5 respondents (2.1%) disagree and 2 respondents (0.9%) are strongly disagree. The whole findings suggest that accessibility is perceived more positively than other governance challenges although the substantial neutral highlights potential inconsistencies in inclusive urban design and service provision across the city.

Table 6: Perceptions of Overcrowding Management as a Governance Challenge

Category	Frequency (n)	Percentage (%)
Strongly Disagree	2	0.9
Disagree	5	2.1
Neutral	71	30.5
Agree	110	47.2
Strongly Agree	31	13.3
Total	233	100.0

Sources: Fieldwork (2026)

Based on Table 6, this item captures tourists' perceptions of governance effectiveness in managing visitor concentration within popular urban and heritage areas. The findings indicate generally positive perceptions regarding overcrowding management. A total of 110 respondents (47.2%) agreed and 31 respondents (13.3%) strongly agreed that overcrowding in tourist areas was well-managed. The respondents express agree, suggest that a majority perceived existing governance measures as effective in addressing crowd-related issues. Nevertheless, a substantial proportion of respondents selected the neutral option, with 71 respondents (30.5%) neither agreeing nor disagreeing. This high level of neutrality may reflect variability in crowd management across different locations or times, or differences in individual tolerance towards crowding. Only a small proportion of respondents expressed negative perceptions, with five respondents (2.1%) disagreeing and two respondents (0.9%) strongly disagreeing. Overall, while perceptions of overcrowding management were more favourable than perceptions of congestion and pollution, the relatively high neutral response indicates that crowd management effectiveness may be uneven and context-dependent across tourist areas.

Discussion

This study examined tourist perceptions of governance challenges in urban tourism development in Penang with a particular focus on traffic congestion, environmental pollution, overcrowding management and accessibility for elderly and disabled visitors. The findings reveal an uneven pattern of governance performance, where certain dimensions of urban



tourism governance are perceived more positively than others. The overall of the findings reinforce the argument that governance challenges in tourism intensive heritage cities are closely intertwined with the broader urban management and policy coordination issue. The first of governance challenges is traffic congestion that emerged as the most critical governance with more than three quarters of respondents perceiving congestion as a significant issue during their visit. This finding is consistent with existing urban tourism literature, which identifies transport congestion as one of the most visible and immediate impacts of tourism growth in historic city centres (Hall & Page, 2014; Koenset.al, 2018). In heritage cities such as Penang, limited road capacity, narrow streets and conservation restrictions constrain infrastructural expansion, making congestion particularly difficult to manage. In the context of governance perspectives, the congestion reflects not only physical infrastructure limitation but also coordination challenges across transport training, tourism management and land use regulation. The prominence of congestion in tourists' perceptions suggests that transport governance remains a key pressure point in Penang's urban tourism system. According to Bramwell (2011) and Le-Klahn & Hall (2023), the ineffective integration between tourism planning and urban mobility strategies can undermine visitor experiences and overall destination competitiveness.

The second governance challenges is environmental pollution was identified as the second most salient governance challenge, with a substantial majority of respondents perceiving waste, air, and noise pollution as significant issues. This finding aligns with prior studies highlighting environmental stress as a common consequence of tourism intensification in urban destinations (Dodds & Butler, 2019; Gossling et al., 2021). Pollution-related concerns often indicate governance gaps in waste management, environmental monitoring, and regulatory enforcement, particularly in areas experiencing high visitor density. The relatively high proportion of neutral responses suggests that environmental conditions may vary across locations and time periods, reflecting uneven governance performance within the city. This variation reinforces the view that urban tourism governance outcomes are spatially differentiated and dependent on local implementation capacity. From a sustainability perspective, persistent pollution concerns signal risks to both environmental quality and the long-term attractiveness of the destination, underscoring the need for stronger integration between tourism development and environmental governance frameworks.

Besides that, compared to congestion and pollution, the management of overcrowding in tourist areas received more moderate evaluations. While a majority of respondents agreed that overcrowding was well-managed, the relatively high level of neutrality suggests that crowd management effectiveness is context-dependent. This finding reflects broader debates on overtourism, where governance interventions may succeed in some locations or time periods but remain inconsistent across the city (Koens et al., 2018; Seraphin et al., 2021). In heritage cities context, overcrowding poses unique governance challenges because visitor concentration often coincides with fragile cultural assets and residential neighbourhoods. The findings suggest that while existing measures may partially mitigate crowding impacts, governance responses remain uneven. This supports the argument that effective overcrowding management requires not only site-specific interventions but also city-wide coordination, visitor dispersal strategies, and real-time governance mechanisms (Bramwell & Lane, 2011).

The next is accessibility for elderly and disabled tourists was perceived more positively than other governance dimensions, indicating some success in inclusive urban design and service



provision. However, the substantial neutral response suggests that accessibility remains inconsistent across urban spaces. This finding aligns with previous studies emphasising that inclusivity in urban tourism governance is often uneven, with improvements concentrated in selected areas rather than embedded across the entire urban system (UNWTO, 2019). From a governance standpoint, accessibility serves as a key indicator of inclusive and equitable urban development. The mixed perceptions observed in this study highlight the need for governance approaches that mainstream universal design principles across transport systems, public spaces, and heritage sites, rather than treating accessibility as a peripheral concern.

Taken together, the findings demonstrate the value of tourists' perceptions as experience-based indicators of governance performance in urban tourism development. As temporary but intensive users of urban systems, tourists encounter governance outcomes directly through transport efficiency, environmental conditions, crowd management, and accessibility. The dominance of congestion and pollution concerns suggests that governance challenges are most visible where tourism pressures intersect with everyday urban systems. This study contributes to the urban tourism governance literature by reinforcing the argument that governance effectiveness should not be evaluated solely through institutional or policy frameworks but also through stakeholder experiences. Incorporating tourists' perspectives provides a complementary lens for identifying governance gaps that may not be evident through formal assessments alone. In heritage cities such as Penang, where tourism and urban life are deeply intertwined, such perception-based evaluations are particularly valuable for informing more responsive, integrated, and sustainable governance strategies.

Conclusion

This study examined tourists' perceptions of governance challenges in urban tourism development in Penang, focusing on traffic congestion, environmental pollution, overcrowding management, and accessibility for elderly and disabled visitors. The findings reveal an uneven pattern of governance performance, with traffic congestion emerging as the most critical challenge, followed by environmental pollution, while overcrowding management and accessibility were perceived more positively but inconsistently. By foregrounding tourists as evaluators of governance outcomes, the study contributes to the urban tourism governance literature by demonstrating how governance challenges are experienced in practice through everyday interactions with urban systems. The results reinforce the argument that effective urban tourism development depends not only on tourism promotion but also on governance capacity to coordinate transport, environmental management, inclusivity, and regulatory enforcement within complex urban environments. For future research, several avenues merit attention. Comparative studies across multiple heritage cities could provide deeper insights into how governance challenges vary across institutional and spatial contexts. Longitudinal research could also examine how governance perceptions evolve over time, particularly in response to policy interventions or major urban infrastructure investments. In addition, future studies may benefit from integrating qualitative methods, such as interviews or focus groups, to complement perception-based surveys and capture more nuanced stakeholder perspectives.

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THE ROLE OF PARASOCIAL INTERACTION IN INFLUENCER MARKETING AND CONSUMER PURCHASE INTENTIONS WITHIN THE TPB FRAMEWORK

Annie Yong Ing Ing, Zahir Osman, Irene Yong Ley Mui

Open University Malaysia (inging1986@oum.edu.my)

Open University Malaysia (zahir_osman@oum.edu.my)

Open University Malaysia (irene5565@oum.edu.my)

Abstract: *This study examines the role of parasocial interaction (PSI) as a mediator between media figure characteristics and consumers' behavioral intentions within the framework of the Theory of Planned Behavior (TPB). With the growing influence of social media personalities and brand ambassadors, the research investigates how variables such as media figure credibility, attractiveness, interaction frequency, and emotional connection foster strong parasocial bonds with consumers. These bonds are hypothesized to influence key TPB components—attitudes toward purchasing or endorsing a product, subjective norms related to brand perception, and perceived behavioral control—ultimately affecting consumers' purchase intentions and behaviors. The proposed model emphasizes the mediating role of PSI in translating media-driven relationships into consumer decision-making processes. This integration aims to enhance understanding of how influencer marketing and parasocial bonds can effectively shape consumer behavior and brand loyalty. The findings provide valuable insights for business managers and marketers, suggesting that cultivating meaningful parasocial connections with influencers can strengthen brand engagement and drive purchasing actions. Overall, this study contributes to the theoretical development of media psychology and behavioral prediction models by highlighting parasocial interaction as a key mechanism in consumer behavior within the TPB framework.*

Keywords: *Parasocial interaction, media figure credibility, attractiveness, interaction frequency, emotional connection, behavioral intentions*

Introduction

The rapid growth of digital media has fundamentally transformed the landscape of marketing, shifting from traditional, one-way communication to more interactive and personalized engagement. Social media platforms such as Instagram, TikTok, YouTube, and Facebook have democratized content creation, allowing ordinary individuals to emerge as influential figures with substantial followings. This evolution has given rise to influencer marketing, a strategic approach that leverages social media personalities—referred to as influencers or media figures—to shape consumer perceptions, attitudes, and purchasing behaviors (Kumar et al., 2022). Unlike conventional advertising, influencer marketing capitalizes on the perceived authenticity, credibility, and relatability of influencers, which can elicit stronger emotional engagement from followers. The success of these campaigns depends heavily on the nature of the influencer-follower relationship, particularly the development of parasocial bonds—one-sided emotional connections that followers form with influencers, which often mimic genuine social relationships (Lee et al., 2023).



Parasocial relationships, originally conceptualized by Horton and Wohl (1956), describe the phenomenon whereby audiences develop feelings of intimacy, familiarity, and trust toward media figures, despite the lack of reciprocal interaction. With the advent of social media, this phenomenon has intensified, as influencers now engage directly with their followers through comments, live sessions, and personalized content, fostering a sense of closeness and emotional attachment. Such bonds are increasingly regarded as critical determinants of consumer trust, loyalty, and behavioral intentions within influencer marketing. Recognizing these dynamics, contemporary research emphasizes understanding how parasocial interaction (PSI) mediates the relationship between media figure characteristics and consumer behavior, particularly within the framework of the Theory of Planned Behavior (TPB). This integration seeks to elucidate the psychological mechanisms that underlie the influence of influencer marketing on purchase intentions, providing a nuanced perspective that extends beyond traditional models of consumer decision-making.

The importance of this research is magnified by the proliferation of social media influencers and their growing role in shaping consumer behavior across diverse markets. As brands seek more authentic and relatable avenues for engagement, understanding the development and impact of parasocial bonds becomes essential. These bonds not only influence attitudes toward products and brands but also affect subjective norms and perceived behavioral control—core components of the TPB—thus playing a pivotal role in driving consumers' purchase intentions and behaviors (Chen & Wang, 2022). This study aims to explore how factors such as media figure credibility, attractiveness, interaction frequency, and emotional connection foster parasocial bonds, and how these bonds translate into behavioral intentions within the TPB framework.

Evolution of Influencer Marketing and the Social Media Ecosystem

The evolution of influencer marketing aligns with broader technological trends that have democratized information dissemination and shifted power from traditional mass media to social media platforms. Social media has enabled ordinary users to amass large followings based on authenticity, niche expertise, or relatable content, thereby challenging traditional celebrity influence rooted in mass communication channels (Smith & Johnson, 2021). Influencers now serve as intermediaries between brands and consumers, offering more personalized, engaging, and credible endorsements. According to recent reports, the impact of influencer marketing is substantial; businesses report significantly higher engagement rates and return on investment (ROI) compared to traditional advertising formats (Li et al., 2023). This shift is driven by the perception that influencers are more authentic and trustworthy, especially when they share personal stories and interact directly with followers.

The literature suggests that the effectiveness of influencer marketing hinges on several key attributes, including perceived credibility, attractiveness, and the strength of interpersonal bonds established with followers (Khan et al., 2022). The social media environment facilitates ongoing interaction, enabling influencers to respond to comments, participate in live chats, and share behind-the-scenes content. These features foster a sense of community and emotional closeness, which are instrumental in developing parasocial bonds. As followers increasingly see influencers as relatable and trustworthy, the influence of these figures extends beyond mere exposure, affecting attitudes, perceived social norms, and behavioral intentions (Zhao et al.,



2024). Notably, recent research indicates that consumers are more likely to trust and act upon recommendations from influencers with whom they share a strong parasocial bond, making these relationships a strategic asset for brands seeking to deepen consumer engagement (Martinez & Garcia, 2025).

Furthermore, the rise of micro- and nano-influencers—who often have more engaged and niche audiences—has further emphasized the importance of authentic relationships (De Vries et al., 2022). These influencers tend to foster closer connections through regular interaction and shared values, strengthening parasocial bonds that can significantly influence consumer attitudes and purchase decisions. As a result, contemporary influencer marketing strategies increasingly focus on fostering genuine relationships rather than simply maximizing reach, aligning with broader trends toward authenticity and emotional engagement in branding.

Conceptualizing Parasocial Relationships and Interactions

Parasocial relationships are characterized by a sense of intimacy and emotional attachment that viewers develop with media figures, despite the lack of reciprocity. Horton and Wohl (1956) initially described these bonds as a form of pseudo-relationship, where audiences project personal qualities onto media personalities, creating a sense of familiarity and trust. In the context of traditional mass media, these relationships were often limited to television or radio personalities. However, social media platforms have transformed this dynamic by enabling direct communication, real-time feedback, and personalized content, thereby intensifying parasocial bonds (Chen et al., 2022).

Recent studies emphasize that factors such as perceived attractiveness, credibility, and interaction frequency significantly influence the development and strength of parasocial bonds (Shah & Ahmed, 2023). For instance, an influencer's perceived credibility—defined as the extent to which followers trust the influencer's expertise and honesty—can enhance emotional attachment and foster a sense of trust and authenticity. Similarly, attractiveness and likability evoke positive affect, which further consolidates parasocial bonds. Emotional connection, a critical dimension of PSI, refers to feelings of warmth, empathy, and identification with the influencer, which can influence followers' attitudes toward products and their likelihood of engaging in purchase behaviors.

The emotional depth and perceived intimacy inherent in parasocial bonds have been linked to increased persuasion, loyalty, and behavioral compliance (Liu et al., 2024). When followers feel emotionally connected to an influencer, they are more receptive to recommendations, perceive endorsements as more authentic, and are more likely to engage in purchasing actions. This phenomenon underscores the importance of understanding the antecedents and effects of PSI within influencer marketing, not only from a psychological perspective but also for strategic brand management.

Theoretical Foundations and Frameworks

The study of consumer behavior in social media settings is often grounded in well-established psychological theories. The Theory of Planned Behavior (TPB), formulated by Ajzen (1991), remains one of the most influential models for predicting and understanding intentional



behavior. According to TPB, an individual's behavioral intention is primarily shaped by three factors: attitudes toward the behavior, subjective norms, and perceived behavioral control. Attitudes refer to the positive or negative evaluations of performing the behavior, subjective norms involve perceived social pressures, and perceived behavioral control pertains to the perceived ease or difficulty of performing the behavior.

Although the TPB provides a robust framework for understanding behavioral intentions, it has been critiqued for insufficiently accounting for emotional and relational factors that influence decision-making (Hagger & Chatzisarantis, 2022). This gap presents an opportunity for integrating parasocial interaction into the TPB framework, especially in the context of influencer marketing, where emotional bonds and perceived intimacy play a crucial role.

Media psychology contributes to this integration by emphasizing the affective and relational dimensions of media consumption. Parasocial interaction, with its focus on emotional bonds and perceived closeness, offers a mechanism through which media figure attributes influence consumer attitudes and behaviors (Rubin et al., 2023). When followers develop strong parasocial bonds, these relationships can influence attitudes toward products endorsed by influencers, modify subjective norms by shaping perceptions of social approval, and enhance perceived behavioral control through increased trust and confidence. Such integration extends the predictive power of the TPB, making it highly relevant for understanding consumer responses to influencer marketing campaigns.

Significance of the Study

The proliferation of social media influencers and their embeddedness in everyday consumer lives underscores the importance of understanding the psychological mechanisms underpinning their influence. Recognizing parasocial interaction as a mediating factor provides valuable insights into how influencer attributes translate into consumer attitudes and purchase intentions. For marketers and brand managers, cultivating authentic parasocial bonds represents a strategic avenue to foster loyalty, trust, and positive behavioral outcomes.

From an academic perspective, this study contributes to the ongoing development of the media psychology literature by explicitly integrating PSI within the TPB framework. It advances theoretical understanding by elucidating how emotional and relational bonds influence the core components of behavioral intention. Moreover, it offers practical guidance for designing influencer marketing strategies that prioritize relationship-building, emotional authenticity, and ongoing engagement.

Furthermore, given the cultural and regional diversity of social media users, this research also addresses contextual gaps, particularly in non-Western markets such as Malaysia, where social media consumption and influencer influence are rapidly growing. By focusing on such settings, the study broadens the applicability of existing theories and provides localized insights that are critical for global marketing success.



Research Gaps

Despite the burgeoning interest in influencer marketing and parasocial relationships, several gaps remain in the literature. Most existing studies tend to examine PSI in isolation or focus solely on influencer attributes without considering how these relationships translate into behavioral intentions through established psychological models. There is also a limited understanding of the mediating role of PSI within the TPB framework, particularly in Asian contexts where cultural factors may influence relationship dynamics.

Additionally, current research often emphasizes superficial engagement metrics such as likes and comments, neglecting the emotional and psychological depth of parasocial bonds that drive actual purchase behaviors. The literature also lacks comprehensive models that incorporate emotional connection and interaction frequency as antecedents of PSI, which are critical in understanding consumer decision-making in social media environments.

This study aims to address these gaps by developing an integrated model that explores how media figure characteristics foster parasocial bonds, which in turn influence TPB components and ultimately, purchase intentions. By doing so, it seeks to provide a more nuanced understanding of the psychological pathways through which influencer marketing exerts its influence, especially within the cultural context of Malaysia.

Objectives and Contributions

The primary objective of this research is to investigate the mediating role of parasocial interaction between media figure characteristics—such as credibility, attractiveness, interaction frequency, and emotional connection—and consumer behavioral intentions within the TPB framework. Specifically, the study aims to examine the direct effects of these influencer attributes on PSI, and how PSI subsequently influences attitudes, subjective norms, and perceived behavioral control, leading to purchase intentions.

This research makes several significant contributions. It extends the theoretical understanding of the TPB by incorporating emotional and relational dimensions, highlighting the importance of parasocial bonds in shaping consumer behavior in digital contexts. Practically, the findings offer insights for marketers seeking to develop more authentic and emotionally engaging influencer campaigns. By emphasizing relationship-building and emotional authenticity, brands can foster stronger parasocial bonds, increasing the likelihood of positive purchase behaviors.

Finally, this study contributes to the growing body of knowledge on media psychology and social influence in non-Western settings, providing contextual insights relevant to emerging markets such as Malaysia. Overall, it strives to bridge the gap between psychological theory, marketing practice, and cultural nuances, offering a comprehensive perspective on the influence of parasocial interaction within influencer marketing.



Literature Review

Underpinning Theory: Theory of Planned Behavior (TPB)

This study is grounded in the well-established psychological framework that predicts deliberate behavior based on three core components: attitudes toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 1992). TPB posits that an individual's intention to perform a specific action is the most immediate predictor of actual behavior, and this intention is influenced by personal attitudes, perceived social pressures, and perceived ease or difficulty of performing the behavior (Ajzen, 2021).

In the context of consumer behavior within social media environments, TPB provides a valuable lens to understand how consumers form intentions to purchase or endorse products based on their attitudes, social influences, and perceived control over the behavior (Kumar et al., 2023). For instance, a consumer's positive attitude toward a product endorsed by a social media influencer, perceived social approval from their peer group, and confidence in their ability to make the purchase collectively shape their behavioral intentions.

The underpinning theory guiding this research extends beyond TPB to incorporate elements of media psychology and parasocial relationship theory. Parasocial interaction (PSI), which refers to one-sided, emotionally engaging relationships consumers develop with media figures, serves as a mediating mechanism that links media figure characteristics to TPB components (Giles, 2022). Specifically, variables such as media figure credibility, attractiveness, interaction frequency, and emotional connection foster strong parasocial bonds. These bonds influence consumers' attitudes—by making endorsements more credible and persuasive—shape subjective norms through perceived social influence, and enhance perceived behavioral control by increasing consumers' confidence and familiarity with the product or brand (Chen & Lin, 2024).

By integrating parasocial interaction into the TPB framework, the model emphasizes how these media-driven relationships act as a mediator that translates media figure characteristics into behavioral intentions. This approach recognizes that consumers' psychological attachment to influencers can significantly impact their decision-making processes, aligning with recent developments in media psychology that highlight the importance of emotional bonds in consumer behavior (Li & Zhao, 2025). The combination of TPB with parasocial relationship theory thus provides a comprehensive understanding of the pathways through which influencer marketing influences consumer actions in the digital age.

Variables

Attitudes toward Purchase refer to the consumer's overall evaluation of whether engaging in a specific behavior, such as buying a product or endorsing a brand, is favorable or unfavorable (Ajzen, 1995). These attitudes are shaped by personal beliefs about the benefits, quality, and trustworthiness of the product or endorsement message. In the context of parasocial interactions with media figures, consumers who develop strong emotional bonds are likely to form positive attitudes toward the endorsed products, perceiving them as more credible and appealing (Horton & Wohl, 1956). Such favorable attitudes increase the likelihood of engaging in purchasing or endorsement behaviors.



Subjective Norms involve the perceived social pressures to perform or not perform a behavior, influenced by the opinions of significant others such as friends, family, or societal groups (Ajzen, 1995). When consumers feel connected to media figures through parasocial interactions, they may also perceive that endorsing or purchasing certain products aligns with social expectations or enhances their social approval. Media figures often serve as influential role models, shaping consumers' perceptions of what is socially acceptable or desirable, thus impacting subjective norms (Labrecque et al., 2013). These norms can significantly influence consumers' intentions to engage in specific behaviors, especially if they believe that important others approve of such actions.

Perceived Behavioral Control refers to the individual's perception of their ability and resources to perform the behavior, such as purchasing a product. This includes factors like financial means, accessibility, and confidence in making the purchase (Ajzen, 1995). Parasocial relationships can enhance perceived control by providing consumers with information, reassurance, or a sense of support from the media figure, which reduces uncertainty and increases confidence in their ability to carry out the behavior (Giles, 2002). When consumers feel capable and confident, they are more likely to translate intentions into actual purchase actions.

Purchase Intentions and Behaviors represent the culmination of the preceding cognitive and social factors. Purchase intentions refer to the likelihood that a consumer plans or intends to buy a product or endorse it, which is influenced by their attitudes, perceived norms, and perceived control (Ajzen, 1995). Actual purchase behaviors are the real-world actions taken by consumers, reflecting their commitment and decision-making processes. Parasocial interactions foster trust and emotional attachment with media figures, which can significantly elevate purchase intentions and lead to actual buying or endorsement behaviors (Chung & Zhao, 2018). These behaviors are the ultimate outcomes of the interplay among media figure characteristics, parasocial bonds, and the components of the Theory of Planned Behavior.

Parasocial Interaction (PSI) refers to the one-sided, perceived social relationship that develops between consumers and media figures, such as celebrities, influencers, or social media personalities. Unlike traditional social interactions, PSI is characterized by a sense of familiarity, intimacy, and emotional connection that consumers feel towards media figures without actual reciprocal interaction (Horton & Wohl, 1956). This phenomenon occurs because media figures often create content that fosters the illusion of personal closeness, making viewers feel as though they are engaged in a real relationship with them. As a result, consumers may develop trust, admiration, and emotional attachment, which can influence their attitudes and behaviors toward the media figure and associated products or endorsements (Giles, 2002).

The development of PSI is significantly influenced by media figure characteristics such as credibility, attractiveness, interaction frequency, and emotional connection. For instance, media figures perceived as trustworthy and authentic tend to foster stronger parasocial bonds, enhancing consumers' perceived closeness (Cohen, 2004). Similarly, attractive and engaging figures who interact frequently with their audience, especially through social media platforms, are more likely to cultivate intense PSI experiences. Emotional connection plays a crucial role, as the depth of personal feelings and identification with the media figure can intensify the



parasocial bond, making consumers more receptive to endorsements and persuasive messages (Rubin et al., 1985).

Parasocial interactions serve as a mediator in the relationship between media figure characteristics and consumers' behavioral intentions. They act as a psychological bridge, translating the influence of media figure traits into attitudes, norms, and perceived control that ultimately shape purchase intentions and behaviors (Chung & Zhao, 2018). In essence, PSI enhances the persuasive power of media figures by fostering a sense of intimacy and trust, which can significantly impact consumer decision-making processes. Therefore, understanding PSI is essential for comprehending how media figure characteristics influence consumer behaviors in modern marketing contexts.

Media Figure Credibility is a critical characteristic that influences how consumers perceive and respond to media figures. Credibility encompasses the perceived trustworthiness, expertise, and honesty of the media figure (Ohanian, 1996). When media figures are viewed as credible, consumers are more likely to accept their endorsements and recommendations, which enhances their persuasive power (Hovland & Weiss, 1951). Credibility can be built through consistent, honest communication and demonstrated expertise, leading consumers to develop greater trust and positive attitudes toward the endorsed products or messages (Metzger et al., 2010). As a result, credible figures are more effective in shaping consumers' behavioral intentions, such as purchasing or endorsing products.

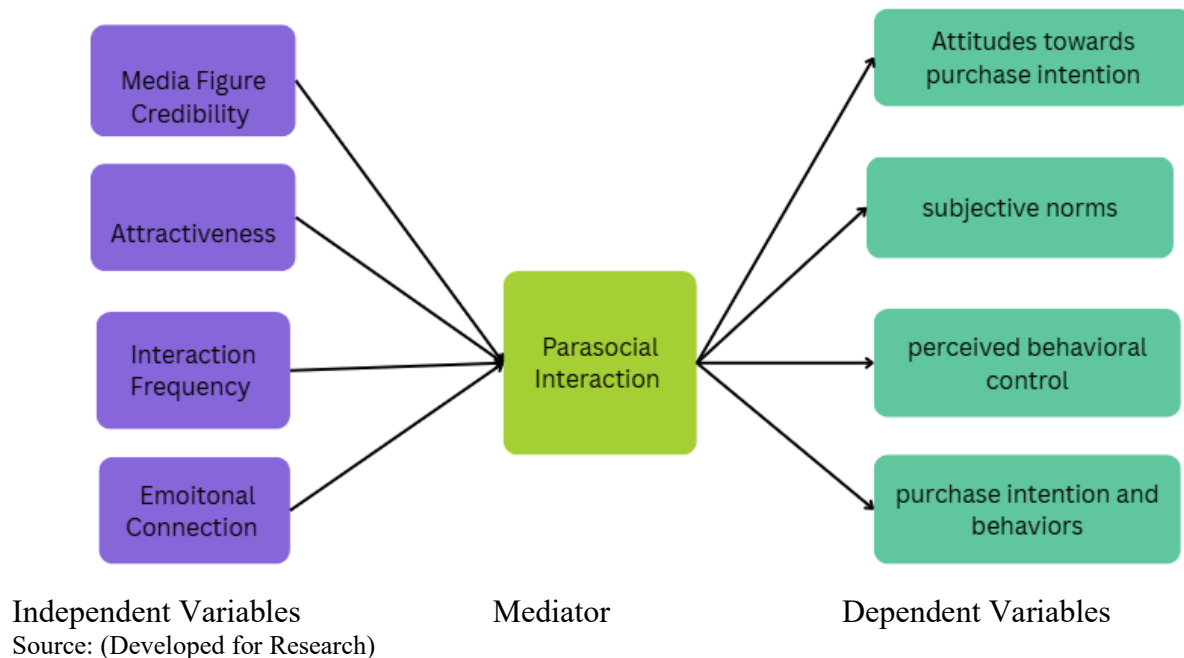
Media Figure Attractiveness refers to the physical appearance, charm, and overall appeal of the media figure. Attractiveness influences consumer perceptions by increasing attention and engagement with the figure and their messages (McGuire, 1985). Attractive media figures often evoke positive emotional responses and can create a favorable attitude toward the endorsed product simply through their visual appeal (Ohanian, 1990). This characteristic is especially influential in advertising contexts, where attractiveness can enhance persuasiveness and brand recall (Erdogan, 1999). The attractiveness of media figures can also foster parasocial bonds, making consumers more receptive to their messages.

Interaction Frequency pertains to how often consumers engage or interact with media figures, whether through social media comments, messaging, or passive exposure. High interaction frequency can strengthen the relationship between consumers and the media figure by increasing familiarity and perceived closeness (Hoeffner et al., 2018). Frequent interactions may lead to the development of deeper parasocial bonds, as consumers feel more personally connected and engaged with the figure (Chung & Zhao, 2018). This variable influences the strength of parasocial interactions, which in turn affect consumers' attitudes and behavioral intentions.

Emotional Connection describes the affective bond that develops between consumers and media figures. This connection is characterized by feelings of attachment, admiration, and empathy towards the figure, often cultivated through consistent, relatable, and authentic interactions (Caughey & Stryker, 2016). Emotional connection enhances parasocial relationships, making consumers more likely to trust and identify with the media figure, which can significantly influence their attitudes and behavioral responses (Giles, 2002). Strong

emotional bonds can increase the persuasiveness of endorsements and foster loyalty, ultimately impacting consumer behavior.

Conceptual Framework



Research Methodology

Research Design and Approach

This study adopts a quantitative research approach to examine the relationships among media figure characteristics, parasocial interaction (PSI), and consumers' behavioral intentions. Quantitative methods are suitable for testing theoretical models and hypotheses through numerical data analysis (Creswell & Creswell, 2021). Specifically, this research employs Structural Equation Modeling (SEM) using SMARTPLS, a variance-based SEM technique favored for its flexibility in handling complex models and small to medium sample sizes (Henseler et al., 2016). The use of SMARTPLS allows for the simultaneous assessment of measurement models and structural relationships, providing robust insights into the mediating role of PSI within the proposed framework (Hair et al., 2022).

Sampling Technique and Sample Size

A non-probability purposive sampling technique will be utilized to select respondents who are active social media users and have exposure to influencer marketing. This targeted approach ensures that participants are relevant to the study's context, as they are more likely to have developed parasocial relationships with media figures (Etikan et al., 2016).

Determining an appropriate sample size is crucial for SEM analyses. Based on recent methodological guidelines (Kock, 2021), a minimum sample size of 200 respondents is recommended for PLS-SEM to ensure sufficient statistical power and model stability (Hair et



al., 2022). To account for potential data attrition or incomplete responses, the sample size will be increased to approximately 250 respondents.

Data Collection Procedure

Respondents will be recruited through online platforms, primarily via social media channels such as Facebook, Instagram, and TikTok, where influencer marketing is prevalent. Participants will be invited to complete a structured questionnaire hosted on a survey platform like Google Forms. To enhance response rates, incentives such as gift cards or social media shoutouts may be offered. The survey will include screening questions to confirm participants' active engagement with social media influencers and familiarity with parasocial relationships.

Measurement and Instrument Development

The questionnaire will comprise validated scales adapted from previous studies, measuring media figure credibility, attractiveness, interaction frequency, emotional connection, PSI, and behavioral intentions. All items will employ a Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Pre-testing will be conducted to ensure clarity and reliability of the items.

Data Analysis

Collected data will be analyzed using SmartPLS 4.0 software. The analysis will proceed in two phases: first, assessing the measurement model for reliability and validity (composite reliability, AVE, discriminant validity), followed by evaluating the structural model to test hypothesized relationships, including the mediating role of PSI (Henseler et al., 2019). Bootstrapping with 5000 resamples will be employed to determine the significance of path coefficients.

Conclusion

In conclusion, this study provides valuable insights into the role of media figure characteristics and parasocial interaction in shaping consumer behavioral intentions within the context of influencer marketing. By employing SmartPLS SEM, the research offers a robust analytical framework to understand the direct and indirect relationships among variables, highlighting the mediating effect of PSI. The findings contribute to the existing literature by emphasizing the importance of media figure attributes such as credibility and attractiveness in fostering strong parasocial bonds that influence consumers' attitudes and purchase decisions. Practically, the results offer marketers strategic guidance on selecting and managing influencers to enhance engagement and drive behavioral outcomes. Theoretically, the study advances understanding of the psychological mechanisms underpinning consumer responses to social media influencers, filling gaps related to the mediating role of parasocial interactions. Overall, this research contributes to both academic scholarship and marketing practice by elucidating how influencer characteristics and parasocial bonds impact consumer behavior, ultimately aiding in the development of more effective influencer marketing strategies.



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DETERMINANTS OF EMPLOYEE PERFORMANCE IN PRIVATE HIGHER EDUCATION INSTITUTIONS (PHEIS) IN MALAYSIA AND EMPLOYEE ENGAGEMENT AS MEDIATOR

Irene Yong Ley Mui, Zahir Osman, Annie Yong Ing Ing

Open University Malaysia (zahir_osman@oum.edu.my)

Open University Malaysia (irene5565@oum.edu.my)

Open University Malaysia (inging1986@oum.edu.my)

Abstract: *This study investigates the determinants of employee performance in private higher education institutions in Malaysia, with a particular focus on the mediating role of employee engagement. Guided by Social Identity Theory, the research explores how various organizational factors—workload, training and development, leadership support, compensation fairness, and job autonomy—affect employee engagement and, subsequently, employee performance. Using a quantitative research approach, data will be collected from employees across multiple private higher education institutions in Malaysia using SMARTPLS 4.0. This study will offer valuable insights for higher education administrators aiming to improve workforce productivity and organizational effectiveness through targeted human resource strategies.*

Keywords: *Workload, training and development, leadership support, compensation fairness, job autonomy, employee engagement, employee performance.*

Introduction

This study focuses on the determinants of employee performance within Malaysian private higher education institutions (PHEIs), emphasizing employee engagement as a mediator. Malaysian higher education has transitioned from a predominantly public system to a diversified sector with significant private sector involvement (MOHE, 2022). PHEIs have expanded rapidly following supportive policies and legislative frameworks like the Private Higher Educational Institutions Act 1996, now hosting over 500 institutions enrolling approximately 420,000 students (MQA, 2023). Today, they form about 40% of higher education enrolments, competing nationally and internationally through quality standards, accreditation, and branding strategies (Chin & Lee, 2021).

The sector's growth aligns with Malaysia's strategic goals such as becoming an educational hub and fostering economic development (MOHE, 2015). However, this rapid expansion presents challenges, particularly concerning human resource management (HRM). Employee performance—encompassing faculty, staff, and management—is pivotal for sustaining quality, research output, and institutional competitiveness (Yusoff et al., 2023). Performance factors are influenced by workload, training, leadership, compensation, and autonomy, which directly impact engagement and productivity.



Evolution & Current Landscape

Historically, Malaysian higher education was dominated by public universities like UM and UKM (Chin & Lee, 2021). Private institutions gained momentum in the 1990s, regulated by the 1996 Act, and have since diversified, with the Malaysia Education Blueprint 2015-2025 emphasizing their strategic importance (MOHE, 2015). Currently, PHEIs face intense competition to attract students through quality accreditation, research, and international linkages (Chin & Lee, 2021).

Post-pandemic, the sector faces pressures including declining enrollments, resource constraints, and faculty shortages (PwC Malaysia, 2021). High faculty turnover (20-30%) due to workload, compensation disparities, and burnout has been reported, affecting research productivity and student satisfaction (Lee, 2023). The 2025 Ministry audits show research output down 12%, student satisfaction at 65% (versus 78% in public universities), driven by administrative overload and funding volatility (MOHE, 2025).

Significance of Employee Performance

Employees are critical assets in PHEIs, influencing teaching quality, research, and institutional reputation (Ng & Tan, 2021). High engagement among faculty and staff enhances innovation, service delivery, and competitiveness, while disengagement leads to poor performance, attrition, and financial instability.

Employee performance includes teaching efficacy, research productivity, administrative efficiency, and community engagement (Yusoff et al., 2023). Factors such as workload, training, leadership, and compensation influence engagement and, consequently, performance (Alonso et al., 2025). In Malaysia's competitive landscape, engagement acts as a mediator between HR practices and performance outcomes, aligning with Social Exchange Theory (SET).

Challenges in Malaysian PHEIs

Post-pandemic recovery revealed issues like excessive workload, research pressure, and resource limitations. Faculty attrition is high, with 20-30% intending to leave due to workload, salary issues, and lack of support (Lee, 2023). Overloaded faculty report emotional exhaustion, which hampers performance (Saad et al., 2022). Insufficient training and development further hinder employee growth (Lee, 2023). Compensation and autonomy also play vital roles, influencing engagement levels (Fraij, 2025).

Research Questions

The study explores relationships and mediating effects among variables:

- How do workload, training, leadership, compensation, and autonomy relate to employee engagement and performance?
- Does employee engagement mediate these relationships?



Research Objectives

To examine determinants of employee performance in Malaysian PHEIs, with focus on engagement as a mediator.

Significance of the Study

Understanding HR determinants and engagement mechanisms can help PHEIs improve performance, retain talent, and enhance educational quality. The study contributes academically by applying theories like SET and the Job Demands-Resources model (Bakker & Demerouti, 2017), and practically by informing HR strategies to foster engagement and boost institutional sustainability (Shah et al., 2023).

Limitations and Future Directions

Limitations include the cross-sectional design, which restricts causal claims, and focus on Malaysia, limiting generalizability. Future research could adopt longitudinal approaches, explore additional variables like organizational culture, or compare public vs. private institutions.

Literature Review

Theoretical Foundations

This study is underpinned by two central theoretical perspectives. The first, Social Exchange Theory, posits that employment relationships are based on reciprocal exchanges. When organizations provide support, fairness, and opportunities for development, employees tend to reciprocate through increased engagement and improved performance. These social exchanges foster trust, commitment, and motivation, which translate into discretionary effort and organizational outcomes. The second framework, Job Demands-Resources Theory, explains how job demands, such as workload, deplete employees' energy and induce strain, while job resources, including autonomy, leadership support, and fairness, promote engagement and motivation. These resources activate positive psychological states that enhance performance. Together, these theories provide a comprehensive understanding of how organizational and job-related factors influence employee engagement and, subsequently, organizational performance, especially in knowledge-intensive settings like higher education.

Employee Performance as the Dependent Variable

Employee performance encompasses a range of behaviors, including task performance—such as teaching and research—contextual performance like mentoring and innovation, and adaptive behaviors that help employees navigate complex work environments. In the context of higher education, performance is critical for maintaining institutional reputation, quality, and competitiveness. From the perspective of Social Exchange Theory, employee performance reflects reciprocal behaviors driven by perceptions of organizational support, fairness, and relational quality. Recent meta-analyses and empirical studies confirm that engagement serves as a significant mediator in the relationship between HR practices and performance. When



employees perceive organizational support and fairness, their engagement levels increase, leading to higher productivity, commitment, and discretionary effort.

Independent Variables and Their Relationships with Performance

The first antecedent, workload, is defined as the volume and complexity of tasks assigned to employees, including teaching, research, and administrative duties. In private higher education institutions, workload tends to be high due to staffing shortages and competitive pressures. According to Job Demands-Resources Theory, excessive demands deplete employees' psychological and physical resources, leading to burnout and disengagement. Empirical studies support this, showing that high workload adversely affects both engagement and performance, as employees have less energy and motivation to contribute effectively. For example, studies in various contexts confirm that overload reduces vigor, dedication, and overall productivity. Consequently, it is hypothesized that workload negatively relates to employee engagement and performance.

The second antecedent, training and development, involves organizational initiatives aimed at enhancing employees' skills, knowledge, and competencies. These initiatives signal organizational support and investment in employee growth. Social Exchange Theory suggests that when employees perceive such support as genuine and equitable, they reciprocate with higher engagement and better performance. Empirical evidence supports this, indicating that training increases engagement and contributes directly to task mastery, innovation, and overall effectiveness. The mediating role of engagement has also been confirmed in recent studies, where training enhances discretionary effort and performance through increased psychological commitment. Therefore, it is hypothesized that training and development positively influence both engagement and performance.

Leadership support, operationalized through the quality of leader-member exchange, reflects the extent to which supervisors provide guidance, recognition, and socio-emotional backing. High-quality leader-member exchange relationships foster trust, respect, and psychological safety, which are valued resources in Social Exchange Theory. Supportive leadership encourages employees to invest effort and remain engaged, resulting in improved performance. Empirical studies confirm that leadership support directly and indirectly enhances engagement and performance, with high-quality relationships serving as vital relational resources. Based on this, it is hypothesized that leadership support positively affects both engagement and performance.

Compensation fairness pertains to employees' perceptions of the equity and transparency of reward systems, including salary, incentives, and recognition. Perceptions of fairness reinforce social exchange principles, fostering trust and reciprocal effort. Empirical research demonstrates that perceived fairness in rewards enhances engagement and motivation, leading to higher performance levels. Conversely, perceived injustice can diminish motivation and lead to withdrawal behaviors. Consequently, it is hypothesized that perceived fairness in compensation positively influences both employee engagement and performance.

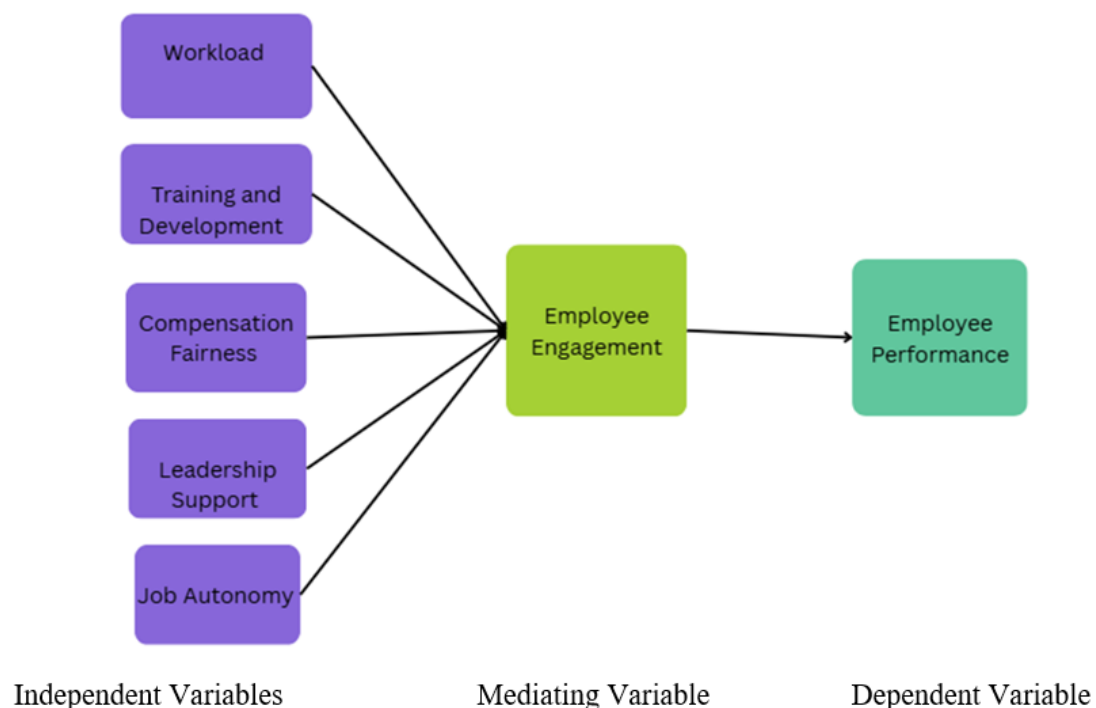
Job autonomy, defined as the degree of discretion employees have over their work processes and decisions, is a vital resource in Job Demands-Resources Theory. Autonomy fulfills

intrinsic needs for control and competence, fostering motivation and engagement. Theoretical and empirical evidence indicates that higher levels of autonomy are associated with greater engagement and better performance, as employees are empowered to innovate and adapt their work. Autonomy also buffers the negative effects of workload by enabling employees to manage their tasks more effectively. Accordingly, it is hypothesized that job autonomy positively relates to both engagement and performance.

Employee Engagement as a Mediator

Employee engagement—characterized by vigor, dedication, and absorption—is a psychological state that mediates the relationship between antecedents and performance. Theories suggest that resources such as support, fairness, and autonomy foster engagement, which in turn leads to higher productivity, innovation, and commitment. Empirical findings support this mediating role, with engagement consistently linked to improved organizational outcomes. High engagement not only enhances current performance but also sustains long-term organizational effectiveness. Based on this, it is hypothesized that employee engagement mediates the relationships between workload, training, leadership support, fairness, autonomy, and employee performance.

Conceptual Framework



Source: Developed for Research



Research Gaps

While recent research confirms the importance of the examined antecedents and the mediating role of engagement, several gaps remain. There is a lack of sector-specific studies focusing on private higher education institutions, especially within the Malaysian context. Many studies examine individual antecedents in isolation without integrating multiple variables into a comprehensive model. Furthermore, the mediating role of engagement in linking these antecedents to performance remains underexplored in educational settings. Longitudinal studies are needed to establish causal relationships, and contextual factors specific to PHEIs should be considered to enhance the applicability of theoretical models.

This study aims to address these gaps by examining the combined effects of workload, training and development, leadership support, fairness, and autonomy on employee performance, with engagement serving as the mediating variable, grounded in Social Exchange Theory and Job Demands-Resources Theory.

Research Methodology

Research Design

A quantitative, deductive design is adopted, as it allows measurement of specific constructs—such as workload and engagement—across a large sample of staff. This approach aligns with prior studies (Alonso et al., 2025) and supports testing the relationships derived from JD-R and SET. The cross-sectional survey captures data at a single point, suitable for assessing sector-wide performance issues during 2021–2025, with SEM allowing examination of direct and mediated effects.

Population and Sampling

The target population comprises academic and administrative staff from all Malaysian PHEIs registered with MQA, totaling over 500 institutions and 1.2 million staff. The focus is on those within top-ranked universities in Klang Valley—such as Taylor’s, UCSI, Sunway, APU, and UTAR—chosen for their high density and sector representativeness. Stratified random sampling proportionally allocates responses from role, faculty, and university to ensure diversity, with a total sample size of 420 respondents based on power analysis (G Power, 2009), ensuring robustness for SEM.

Instrumentation

The survey instrument operationalizes five independent variables—Workload, Training & Development, Leadership Support (LMX), Compensation Fairness, Job Autonomy—and two dependent variables—Employee Engagement (mediator) and Employee Performance. All items are adapted from validated scales using a 5-point Likert scale.

Data Collection Procedures

The survey is administered online via Google Forms. Institutional permissions are secured before dissemination through email, academic networks, and social media. The survey includes



clear consent and guarantees anonymity, with follow-up reminders sent at two-week intervals to maximize response rates. The pilot with 30 staff ensures clarity, reliability (Cronbach's Alpha > 0.70), and cultural relevance, with refinements made accordingly.

Data Analysis Methods

Data analysis proceeds in two phases: measurement and structural modeling. Using SmartPLS 4, the measurement model's reliability (indicator loadings >0.708, Cronbach's Alpha >0.70, AVE >0.50) and validity (HTMT <0.85) are assessed first. The structural model then evaluates path coefficients, collinearity (VIF <3.0), R-squared for explanatory power, and effect sizes (f^2). Significance is tested via bootstrapping (5,000 resamples). Mediation analysis follows Preacher and Hayes (2022), confirming whether engagement fully or partially mediates the links between antecedents and performance.

Ethical and Validity Considerations

The study adheres to ethical standards—obtaining consent, ensuring confidentiality, and minimizing bias through procedural remedies (section separation, anonymity). Content validity is verified by expert panels, and construct validity via HTMT ratios. To address common method bias, Harman's single-factor test and VIF checks are performed, expecting values below thresholds.

Summary

This systematic methodology integrates a structured survey, rigorous sampling, and advanced SEM analysis to empirically examine how organizational investments and demands influence employee performance through engagement. The approach ensures validity, reliability, and contextual relevance, providing robust insights into performance determinants within Malaysia's private higher education sector.

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DIVIDEND PERFORMANCE: A COMPARATIVE STUDY OF MALAYSIAN AND INTERNATIONAL DAIRY COMPANIES

Ani Asmaa Asli^{1*}, Nur Azwani Mohamad Azim², Nurul Badzlin Azhar³, Siti Nur Aisyah Mazlan⁴, Wan Nur Maizalieza Wan Mustafa⁵

¹Fakulti Pengurusan Perniagaan, Universiti Teknologi MARA Terengganu, Malaysia
Email: aniasmaa@uitm.edu.my

²Fakulti Pengurusan Perniagaan, Universiti Teknologi MARA Terengganu, Malaysia
Email: nurazwani@uitm.edu.my

³Fakulti Pengurusan Perniagaan, Universiti Teknologi MARA Terengganu, Malaysia
Email: badzlinworks@gmail.com

⁴Fakulti Pengurusan Perniagaan, Universiti Teknologi MARA Terengganu, Malaysia
Email: aisyahmazlan28@gmail.com

⁵Fakulti Pengurusan Perniagaan, Universiti Teknologi MARA Terengganu, Malaysia
Email: maizalieza5152@gmail.com

Abstract: *This research focuses on the factors that influence the dividend performance of dairy companies which are affected by increasing production cost, economic instability and post-COVID-19 conditions that impact the ability of companies to pay stable dividends. The aims of this research are to investigate the relationship between firm-specific financial variable and dividend policy for Malaysian and global dairy firm from 2015 to 2024. A quantitative method is used in this research and secondary sources in the panel data regression analysis to test the impact of profitability, firm size and leverage on the dividend payout ratio. The findings indicate that profitability and firm size are positively associated with dividend payments whereas leverage is negatively associated with dividend payments which means that companies with high leverage are likely to retain their earning instead of paying dividends. In conclusion, the findings of the study emphasize the significance of financial variable in determining the dividend policy in the dairy sector and help investors, manager and policymaker understand the importance of financial variables in assessing in the performance of companies and the stability of dividends in the dairy sector.*

Keywords: *dividend payout ratio, dairy company, secondary data, COVID19, panel data.*

Introduction

Food and Beverage (F&B) are a critical industry in the domestic and global economies as it provides key goods to the consumer. In this industry, the dairy industry is of great significance because it is dependent on the raw material, quality requirements and the production and operation costs of the industry are relatively high. These are the traits that put dairy companies under financial strain, particularly in terms of profitability and dividend distributions (Feryanto & Tri Rahmawati, 2023).

The dairy industry underwent serious economic and financial transformation in the years 2015 to 2024. Before the COVID-19 pandemic, the situation in the dairy firms was mostly about having relatively constant demand and costs. The pandemic though shook supply chains, consumer demands and created more operational uncertainty. During the post-pandemic years, companies were also exposed to inflationary prices, increasing prices on inputs, and unstable



interest rates, which impacted on the corporate performance and dividend payments (Kafi, et al., 2023; Md Sapry & Zulkifli, 2023). The developments render the chosen period appropriate in the study of dividend performance changes.

The dividend payout ratio (DPR) is used in this study to determine the dividend performance by finding the percentage of the earnings paid to shareholders. Dividend disbursement is largely considered as a measure of financial stability, profitability and confidence of management of a firm, especially when the economy is uncertain (Chintya & Hajanirina, 2020; Roj, 2019). Companies that manage to pay regular dividends are considered to be financially strong and well-run.

This paper will analyze firm specific financial variables, which have an effect on the performance of dividends that include profitability, firm size, and leverage. Profitability is a measure of the capacity of the firm to make profits, firm size is the size of operation and financial maturity, and leverage measures the use of debt financing and financial risk. The variables have been extensively utilized in previous empirical research to model the dividend policy behavior in various industries and economic environments (Khan, N. U. et al., 2017).

The study will mainly concentrate on the Malaysian dairy firms with some comparative understanding bearing on the targeted international dairy companies. According to Aivazian, V. et al. (2023), these cross-country comparisons provide a wider scope of understanding of the performance of dividends in different institutional, regulatory and economic settings.

This paper is divided into three chapters which are in chapter 1 presents the research background, problem statement, research objectives, scope and the significance of the research. On the other hand, chapter 2 summarizes literature on the theoretical and empirical studies regarding dividend performance and firm-specific financial variable. Lastly, chapter 3 describes the research methodology including data sources, research design, model specification as well as analysis tools.

2. Literature Review

The literature review of this research will focus on the previous literature concerning the performance of the company and the dividend policy, particularly concerning the food and beverage industry and the dairy product industry (Ed-Dafali, S. et al., 2023). Dividend policy is an essential financial decision that indicates the amount of profit a company shares with its shareholders (Anuar et al., 2023). Dividend policy also indicates the perceptions of the company's financial status and future growth prospects of the company (Anuar et al., 2023). Therefore, it is crucial to understand the factors that affect the dividend payment of the company, particularly concerning the industry that experiences a constant demand and increasing cost, such as the dairy product industry (Roj, 2019).

Theoretically, various financials have been formulated to describe the nature of dividend behavior and company performance (Radziah, 2022). These theories include dividend relevance and irrelevance theories, agency theory, signalling theory and the pecking order theory (Radziah, 2022). These theories describe different aspects of dividend policy and demonstrate how internal company factors such as profitability, Firm size and leverage can



affect dividend payments (Chin & Suel, 2025). These theories form the fundamental basis for examining the relationship between company specific factors and company performance in this research (Ed-Dafali, Patel, & Iqbal, 2023).

Various empirical studies have been conducted to identify factors that affect dividend policy in different industries and countries (Roj, 2019). Previous studies have used different approaches to investigate the effects of Profitability, firm size and leverage on the payment of dividend (Anuar et al., 2023), the majority of the studies have confirmed that profitability is positively related to the payment of dividends. However, the findings regarding the size and leverage, reflecting the importance of further research in the area (Fatemi & Bildik, 2012).

Empirical findings for F&B industries, specifically dairy products, are still limited, as seen in other industries such as banking or manufacturing, due to literature imbalance as identified in other dividend related literature. Existing literature has mainly been based on developed countries, while few studies were found on emerging economies such as Malaysia (Anuar et al., 2023). Moreover, previous literature did not reflect recent economic events such as the COVID-19 pandemic and post pandemic inflation, as seen in recent literature (Louziri & Oubal, 2022).

Therefore, this literature review combines theoretical and empirical findings on dividend policy and company performance while pointing out gaps and inconsistencies in previous studies (Ed-Dafali, S. et al., 2023). It provides a strong basis for developing the theoretical framework and research hypotheses of this study, focusing on the impact of profitability, firm size and leverage on dividend payments in Malaysian and international dairy companies during 2015 until 2024.

Methodology

In this chapter, the research methodology used in this study is presented to discuss the dividend performance of Malaysian and international dairy companies. It describes the research design, methodology approach, data collection process, selection of variables, theoretical framework and the methods of data analysis. This chapter also contains the diagnostic checks that were taken to achieve the reliability and validity of the results. This methodology will make the research goals to be managed systematically and diligently.

3.2 Methodological Choice

The research strategy adopted by this study is a quantitative study, as it will be testing the correlation between the specific firm factors and the dividend performance empirically. Quantitative methods are appropriate in researching numerical data and facilitate performing statistical testing of the hypothesis based on objective scales (Khan, Shah Jehan, and Shah, 2017). This is the right approach in terms of comparing policies of different firms in different countries concerning dividend policies and determining the trends in the dependence on the independent variable and the dependent variable (Wirama and Krisnadewi, 2024).

3.3 Purpose of Research Design



This study is explanatory because it aims to investigate and describe the causal relationship between firm specifics and dividend policies in the publicly traded companies in the developing economies (George and Merkus, 2025). A quantitative-based explanatory study is particularly appropriate because it permits the systematic testing of existing theories and hypothesis on how internal factors such as profitability, firm size, and leverage on dividends, as it will be possible to test the relationship between independent and dependent variables in a systematic manner (Khan, N. U., et al. 2017). Quantitative research designs are primarily deductive and used to test hypotheses and analyze numerical data to determine relationships among variables, thereby supporting rigorous empirical validation of theoretical propositions (*Starbuck, 2023*). It gives a broad analysis of the impacts of changes in business fundamentals on dividend behaviour and, therefore, increases the empirical value of the findings, by targeting variables that are measurable and through the use of statistics (*Kengatharan, 2021*).

To provide deeper insights into the dynamics of dividend policy, the framework also incorporates moderating factors, including corporate governance practices and the firm life-cycle stages, which can influence the relationship between firm-specific characteristics and dividend decisions (*Munzhelele, Wolmarans & Hall, 2021*). Locating the explanatory approach in the environment of the emerging markets, the study will add to the current body of literature by providing evidence on dividends determinants in the conditions of economic instability, institutional modification, and changing business conditions (*UNCTAD, 2022*).

The present research design follows a quantitative research design where the hypothesis testing will be carried out to identify the determinants of Dividend Payout Ratio (DPR) of Malaysian and foreign dairy companies. The research design is explanatory in nature because it seeks to exclude the cause-and-effect relationship between firm specific attributes and dividend performance. The authors examine the profitability, firm size and leverage as the most important explanatory variables that affect dividend payout decisions.

According to (Li, Zhao, & Zhang, 2024), the panel data analysis applied in the study related to 2015-2024 is appropriate to understand the dividend behaviour in various economic situations such as the COVID-19 pandemic and the post-pandemic period of inflation. The secondary data is gathered using audited financial statements and acquired using valid financial databases like the London Stock Exchange Group (LSEG) that can be accessed via Perpustakaan Tun Abdul Razak, Universiti Teknologi MARA. This gives uniformity, comparability and reliability of data among firms in different countries.

3.4 Research Strategies

The researcher will use the comparative case study method and survey of secondary data to study the performance of the companies and their dividend policy, especially in the dairy industry (Bhat, 2022). The researcher can use the comparative case study method to compare the different companies and understand the similarities or differences between the company's dividend policy and performance (Bhat 2022; O'Learly, 2017). The survey of secondary data is a method where the researcher will study the existing information instead of talking to the companies or the people (O'Learly, 2017; Sauders et al., 2019).



The research uses many reliable data source to make sure the study is reliable and valid (Saunders et al., 2019). For example, journal articles provide ideas, theories and evidence related to dividend policy. Company reports and financial statements provide real data on dividend payments, profitability, firm size and debt levels (Chintya & Hajanirina, 2020). In addition, reliable financial websites are used to cross check and support the data which helps improve its accuracy (Kafi et al., 2023). Using more than one data source also makes the data more consistent and helps make comparisons easier (Saunders et al., 2019).

The comparative case study method can be employed to study the trend over time and to compare the firms in different markets (Bhat,2022; O'Learly, 2017). The study of dairy firms in Malaysia and the comparison with firms in other Asian countries and across the world can help to understand the similarities and differences in dividend payment and financial performance (Ahmad et al., 2023; Zubir et al., 2022). The study uses the data from 2015 to 2025 which helps to understand the trends over time, including during period of economic downturn, growth and post pandemic (kafi et al., 2023) This helps to understand the impact of profitability, firm size and leverage on dividend payment in both the short and long term (Bhat, 2022).

This method is accomplished by carrying out a survey of secondary data which is demand to be appropriate for the case study and the quantitative research approach used in conducting the research (Bryman & Bell, 2015; O'Leary, 2017). in carrying out the financial analysis statical methods are used in assessing the effect of profitability, size and leverage on the dividend policy of the firm (Chintya & Hajanirina; Ahmad et al., 2023). This method reduces the possibility of making mistakes and biases because the data used in conducting the analysis is collected from the audited financial statements of the firm and credible sources (Saunders et al., 2019). Additionally, this method allows for a good comparison of the firms (Saunders et al., 2019).

Overall, it can be stated that an effective, efficient and reliable method can be adopted for carrying out this research by adopting the comparative case study method and conducting the survey based on the secondary data (O'Leary, 2017; Sauders et al., 2019).it is an effective and efficient way for conducting research as it can be utilized for making comparisons as well as for obtaining accurate and reliable information. It can also be stated that this method is effective and efficient for theory as well as practice as it can enhance the understanding regarding the behaviour of dividends (Bhat, 2022).

3.5 Theoretical Framework

In this research, the dependent variable is company performance which is measured by the dividend payment (Chintya & Hajanirina, 2020; Ahmad et al., 2023). The payment of the dividend refers to the percentage of the company's earnings that are distributed to the shareholders of the company. The payment of the dividend is a critical component of the performance of a company, its sustainability and the confidence of the management of the company in its future earnings (Alon et al., 2023; Zubir et al., 2022). From a financial perspective, the payment of the dividend indicates the potential of the company to create continuous earnings and cash flows as well as the potential of the company to fulfil financial obligations (Farah Chintya & Hajanirina, 2020; Madhani & Sytrisno, 2023). In the case of the



dairy companies which come under the food and beverages category, the aspect of the dividend payment gains importance particularly with reference to the way the company manages the cost, challenge and competition (Kafi et al., 2023; Ahmad et al., 2023). Through the aspect of the firm characteristics on the shareholder return which reflect the financial position of the company (Alon et al.; Chintya & Hajanirina, 2020).

Profitability is the one of the most importance characteristics of firms which affects the payment of dividends. Profitability measures the potential of firms to make profits from their main business activities (Chintya & Hajanirina, 2020; Ahmad et al., 2023). In other words, it measures the financial strength of firms (Zubir et al., 2022; Farah Chintya & Hajanirina, 2020). Firms with higher profitability have more potential to pay out more dividends to their shareholders. This is because profitable firms have enough resources to distribute to their shareholders as dividend payments without affecting their business operation (Alon et al., 2023). In the case of dairy firms, higher profitability implies better cost management and demand for their products. Therefore, it has a positive impact on their dividend payments (Ahmad et al., 2023). The impact of profitability on dividend payments is expected to be positive (Alon et al., 2023).

Firm size, on the other hand, refers to the size of the company. Firm size is usually associated with the stability and the size of the company (Zubir et al., 2022). Larger companies tend to have more sources of income, stability and low risk hence the ability to pay dividends on a consistent basis (Ahmad et al., 2023). Larger companies tend to enjoy the advantages that come with the dairy industry including the ability to enjoy the benefits that come with their reputation and the ability to negotiate better deals (Kafi et al., 2023). Firm size is an essential factor that is considered when paying dividends. Firm size is essential since it reflects the stability of the company (Farah chintya & Hajanirina, 2020).

Leverage is the amount of dependence the company has on debt to operate its businesses and expand (Ahmad et al., 2023). Companies that have high debts to pay will have to pay the interest and the loans first which may affect the amount of dividends to be paid (Alon et al., 2023). In the dairy industry the production and machines require high investment and high debts may affect the payment of dividends (Kafi et al., 2023). Leverage is also related to the risks and the way the management distributed the earnings to the debt and the shareholders (Madhani & Sutrisno, 2023). Therefore, the effect of leverage on the payment of dividends is negative (Alon et al., 2023).

In conclusion, the framework of this study considers that the payment of dividends is a reflection of business performance, which is influenced by important characteristics of the firm which are profitability, firm size and leverage (Alon et al., 2023). In this manner, this research examines how the financial performance and activities of a firm influence the returns of shareholders, providing valuable information on the dividend policy in the Malaysia dairy sector (Ahmad et al., 2023). This framework integrates finance theory and empirical evidence, offering a clear approach to examine what influence the dividend policy and its relationship with company performance (Zubir et al., 2022).

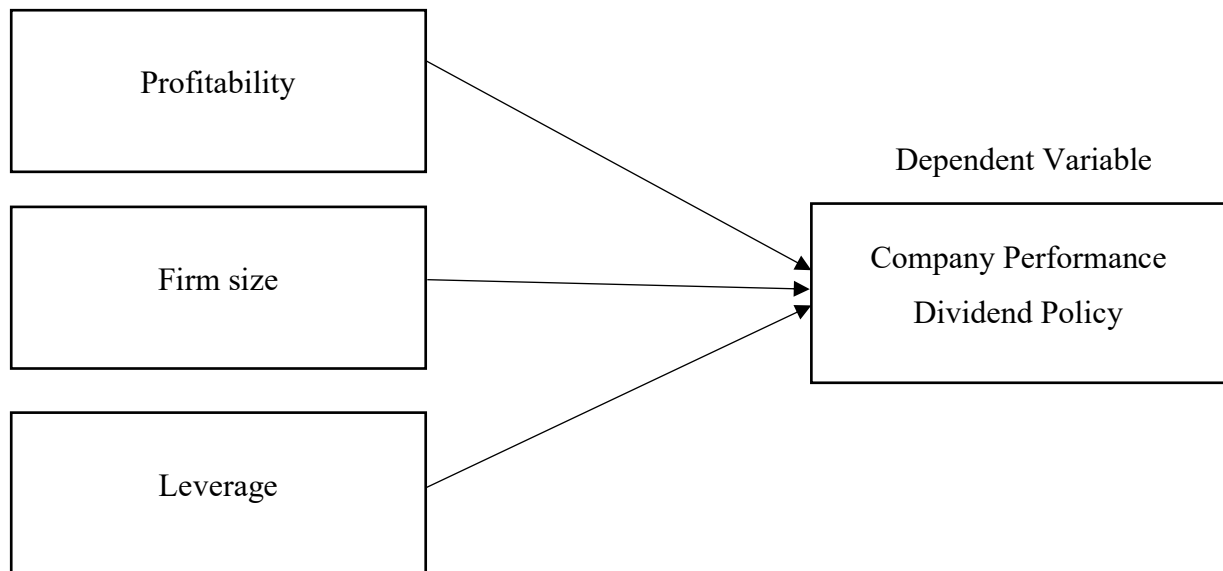


Figure 1: Research Framework

3.6 Type of Analysis

The research design used in the study is Ordinary Least Squares (OLS) regression to examine the relationship between the dividend policy and the firm-specific characteristics (Lawal & Kareem, 2024). The OLS is also appropriate because it can be used to estimate the impact of a combination of independent variables, including profitability, firm size, leverage, capital expenditure, and working capital on the dependent variable, dividend payout (Lawal & Kareem, 2024). By approximating the size and effect of the influence of each factor keeping other factors constant, OLS can give a good idea of the determinants that have the most significant effect (Lawal & Kareem, 2024). By so doing, the study can be used to test theory hypotheses and come up with empirical findings regarding the motivators of dividend decisions in publicly-traded companies (Lawal & Kareem, 2024).

In addition, under the given assumptions, OLS regression is one of the most commonly used methods of carrying out research in the fields of accounting and finance, as it is simple, interpretable, and efficient (Kieschnick et al., 2025). The approach is highly suitable to the linear modelling of independent and dependent variables since the data that is to be utilized is quantifiable financial information of various companies over a time frame (Kieschnick et al., 2025). Regression results will help to identify the significant firm specific variables that influence the dividend policy and present the information about how the firms react on the internal financial conditions and external economic shocks by altering the payout policies (Farah Chintya & Andrianantenaina, 2020).



Additionally, the application of OLS regression in the research provides an opportunity to compare the companies and time across the companies and identify the trends, which would not have been possible to find by means of the descriptive statistics alone (Ham et al., 2021). The methodology uses the firm level financial data as a single model and finds both direct and indirect impacts of dividend policy on the dividend policy and it gives a more comprehensive approach on the payout behaviour within the emerging markets (Beers, 2025). It is a suitable methodological choice as it ensures the findings are as credible as possible, not to mention that it can use the findings in a purposeful manner in managerial decision-making and (policy-making) offered the advantage of connecting theory with practice (Hasan et al., 2023).

3.7 Conclusion

This chapter will discuss the research methodology employed in this research to identify the factors affecting the performance of the dividend in the dairy industry. This includes an explanation of the research design employed in this research to obtain the necessary data for this research. A quantitative research approach employing secondary research has been employed as it is appropriate in conducting research on financial data by employing an annual report in a simple way. This chapter will also discuss the variables employed in this research as the dividend payout ratio is employed as the dependent variable. A panel data regression analysis has been employed as it is appropriate in conducting research on various companies.

It also explains the process of analysis of the data collected during this research. To analyse the relationship between the dependent variable and the independent variable in an organized way, data regression analysis is used for the purpose in this research. In this process, several tests are carried out to check for multicollinearity and autocorrelation as these are some of the basic conditions for effective regression analysis. These tests help avoid any kind of error in the data, making it more accurate and meaningful.

Overall, it is evidence that the research methodology discussed in this chapter gives a clear guideline for the research. The research methods adopted for the conduct of the research are suitable for the achievement of the research objectives as well as the research question appropriately. Moreover, the use of suitable data sources, variable and analysis adds more credibility to the research. So, the evidence that this chapter gives a clear foundation for the next chapter which will discuss the research findings.

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MUDAHNYA TAJWID DENGAN SIMBOL: KAJIAN TINDAKAN DI POLITEKNIK MUKAH

Mohd Norfaeezwan Buang¹, Ninie Amira Drahim²

¹Jabatan Pengajian Am, Politeknik Mukah (PMU), Malaysia, (norfaeezwan@pmu.edu.my)

²Jabatan Pengajian Am, Politeknik Mukah (PMU), Malaysia, (ninie@pmu.edu.my)

Abstract: *Kajian ini dijalankan bagi membantu pelajar Politeknik Mukah yang menghadapi kesukaran dalam memahami dan mengaplikasikan hukum tajwid yang betul dalam pembacaan al-Quran. Pemerhatian awal menunjukkan bahawa ramai dalam kalangan pelajar keliru apabila diminta mengenal pasti hukum tajwid terutama ketika diminta membaca secara spontan. Antara punca utama yang dikenal pasti ialah istilah-istilah tajwid yang agak teknikal serta kekeliruan dalam mengenal simbol atau tanda tertentu dalam mushaf al-Quran. Sebagai solusi, satu pendekatan inovatif diperkenalkan iaitu kaedah 'Simbol Tajwid Pintar'. Kaedah ini diinspirasikan daripada buku Oh Mudahnya Tajwid oleh Mohd Arif Asad Johari. Pendekatan ini menggunakan simbol visual yang mudah difahami dalam bahan pembelajaran untuk mewakili hukum tajwid seperti idgham, ikhfa' dan iqlab. Pendekatan ini menjadikan pengajaran lebih interaktif dan membolehkan pelajar mengenal pasti hukum tajwid dengan lebih pantas. Kajian ini menggunakan reka bentuk kuasi-eksperimen melibatkan dua kumpulan. Kumpulan pertama adalah kumpulan eksperimen yang menggunakan kaedah simbol. Kumpulan kedua ialah kumpulan kawalan menggunakan kaedah konvensional. Data dikumpul melalui ujian pra dan pasca intervensi, pemerhatian semasa sesi pembelajaran dan pengajaran serta melalui soal selidik. Dapatan daripada ujian pra dan pasca intervensi menunjukkan peningkatan sebanyak 40% dalam penguasaan tajwid dalam kumpulan eksperimen, berbanding hanya 15% dalam kumpulan kawalan. Selain itu, 90% pelajar menyatakan bahawa penggunaan simbol membantu mereka memahami tajwid dengan lebih baik dan meningkatkan keyakinan mereka dalam membaca al-Quran. Secara keseluruhan, pendekatan simbol visual terbukti membantu pelajar menguasai hukum tajwid dengan lebih berkesan dan menyeronokkan serta mampu menjadi alat bantu mengajar. Kaedah ini wajar diperluaskan ke institusi lain bagi memantapkan lagi pendidikan al-Quran yang lebih bersifat visual, inklusif dan berkesan.*

Kata Kunci: *Tajwid; Simbol Visual; Pembelajaran al-Quran; Politeknik*

Pengenalan

Sebagai individu beragama Islam, membaca al-Quran dengan tajwid yang betul bukanlah seperti kemahiran yang lain. Ia merupakan tuntutan asas dalam ibadah umat Islam dan bukan sekadar satu kemahiran akademik semata-mata (Abdul Wahid, 2018). Tajwid bukan sekadar pengetahuan, tetapi amanah dalam ibadah yang perlu kita jaga dan fahami sendiri.

Di Politeknik Mukah, didapati ramai pelajar menghadapi masalah dalam mempelajari dan mengamalkan hukum-hukum tajwid ketika membaca al-Quran. Perkara yang sering dilihat adalah kekeliruan pada peraturan tajwid yang terdapat dalam ayat. Kekeliruan ini berakar daripada istilah teknikal, peraturan bacaan yang pelbagai, serta ketiadaan penanda visual dalam sesetengah mushaf (Ismail, 2020). Mereka juga menghadapi kesukaran untuk menghafal



istilah-istilah teknikal yang berkaitan dengan tajwid. Kekeliruan ini meningkatkan beban kognitif pelajar (Sweller, 1994) dan menyebabkan mereka kurang yakin ketika membaca terutama apabila mereka diminta untuk mengenal pasti hukum tajwid dan cara bacaan secara spontan.

Bagi menyelesaikan masalah tersebut, Kaedah Simbol Tajwid telah dicadangkan dan ia berdasarkan buku "Oh Mudahnya Tajwid" yang ditulis oleh Mohd Arif Asad Johari. Teknik ini menekankan penggunaan beberapa tanda asas untuk mewakili hukum tajwid seperti ikhfa', idgham, iqlab, dan sebagainya. Simbol visual memudahkan pengesanan hukum bacaan serta memberikan petunjuk terus kepada bentuk bacaan yang tepat (Johari, 2020). Berdasarkan pemerhatian, didapati pelajar lebih mudah mempelajari cara bacaan bertajwid dengan pendekatan sedemikian. Kajian ini bertujuan untuk menilai keberkesanan aplikasi Kaedah Simbol Tajwid dalam membantu pelajar Politeknik Mukah memahami peraturan hukum tajwid dan bagaimana ia dapat meningkatkan keyakinan mereka semasa membaca al-Quran.

Refleksi Pengajaran dan Pembelajaran Lalu

Membaca al-Quran dengan tajwid yang tepat merupakan satu daripada aspek penting dalam pendidikan al-Quran. Melalui pemerhatian dan dapatan ujian diagnostik yang dijalankan, didapati bahawa pelajar menghadapi beberapa bentuk cabaran dalam menguasai ilmu tajwid. Antara cabaran utama yang dihadapi oleh pelajar termasuklah kesukaran mengenal pasti hukum tajwid. Para pelajar sering keliru ketika membezakan ciri-ciri dan cara bacaan hukum tajwid utama seperti Ikhfa', Idgham dan Iqlab terutamanya apabila menggunakan mushaf yang tidak disertakan panduan tambahan pada teksnya.

Selain itu, kelemahan dalam mengingat istilah dan konsep asas tajwid turut menjadi faktor yang menyumbang kepada kesukaran pelajar mengaplikasikan ilmu tajwid dalam bacaan mereka. Ramai dalam kalangan pelajar dilihat sukar mengingat istilah dan konsep asas tajwid sehingga menyebabkan mereka tidak dapat menamakan hukum tajwid dengan situasi penggunaannya. Perkara ini menyebabkan mereka bergantung sepenuhnya kepada hafalan tanpa pemahaman yang mantap dalam membaca al-Quran.

Tambahan pula, sikap kurang yakin dan takut melakukan kesalahan ketika membaca al-Quran juga menjadi penghalang kepada peningkatan kemahiran mereka. Kekurangan keyakinan ini berpunca daripada pemahaman yang tidak menyeluruh terhadap kaedah bacaan yang betul.

Berdasarkan permasalahan yang telah dikenal pasti, satu pendekatan pengajaran yang lebih visual dan interaktif diaplikasikan sebagai langkah intervensi yang bersesuaian. Pendekatan yang digunakan adalah diadaptasi daripada buku Oh Mudahnya Tajwid karangan Mohd Arif Asad Johari. Ia memperkenalkan penggunaan simbol visual bagi membantu para pelajar mengenal pasti hukum tajwid dengan lebih mudah dan sistematik. Pendekatan ini diharap dapat membantu para pelajar dalam memahami dan mengaplikasikan ilmu tajwid dalam pembacaan mereka seharian.

Fokus Kajian



Fokus utama kajian ini adalah untuk membantu pelajar Politeknik Mukah yang mengalami kekeliruan dan kurang berkeyakinan dalam memahami serta mengaplikasikan hukum tajwid dalam bacaan mereka. Kajian ini menumpukan kepada cara yang lebih baik bagi pengajaran dan pembelajaran ilmu tajwid melalui penekanan kepada penggunaan simbol tajwid sedia ada di dalam mushaf. Pendekatan yang digunakan diharap dapat membantu para pelajar membuat pengecaman jenis hukum tajwid serta mengaplikasikannya dalam bacaan seharian seterusnya meningkatkan keberkesanan pengajaran tajwid serta memperkukuh kefahaman pelajar terhadap hukum bacaan yang betul.

Objektif Kajian

Kajian tindakan ini mempunyai beberapa objektif yang ingin dicapai. Berikut adalah objektif kajian kajian:

- i. Menenal pasti cabaran pelajar dalam mengenali dan memahami hukum tajwid semasa membaca al-Quran.
- ii. Melaksanakan dan menilai keberkesanan Kaedah Simbol Tajwid berpandukan buku Oh Mudahnya Tajwid dalam membantu pelajar memahami dan mengenal pasti hukum tajwid dengan lebih mudah.
- iii. Membandingkan tahap penguasaan tajwid antara pelajar yang menggunakan pendekatan simbol dengan pelajar yang mengikuti kaedah pengajaran konvensional.

Soalan Kajian

Bagi mencapai objektif kajian, pengkaji mengemukakan soalan-soalan seperti berikut:

- i. Apakah cabaran yang dihadapi oleh pelajar dalam mengenali dan memahami hukum tajwid?
- ii. Bagaimanakah Kaedah Simbol Tajwid membantu meningkatkan kefahaman dan keyakinan pelajar terhadap hukum tajwid?
- iii. Sejauh manakah keberkesanan pendekatan simbol berbanding kaedah konvensional dalam meningkatkan penguasaan tajwid?

Reka Bentuk dan Kumpulan Sasaran

Kajian ini menggunakan reka bentuk kuasi-eksperimen yang melibatkan dua kumpulan pelajar Politeknik Mukah yang mengikuti kursus Pengajian Islam. Seramai 16 orang pelajar telah terlibat. Mereka dibahagikan kepada dua kumpulan ($n=8$ bagi setiap kumpulan) iaitu Kumpulan Eksperimen dan Kumpulan Kawalan. Tempoh pelaksanaan intervensi ditetapkan selama tiga minggu.

Metodologi Kajian (Intervensi dan Pelaksanaan)

Intervensi : Kaedah Simbol Tajwid

Bagi mengatasi kekeliruan pelajar dalam mengenal pasti hukum dan cara bacaan bertajwid, satu intervensi dilaksanakan dengan menggunakan kaedah Simbol Tajwid. Pendekatan ini menggabungkan simbol visual yang digunakan untuk menerangkan pelbagai jenis hukum tajwid. Simbol yang digunakan dalam teks al-Quran diserlahkan untuk memudahkan pelajar mengenal pasti hukum tajwid dalam pembacaan al-Quran.

Pendekatan ini diaplikasi untuk membantu pelajar mengenali simbol dan peraturan tajwid dengan pantas serta mengurangkan pergantungan kepada hafalan penjelasan dan istilah tajwid. Simbol diserlahkan dengan paparan pada helaian bahan bantu mengajar.

Selain itu, pendekatan ini selari dengan teori pembelajaran visual oleh Mayer (2001) dan Gardner (1983) dengan alasan bahawa penyerapan warna dan gambar ke dalam maklumat terbukti lebih mudah difahami dan diingati, khususnya bagi pelajar yang mengalami personaliti visual atau kinestetik. Selain itu, teknik ini menggalakkan penglibatan aktif pelajar dengan bacaan al-Quran apabila mereka dengan cepat dan yakin mengenali simbol tajwid.



Gamabr 1: Contoh penggunaan simbol visual

Pelaksanaan Intervensi

Kedua-dua kumpulan menjalani ujian pra dan pasca intervensi bagi menilai tahap penguasaan hukum tajwid. Perbezaan adalah terletak pada kaedah pengajaran yang diterima oleh setiap kumpulan.

Kumpulan eksperimen diajar menggunakan pendekatan Kaedah Simbol Tajwid. Kaedah ini menggunakan bahan bercetak dan slaid dengan simbol berwarna. Penekanan kaedah ini adalah pada pengecaman simbol dan aplikasi bacaan. Kumpulan kawalan pula mempelajari ilmu tajwid secara konvensional yang menekankan kepada penerangan teori dan hafalan istilah. Selain itu, data juga dikumpul melalui soalan kaji selidik serta pemerhatian sepanjang sesi pengajaran dan pembelajaran dijalankan.

Langkah pelaksanaan kajian melibatkan beberapa aktiviti bermula dengan sesi pengenalan simbol, latihan pembacaan secara individu, aktiviti pengukuhan dan akhirnya pengumpulan data melalui pemerhatian serta soal selidik. Tempoh tiga minggu pelaksanaan merangkumi satu pusingan intervensi yang terdiri daripada tiga fasa utama, iaitu pengumpulan data awal, pelaksanaan tindakan dan penilaian kesan tindakan. Pada peringkat permulaan, satu ujian pra dan soal selidik telah dijalankan untuk mengenal pasti tahap penguasaan tajwid pelajar serta cabaran yang mereka hadapi. Dapatan awal mendapati bahawa ramai dalam kalangan pelajar menghadapi kekeliruan dalam mengenali hukum tajwid dan cara bacaannya serta tidak yakin membaca al-Quran secara bertajwid.

Jadual 1: Jadual Pelaksanaan Mingguan

Tempoh	Aktiviti	Butiran Pelaksanaan
Minggu 1	Ujian Pra & Soal selidik	Ujian pra secara bertulis dilaksanakan kepada kedua-dua kumpulan bagi menilai tahap awal penguasaan tajwid. Soal selidik diedarkan bagi mengenal pasti persepsi awal pelajar terhadap hukum tajwid dan keyakinan membaca.
Minggu 2	Pelaksanaan Intervensi	Kumpulan eksperimen didedahkan kepada Kaedah Simbol Tajwid melalui bahan bercetak dan slaid dengan simbol berwarna.
Minggu 3	Ujian Pasca, Soal selidik Akhir & Pemerhatian	Kedua-dua kumpulan menjalani ujian pasca bagi menilai peningkatan penguasaan ilmu tajwid. Soal selidik diedarkan di akhir sesi untuk menilai perubahan persepsi dan tahap keyakinan pelajar. Pemerhatian juga dilakukan untuk menilai keterlibatan pelajar semasa sesi pembelajaran.

Sumber: Pelaksanaan Intervensi

Dapatan Kajian

Penyelidikan ini bertujuan untuk mengkaji kesan penggunaan Kaedah Simbol Tajwid terhadap penguasaan hukum tajwid dan keyakinan pelajar dalam membaca al-Quran. Hasil kajian diperoleh daripada tiga sumber data utama iaitu ujian pra dan pasca intervensi, soal selidik pelajar, dan pemerhatian semasa sesi pembelajaran.

Analisis Ujian Pra dan Pasca-Intervensi

Ujian pra dan pasca intervensi dilaksanakan untuk menilai tahap penguasaan tajwid sebelum dan selepas pelaksanaan tindakan. Hasil analisis skor purata kedua-dua kumpulan adalah seperti berikut:

Kumpulan	Purata Ujian Pra (%)	Purata Ujian Pasca (%)	Peningkatan Skor Purata (%)
Kumpulan Eksperimen (Kaedah Simbol)	45	85	40
Kumpulan Kawalan (Kaedah Konvensional)	47	62	15

Dapatan kuantitatif menunjukkan bahawa Kumpulan Eksperimen yang menggunakan Kaedah Simbol Tajwid mencapai peningkatan penguasaan sebanyak 40% iaitu lebih dua kali ganda berbanding Kumpulan Kawalan yang menggunakan kaedah konvensional iaitu mencatat



peningkatan sebanyak 15%. Perbezaan ketara dalam kadar peningkatan ini membuktikan bahawa penggunaan simbol visual berjaya membantu pelajar mengenal pasti dan memahami peraturan tajwid dengan lebih mudah dan berkesan. Penemuan ini menyokong kepentingan isyarat visual dalam pembelajaran kognitif (Wooten & Cuevas, 2024).

Analisis Soal Selidik Pelajar

Soal selidik telah diedarkan kepada pelajar Kumpulan Eksperimen selepas intervensi untuk menilai persepsi dan impak kaedah tersebut terhadap keyakinan diri. Seramai 90% pelajar dalam Kumpulan Eksperimen melaporkan tindak balas positif mengenai penggunaan simbol untuk mengenali hukum tajwid dengan mudah. Manakala sebanyak 88% peserta menyatakan mereka merasa lebih yakin apabila pertama kali membaca al-Quran selepas intervensi dijalankan.

Pelajar turut memberi maklum balas bahawa kaedah ini disifatkan sebagai menyeronokkan, mudah dan sangat membantu dalam proses menghafal istilah hukum tajwid. Mereka berpendapat bahawa tanda tajwid mudah dikenali sebagai petunjuk visual, sekali gus mengurangkan keperluan untuk menghafal istilah dan huruf hukum tajwid yang banyak.

Analisis Pemerhatian Pengajaran dan Pembelajaran

Pemerhatian yang dibuat sepanjang tempoh kajian menunjukkan perbezaan ketara dalam tingkah laku pembelajaran kedua-dua kumpulan. Pelajar dalam Kumpulan Eksperimen menunjukkan penglibatan yang lebih aktif berbanding Kumpulan Kawalan. Mereka lebih proaktif dalam bertanya, melakukan latihan membaca, dan menunjukkan minat terhadap simbol yang dibincangkan. Kesediaan pelajar untuk membaca ayat-ayat al-Quran secara langsung juga meningkat dengan ketara.

Peserta daripada Kumpulan Kawalan masih menunjukkan kebergantungan yang tinggi kepada guru untuk bimbingan dalam mengenal pasti tanda-tanda hukum tajwid, serta menunjukkan kekurangan dalam keyakinan ketika diminta membaca.

Dapatan ini secara keseluruhan mengesahkan bahawa intervensi simbol visual bukan sahaja berkesan secara kognitif, malah berupaya memecahkan halangan psikologi yang sebelum ini menghalang pelajar daripada terlibat secara aktif dan yakin dalam pembelajaran tajwid.

Perbincangan

Dapatan kajian ini secara konsisten menunjukkan keberkesanan Kaedah Simbol Tajwid dalam meningkatkan penguasaan dan keyakinan pelajar Politeknik Mukah terhadap hukum tajwid. Peningkatan skor purata sebanyak 40% dalam Kumpulan Eksperimen, berbanding 15% dalam Kumpulan Kawalan membuktikan bahawa pendekatan visual merupakan intervensi pedagogi yang unggul berbanding kaedah pengajaran konvensional. Keberkesanan ini membuktikan beberapa kerangka teori yang dibincangkan.



Refleksi Baharu

Penggunaan Kaedah Simbol Tajwid dalam kalangan pelajar di Politeknik Mukah telah menunjukkan refleksi jelas tentang keberkesanan kaedah visual dalam pengajaran ilmu tajwid. Peningkatan yang ketara dalam skor ujian pasca-intervensi dalam kumpulan eksperimen berbanding kumpulan kawalan menyokong bahawa simbol visual bukan sahaja memudahkan kanak-kanak mengenali peraturan tajwid, tetapi juga menjadikan mereka lebih mudah dan yakin menggunakannya semasa membaca al-Quran.

Refleksi ini mengukuhkan persepsi bahawa pelajar masa kini adalah pelajar visual. Huruf dan tanda yang berwarna dalam al-Quran bukan sahaja memudahkan pembelajaran hukum tajwid, tetapi juga menimbulkan minat dan mencipta semangat kerana warna menjadikan pembelajaran lebih menyeronokkan untuk difahami.

Hasil ini mengesahkan teori oleh Paivio (1990), yang menyatakan bahawa jika maklumat disampaikan dalam format visual dan verbal pada masa yang sama, ia akan memudahkan pelajar untuk memahami dan mengingat. Metodologi ini juga selaras dengan teori Kecerdasan Pelbagai oleh Gardner (1983) dengan mempromosikan kecerdasan visual-spatial pelajar, yang telah diabaikan dalam pendidikan tajwid selama bertahun-tahun.

Pendekatan pedagogi ini telah memberi impak terhadap sikap pelajar, terutamanya berkaitan dengan keyakinan dan penglibatan dalam aktiviti membaca. Pelajar yang sebelum ini ragu-ragu dan malu kini tampil dengan bersemangat mencari hukum tajwid dan membaca secara berdikari. Ini menunjukkan bahawa cara pelajar yang mesra dan berfokus visual mempunyai potensi untuk memecahkan halangan psikologi yang secara tradisinya wujud dalam pengajaran subjek yang berasaskan teknikal seperti ilmu tajwid.

Secara keseluruhan, refleksi pasca intervensi ini menunjukkan bahawa pendekatan simbol tajwid adalah sesuai digunakan untuk pengajaran ilmu tajwid di politeknik dan dapat diperluas untuk digunakan di institusi pendidikan lain. Pendekatan ini membuktikan bahawa strategi yang sesuai dengan gaya pembelajaran pelajar masa kini amat penting dalam menjayakan proses pendidikan Islam yang berkesan, menyeronokkan dan inklusif.

Kesimpulan

Kajian tindakan ini merumuskan bahawa Kaedah Simbol Tajwid merupakan strategi pengajaran yang terbukti berkesan dalam konteks pembelajaran al-Quran di institusi politeknik. Peningkatan penguasaan hukum tajwid sebanyak 40% dalam Kumpulan Eksperimen mengesahkan bahawa pendekatan visual ini berjaya mengatasi halangan kognitif dan kesukaran istilah teknikal yang dihadapi oleh pelajar. Selain dalam peningkatan akademik, kaedah ini juga berjaya meningkatkan keyakinan diri iaitu 88% pelajar merasa yakin dan memupuk penglibatan aktif pelajar. Ia menjadikan proses pembelajaran lebih menyeronokkan dan inklusif. Secara keseluruhannya, Kaedah Simbol Tajwid adalah satu kaedah yang boleh digunakan sebagai alat bantu mengajar yang amat berharga dan relevan. Ia selaras dengan keperluan gaya pembelajaran visual pelajar masa kini serta wajar dijadikan panduan untuk memantapkan mutu pendidikan Islam di institusi pengajian tinggi.



Cadangan Kajian

Kajian tindakan ini berjaya membuktikan keberkesanan Kaedah Simbol Tajwid dalam konteks dan skop yang ditetapkan. Namun ada beberapa dimensi yang boleh dikembangkan pada masa hadapan bagi memaksimumkan impak dan manfaat kaedah ini. Kajian ini wajar dilaksanakan dengan populasi sampel yang lebih besar melibatkan pelajar-pelajar daripada pelbagai institusi pendidikan dengan latar belakang yang berbeza. Seterusnya, kajian boleh dijalankan dalam tempoh yang lebih panjang berbanding tiga minggu supaya keberkesanannya lebih diatasi.

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PERSEPSI PELAJAR TERHADAP PROGRAM INKUBATOR KEUSAHAWANAN DI POLITEKNIK ZON SARAWAK

Surafah Mos¹, Anizawati Mukhtar², Anding Nyuak³

¹Jabatan Teknologi Maklumat & Komunikasi, Politeknik Kuching Sarawak (PKS), Malaysia,
(surafah@poliku.edu.my)

²Jabatan Teknologi Maklumat & Komunikasi, Politeknik Kuching Sarawak (PKS), Malaysia,
(anizawati@poliku.edu.my)

³Jabatan Teknologi Maklumat & Komunikasi, Politeknik Kuching Sarawak (PKS), Malaysia,
(anding@poliku.edu.my)

Abstract: Program inkubator keusahawanan memainkan peranan strategik di politeknik Malaysia dengan meningkatkan inovasi, kecekapan teknikal dan kesediaan keusahawanan dalam kalangan pelajar. Namun begitu, bukti mengenai keberkesanan program ini terutamanya di politeknik Zon Sarawak masih terhad. Kajian ini meneliti persepsi pelajar terhadap hasil program inkubator yang dilaksanakan di institusi menggunakan data soal selidik yang terdiri daripada 32 item yang disusun dalam empat kategori utama: Demografi, Tahap Penglibatan, Implikasi terhadap Kemahiran Keusahawanan, dan Persepsi terhadap Keberkesanan Program. Kategori terakhir ini dibahagikan lagi kepada lima sub-dimensi: Kreativiti, Komunikasi, Penyelesaian Masalah, Kepimpinan dan Inovasi. Statistik deskriptif dan analisis korelasi Pearson digunakan untuk menilai pengaruh program. Keputusan menunjukkan skor min yang tinggi bagi semua lima sub-dimensi ($M = 4.1-4.6$), menandakan peningkatan yang ketara dalam kreativiti, komunikasi, inovasi dan kemampuan kepimpinan. Analisis korelasi menunjukkan hubungan positif yang sangat kuat antara sokongan bimbingan dan kemahiran penyelesaian masalah ($r = .90$), serta antara pemahaman objektif program dan hasil inovasi ($r = .75$). Kekerapan penglibatan juga didapati mempunyai hubungan yang kuat dengan aplikasi teknologi ($r = .59$) dan kemahiran komunikasi ($r = .65$). Dapatan ini membuktikan bahawa penglibatan yang berstruktur terutamanya melalui bimbingan dan penyertaan berterusan menyumbang secara signifikan kepada pembangunan kompetensi keusahawanan pelajar. Walaupun hasilnya positif, pelajar menyatakan keperluan untuk pendedahan yang lebih meluas terhadap pengurusan perniagaan lanjutan dan perancangan usaha jangka panjang. Secara keseluruhan, kajian ini menyerlahkan keberkesanan program inkubator sambil menekankan aspek-aspek yang perlu dipertingkatkan lagi.

Keywords: Inkubator, Keusahawanan, politeknik, Zon Sarawak, Inovasi, Persepsi Pelajar

Pengenalan

Pembangunan keusahawanan telah menjadi keutamaan nasional di Malaysia kerana institusi pengajian tinggi (IPT) semakin diberi tanggungjawab untuk melahirkan graduan yang mempunyai keupayaan inovasi yang tinggi, kebolehan mencipta peluang pekerjaan, serta kesediaan untuk terlibat dalam aktiviti ekonomi berasaskan digital. Perubahan ini amat relevan



dalam sistem politeknik, di mana program dirancang untuk menghasilkan graduan yang mahir dari segi teknikal dan kesediaan industri.

Di Sarawak, institusi seperti Politeknik Kuching Sarawak, Politeknik Mukah Sarawak dan Politeknik Metro Betong telah melaksanakan program inkubator keusahawanan bagi meningkatkan kreativiti, inovasi dan kemahiran membangunkan usaha niaga secara praktikal dalam kalangan pelajar daripada pelbagai latar akademik termasuk kejuruteraan, teknologi maklumat dan pengajian perniagaan.

Agenda pembangunan ekonomi wilayah turut mengukuhkan halatuju ini. Strategi Pembangunan Pasca-COVID Sarawak (PCDS) 2030 menekankan pembangunan bakat, kapasiti keusahawanan dan pertumbuhan ekonomi berasaskan inovasi. Namun demikian, walaupun terdapat usaha di peringkat institusi dan wilayah, bukti empirikal mengenai keberkesanan program inkubator dalam meningkatkan kompetensi keusahawanan pelajar masih terhad, khususnya di politeknik Zon Sarawak. Justeru, memahami persepsi pelajar terhadap program-program ini adalah penting untuk memperkukuh pendidikan keusahawanan dan menyelaraskan inisiatif institusi dengan keutamaan pembangunan wilayah.

Tinjauan Literatur

Inkubator perniagaan telah berkembang menjadi satu mekanisme penting dalam menyokong pembangunan keusahawanan dalam sistem pendidikan tinggi. Rukmana et al. (2023) menyatakan bahawa inkubator berfungsi sebagai platform berstruktur yang menyediakan bimbingan, akses kepada sumber, dan sokongan rangkaian dan faktor yang memberi kesan besar terhadap pembangunan usaha niaga. Namun, dapatan mereka juga menunjukkan wujudnya halangan seperti kekurangan pembiayaan dan kualiti bimbingan yang tidak konsisten, yang menimbulkan wujudnya jurang antara reka bentuk inkubator dan pelaksanaannya.

Dalam konteks Malaysia, Looi dan Maritz (2024) melaporkan bahawa program pemula perniagaan dan inkubator universiti semakin meluas di IPT tetapi sering beroperasi secara terasing daripada penyampaian kurikulum formal. Kekurangan integrasi ini mewujudkan pengalaman pembelajaran yang terasing, sekali gus mengurangkan nilai pendidikan yang seharusnya dibawa oleh inisiatif program inkubator. Sejajar dengan itu, Khawaja (2024) menggambarkan perubahan global yang meletakkan universiti sebagai hab keusahawanan, di mana inkubasi bukan sahaja berperanan sebagai sistem sokongan tetapi juga sebagai fungsi strategik institusi. Inkubator moden kini mengguna pakai platform digital, rangkaian global dan pendekatan berasaskan ekosistem bagi menggalakkan pembangunan syarikat baharu yang lebih tangkas.

Kajian empirikal di politeknik Malaysia memberikan pandangan tambahan. Rosli et al. (2024) mendapati bahawa pengintegrasian pendidikan keusahawanan digital dalam persekitaran inkubator meningkatkan literasi digital pelajar, kemahiran penjanaan idea perniagaan, dan kesiapsiagaan mereka untuk terlibat dalam aktiviti keusahawanan. Mereka menekankan bahawa inkubasi menyediakan ruang pembelajaran praktikal yang menjembatani kerja kursus



teori dengan pengalaman keusahawanan sebenar. Dapatan ini selari dengan Rifai et al. (2023), yang menegaskan bahawa inkubator memperkukuh budaya keusahawanan dalam IPT melalui penyediaan kemudahan khusus, bimbingan terarah, dan pendedahan kepada persekitaran industri kolaboratif.

Penyelarasan kurikulum turut memainkan peranan penting. Al Balushi et al. (2023) menyatakan bahawa pendidikan keusahawanan adalah paling berkesan apabila teori dan komponen pengalaman langsung seperti latihan industri, pembentangan idea (pitching) dan penglibatan dalam inkubator digabungkan secara menyeluruh. Sementara itu, Kandagor dan Nzengya (2023) menekankan bahawa inkubator penting dalam memperkukuh peluang sara hidup dalam kalangan graduan TVET, khususnya melalui pendedahan praktikal, bimbingan dan aktiviti pembinaan keyakinan. Aithal dan Aithal (2023) pula mencadangkan model “incubationship” yang mengangkat inkubator daripada mekanisme sokongan kepada pendekatan pedagogi transformasi, membolehkan pelajar terlibat secara mendalam dalam aktiviti prototaip, ujian pasaran dan pembangunan model perniagaan.

Secara keseluruhannya, kajian-kajian ini menunjukkan pentingnya program inkubator yang berstruktur baik dalam membina kompetensi keusahawanan. Namun, ia juga mendedahkan isu berulang, termasuk pelaksanaan program yang tidak konsisten, kurangnya integrasi dengan kurikulum akademik, dan jurang dalam pendedahan pengalaman praktikal. Adalah faktor yang sangat relevan dalam konteks politeknik di Malaysia.

Masalah Kajian

Walaupun program inkubator keusahawanan di politeknik Malaysia bertujuan untuk memupuk inovasi, kemahiran membangunkan usaha niaga dan kesediaan bekerja sendiri, beberapa jurang kritikal masih wujud.

- 1) Kekurangan penilaian empirikal mengenai keberkesanan inkubator di politeknik Zon Sarawak. Walaupun inisiatif keusahawanan berkembang pesat, masih kurang data tentang bagaimana pelajar menilai keberkesanan inkubator, kemahiran yang mereka peroleh, dan sejauh mana hasil ini berbeza mengikut institusi. Kekurangan data ini menyukarkan penambahbaikan dasar dan peningkatan program.
- 2) Ketidakkonsistenan dalam pelaksanaan program dan penglibatan pelajar. Literatur menunjukkan wujudnya perbezaan dalam model inkubator, penyediaan bimbingan, dan aktiviti pembelajaran antara IPT Malaysia. Variasi ini boleh menyebabkan pembangunan kompetensi keusahawanan yang tidak seimbang, sekali gus menjejaskan keupayaan pelajar untuk terlibat secara bermakna dalam aktiviti berasaskan inovasi.
- 3) Kekurangan pandangan berasaskan data mengenai pembangunan kemahiran keusahawanan pelajar. Meskipun inkubator bertujuan meningkatkan kreativiti, penyelesaian masalah, aplikasi teknologi, komunikasi dan kepimpinan, masih terdapat sedikit bukti kuantitatif yang menunjukkan sama ada kompetensi ini benar-benar diperkukuhkan dalam kalangan politeknik di Zon Sarawak.



4) Ketidakpastian tentang kesediaan pelajar untuk membangunkan usaha niaga sebenar. Agenda nasional termasuk PCDS 2030 Sarawak menekankan keusahawanan sebagai tonggak penting ekonomi. Namun, masih tidak jelas sama ada program inkubator sedia ada benar-benar mempersiapkan pelajar untuk melancarkan usaha niaga yang berdaya maju atau sekadar memupuk kesedaran asas tentang keusahawanan.

Isu-isu yang belum diselesaikan ini menekankan keperluan untuk analisis sistematik berdasarkan maklum balas pelajar. Oleh itu, kajian ini meneliti persepsi pelajar terhadap keberkesanan program inkubator bagi menentukan sama ada amalan semasa benar-benar menyumbang kepada pembangunan kompetensi dan selaras dengan matlamat keusahawanan di peringkat wilayah dan nasional.

Metodologi

Reka Bentuk Kajian

Kajian ini menggunakan reka bentuk tinjauan kuantitatif untuk meneliti persepsi pelajar terhadap program inkubator keusahawanan yang ditawarkan di tiga politeknik Zon Sarawak iaitu Politeknik Kuching Sarawak (PKS), Politeknik Mukah Sarawak (PMU) dan Politeknik Metro Betong (PMB). Pendekatan kuantitatif dipilih bagi membolehkan pengukuran yang sistematik terhadap kompetensi keusahawanan, tahap penyertaan dalam inkubator, serta keberkesanan program seperti yang dirasakan oleh pelajar merentasi kumpulan responden yang besar. Reka bentuk ini selaras dengan kajian inkubator terdahulu yang menekankan penilaian empirikal terhadap hasil pembelajaran melalui instrumen pengukuran berstruktur (Rosli et al., 2024; Rukmana et al., 2023).

Populasi dan Persampelan

Populasi sasaran terdiri daripada pelajar daripada pelbagai program akademik seperti kejuruteraan, perdagangan dan teknologi maklumat yang telah menyertai atau terdedah kepada aktiviti inkubator keusahawanan di politeknik. Kaedah persampelan bertujuan digunakan bagi memastikan hanya pelajar yang mempunyai pendedahan relevan kepada inkubator dimasukkan dalam kajian. Sebanyak $N = 51$ respons yang sah telah diperoleh dan dianalisis.

Instrumen Kajian

Soal selidik diedarkan secara digital melalui Google Forms, di mana para peserta diberikan penjelasan yang jelas mengenai tujuan kajian, dijamin kerahsiaan identiti, dan diminta memberikan persetujuan bermaklumat sebelum menjawab. Pengumpulan data dijalankan selama tiga minggu dan dilaksanakan dengan kerjasama Unit Keusahawanan di Politeknik Kuching Sarawak (PKS), Politeknik Mukah Sarawak (PMU) dan Politeknik Metro Betong (PMB). Data dikumpulkan menggunakan soal selidik berstruktur yang mengandungi 32 item yang dibahagikan kepada empat kategori utama:

1. Demografi
2. Tahap Penyertaan dalam Aktiviti Inkubator



3. Implikasi terhadap Kemahiran Keusahawanan
4. Persepsi terhadap Keberkesanan Program, yang dibahagikan lagi kepada:
 - Kreativiti
 - Komunikasi
 - Penyelesaian Masalah
 - Kepimpinan
 - Inovasi

Item diukur menggunakan skala Likert 5 mata (1 = Sangat Tidak Setuju hingga 5 = Sangat Setuju), dan instrumen ini diadaptasi daripada konstruk yang telah disahkan dan lazim digunakan dalam kajian kompetensi keusahawanan, termasuk kemahiran keusahawanan, kecekapan sendiri, dan ukuran kesediaan memulakan perniagaan seperti yang didokumentasikan dalam kajian terdahulu berkaitan start-up dan keusahawanan graduan (Botella-Carrubi et al., 2024; Al-Kwif et al., 2023; Ogbari, 2023).

Teknik Analisis Data

Min, sisihan piawai dan taburan frekuensi digunakan untuk meringkaskan tiga aspek analisis utama: profil demografi pelajar, tahap penglibatan mereka dalam aktiviti inkubator, dan persepsi mereka terhadap pembangunan kemahiran keusahawanan. Statistik deskriptif ini memberikan gambaran menyeluruh tentang trend respons serta membolehkan pengecaman pola merentas aspek kreativiti, komunikasi, penyelesaian masalah, kepimpinan dan inovasi. Bagi melengkapkan penemuan statistik, rajah visualisasi turut dibangunkan untuk memaparkan taburan serta skor min dengan lebih jelas dan mudah untuk ditafsir.

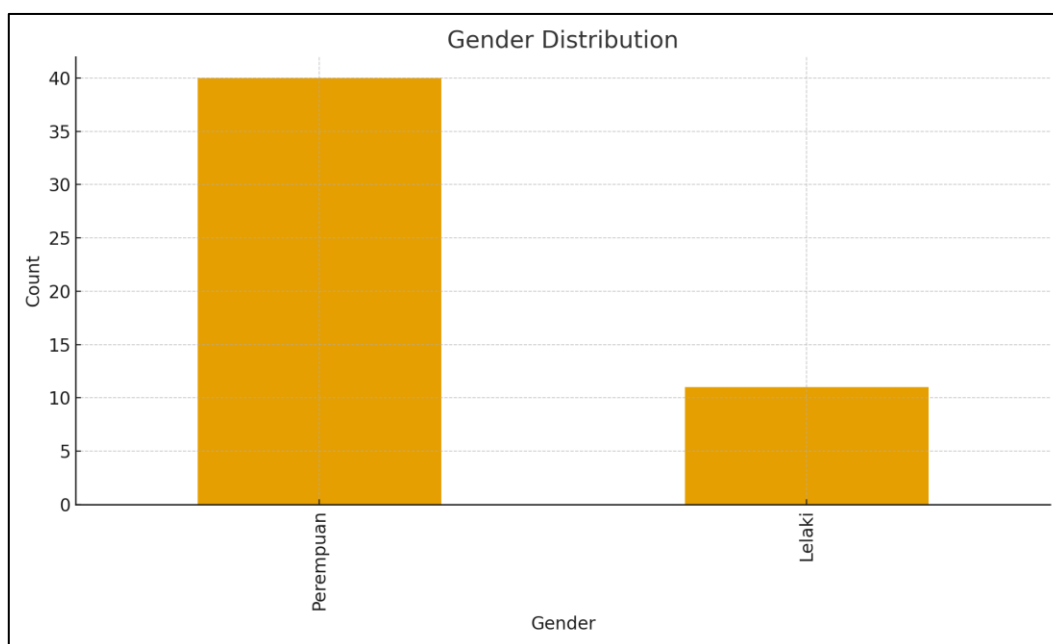
Keputusan

Analisis deskriptif merumuskan pola dalam demografi pelajar, tahap penyertaan dalam inkubator, dan persepsi terhadap pembangunan kompetensi. Responden perempuan mewakili peratusan yang sedikit lebih tinggi berbanding lelaki, dengan majoriti pelajar berumur antara 18 hingga 20 tahun dan kebanyakannya mengikuti program berkaitan teknologi atau kejuruteraan. Rekod penyertaan juga menunjukkan bahawa sebahagian besar pelajar telah terlibat dalam aktiviti inkubator sekurang-kurangnya sekali. Seperti yang ditunjukkan dalam Jadual 1: Statistik Deskriptif bagi Skor Konstruk, nilai min bagi tujuh konstruk yang diukur berada dalam julat 4.12 hingga 4.58, menunjukkan persepsi keseluruhan yang kukuh terhadap keberkesanan program inkubator. Sisihan piawai berada di bawah 0.85 bagi semua konstruk, menandakan respons yang agak konsisten dan mencadangkan bahawa pelajar secara umumnya berkongsi penilaian yang hampir sama terhadap impak program tersebut.

Jadual 1: Statistik Deskriptif bagi Skor Konstruk

Konstruk	Min (M)	SD
Penyertaan	4.12	0.81
Kemahiran Keusahawanan	4.28	0.77
Kreativiti	4.46	0.72
Komunikasi	4.38	0.75
Penyelesaian Masalah	4.33	0.79
Kepimpinan	4.29	0.84
Inovasi	4.58	0.68

Seperti yang ditunjukkan dalam Rajah 1, pelajar perempuan mewakili bahagian responden yang sedikit lebih besar berbanding pelajar lelaki, menunjukkan penglibatan yang kukuh dalam kalangan pelajar perempuan terhadap aktiviti berkaitan keusahawanan.



Rajah 1 : Taburan Jantina

Rajah 2 menggambarkan taburan penyertaan pelajar dalam program inkubator merentas pelbagai program akademik, sekali gus menunjukkan pola kepekatan yang jelas selaras dengan kekuatan institusi politeknik di Sarawak. Peratusan peserta terbesar berasal daripada Diploma Teknologi Maklumat (31.4%), menunjukkan bahawa pelajar dalam program teknologi maklumat (IT) merupakan kumpulan yang paling aktif memanfaatkan peluang inkubator. Hal ini sejajar dengan penekanan yang semakin meningkat terhadap inovasi digital, pengekodan dan keusahawanan berasaskan teknologi dalam institusi TVET Malaysia, di mana pelajar IT lazimnya menunjukkan tahap kesediaan yang lebih tinggi terhadap projek digital aplikasi dan idea permulaan (startup).

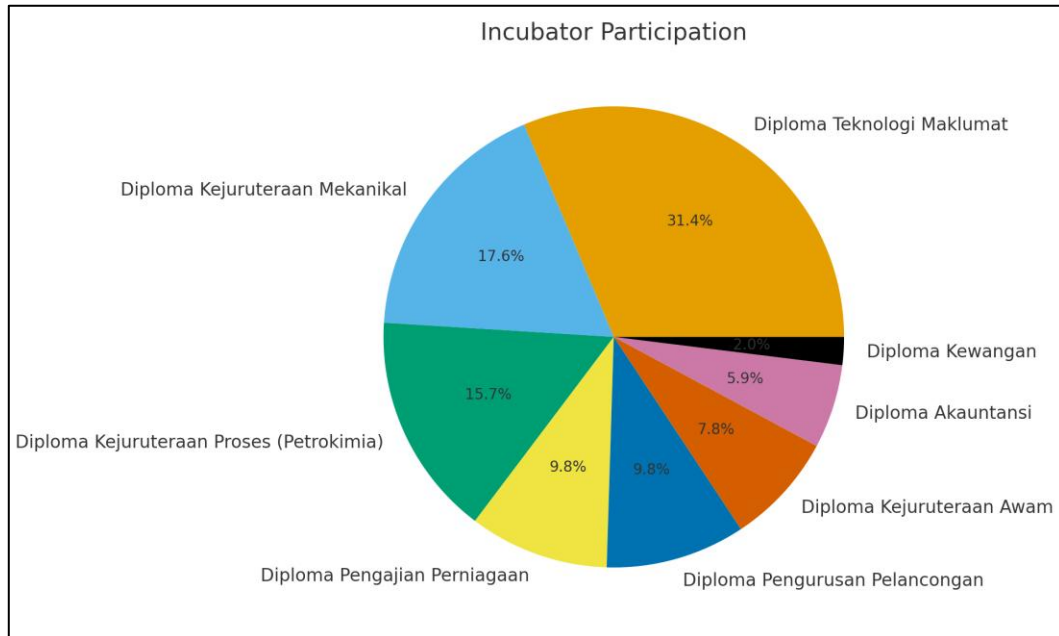


Perwakilan kedua tertinggi datang daripada Diploma Kejuruteraan Mekanikal (17.6%), diikuti oleh Diploma Kejuruteraan Proses (Petrokimia) (15.7%). Pola ini menunjukkan bahawa pelajar berasaskan kejuruteraan menyedari bahawa inkubator merupakan platform untuk pembangunan prototaip, penyelesaian masalah, dan pembangunan penyelesaian teknikal aplikasi semua ini selaras dengan hasil pembelajaran program dan struktur pembelajaran berasaskan projek mereka.

Penyertaan sederhana diperhatikan dalam kalangan pelajar dari Diploma Pengajian Perniagaan (9.8%), Diploma Pengurusan Pelancongan (9.8%) dan Diploma Kejuruteraan Awam (7.8%). Program-program ini lazimnya merangkumi kerja kursus berkaitan pengurusan, operasi dan inovasi perkhidmatan, yang mungkin menjelaskan tahap penglibatan mereka. Pelajar dalam bidang ini cenderung menggunakan inkubator terutamanya untuk pembangunan rancangan perniagaan, inovasi berasaskan perkhidmatan atau pendedahan kepada keusahawanan. Perwakilan lebih rendah direkodkan bagi Diploma Akauntansi (5.9%) dan Diploma Kewangan (2.0%). Bidang-bidang ini lebih menumpukan kepada komponen analitikal dan akademik seperti audit, percukaian dan pelaporan kewangan, yang mungkin menyumbang kepada penyertaan mereka yang agak terhad.

Tahap penglibatan yang rendah ini menunjukkan peluang untuk unit inkubator merangka intervensi khusus seperti makmal inovasi fintech atau bengkel pemodelan kewangan bagi menarik dan menyokong pelajar daripada program berkaitan perdagangan.

Secara keseluruhan, taburan ini menunjukkan bahawa penglibatan dalam inkubator adalah paling tinggi dalam kalangan pelajar IT dan kejuruteraan, sederhana dalam program berorientasikan perniagaan, dan paling rendah dalam kalangan pelajar akauntansi/kewangan. Pola ini menekankan kepentingan menyesuaikan aktiviti inkubator mengikut latar belakang akademik yang berbeza bagi memastikan akses yang saksama serta memaksimumkan pendedahan keusahawanan di seluruh ekosistem politeknik.



Rajah 2: Penyertaan Inkubator

Korelasi Pearson

Hubungan antara konstruk utama dalam kajian ini telah dikaji menggunakan analisis korelasi Pearson, seperti yang dipaparkan dalam **Jadual 2: Jadual Korelasi Pearson (nilai r dan p)**. Jadual ini melaporkan dua statistik penting bagi setiap pasangan pembolehubah: pekali korelasi (r) dan nilai signifikan berkaitan (p). Pekali r mencerminkan kekuatan dan arah hubungan linear antara konstruk, dengan nilai yang menghampiri +1 menunjukkan hubungan positif yang kukuh, nilai berdekatan -1 menunjukkan hubungan negatif yang kuat, dan nilai hampir 0 menunjukkan hubungan linear yang minima atau tiada langsung. Nilai p melengkapkan ini dengan menentukan signifikan statistik bagi setiap korelasi. Nilai p di bawah 0.05 biasanya menunjukkan bahawa hubungan yang diperhatikan tidak mungkin berlaku secara rawak, sekaligus mengesahkan kepentingan statistiknya. Secara keseluruhan, statistik r dan p dalam Jadual 2 memberikan gambaran menyeluruh tentang sejauh mana dan betapa dipercayainya hubungan antara konstruk—seperti penyertaan, kemahiran keusahawanan, kreativiti, komunikasi, penyelesaian masalah, kepimpinan, dan inovasi—dalam konteks program inkubator.

Jadual 2: Jadual Korelasi Pearson (nilai r dan p)

Konstruk	Penyertaan	Kemahiran Keusahawanan	Kretiviti	Komunikasi	Penyelesaian Masalah	Kepimpinan	Inovasi
Penyertaan	1.00 (0.00000)	0.633 (0.00000)	0.798 (0.00000)	0.763 (0.00000)	0.726 (0.00000)	0.607 (0.00000)	0.882 (0.00000)
Kemahiran Keusahawanan	0.633 (0.00000)	1.00 (0.00000)	0.885 (0.00000)	0.747 (0.00000)	0.844 (0.00000)	0.519 (0.00010)	0.698 (0.00000)
Kretiviti	0.798 (0.00000)	0.885 (0.00000)	1.00 (0.00000)	0.815 (0.00000)	0.889 (0.00000)	0.650 (0.00000)	0.820 (0.00000)
Komunikasi	1.00 (0.00000)	0.747 (0.00000)	0.815 (0.00000)	1.00 (0.00000)	0.879 (0.00000)	0.525 (0.00008)	0.809 (0.00000)
Penyelesaian Masalah	0.879 (0.00000)	0.844 (0.00000)	0.889 (0.00000)	0.879 (0.00000)	1.00 (0.00000)	0.620 (0.00000)	0.825 (0.00000)
Kepimpinan	0.607 (0.00000)	0.519 (0.00010)	0.650 (0.00000)	0.525 (0.00008)	0.620 (0.00000)	1.00 (0.00000)	0.677 (0.00000)
Inovasi	0.882 (0.00000)	0.698 (0.00000)	0.820 (0.00000)	0.809 (0.00000)	0.825 (0.00000)	0.677 (0.00000)	1.00 (0.00000)

Peta Haba Korelasi

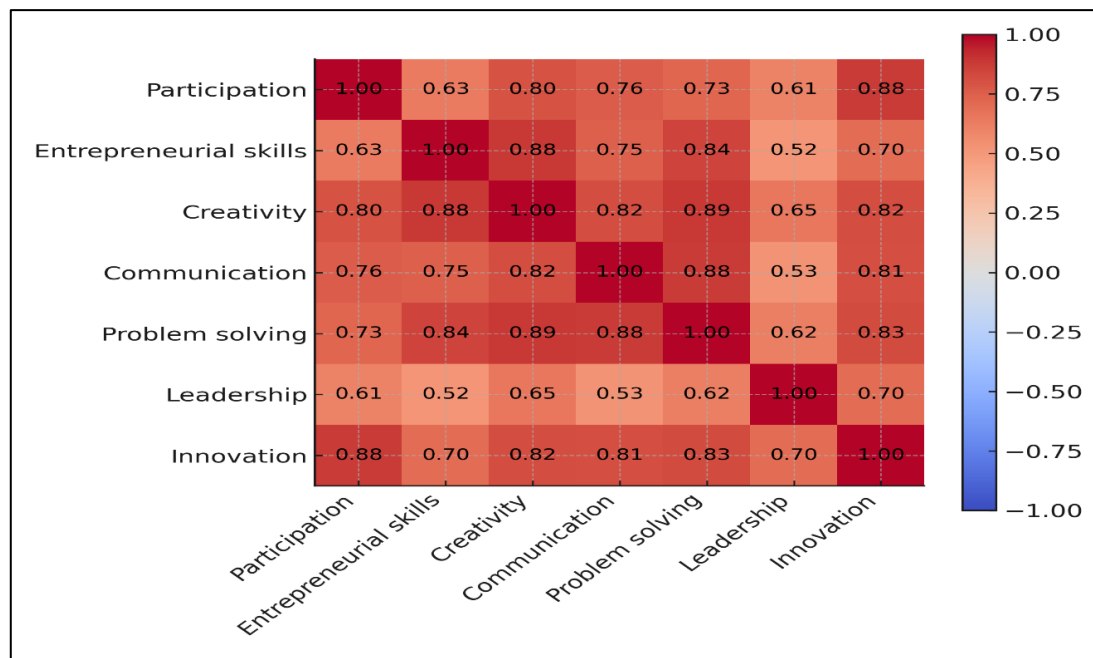
Peta haba korelasi menggambarkan hubungan yang kukuh dan konsisten di antara tujuh konstruk utama yang diukur dalam program inkubator—Penyertaan, Kemahiran Keusahawanan, Kretiviti, Komunikasi, Penyelesaian Masalah, Kepimpinan, dan Inovasi. Secara keseluruhan, matriks menunjukkan korelasi positif yang tinggi, dengan julat dari $r = .52$ hingga $r = .89$, menunjukkan bahawa peningkatan dalam satu bidang kompetensi berkait rapat dengan peningkatan dalam bidang lain.

Penyertaan mempunyai korelasi yang tinggi dengan Inovasi ($r = .88$) dan Kretiviti ($r = .80$), menunjukkan bahawa pelajar yang lebih aktif menyertai aktiviti inkubator cenderung menghasilkan idea yang lebih inovatif dan menunjukkan keupayaan kreatif yang lebih kukuh. Kemahiran Keusahawanan juga berkait rapat dengan Kretiviti ($r = .88$) dan Penyelesaian Masalah ($r = .84$), mencerminkan sifat integrasi aktiviti pengalaman dalam inkubator yang menggalakkan pengiktirafan peluang, pembuatan keputusan, dan penerapan konsep keusahawanan dalam situasi sebenar.

Kreativiti menunjukkan korelasi yang kukuh dengan Komunikasi ($r = .82$), Penyelesaian Masalah ($r = .89$), dan Inovasi ($r = .82$), menunjukkan bahawa pemikiran kreatif adalah pusat kepada pembangunan kompetensi keusahawanan lain. Komunikasi dan Penyelesaian Masalah juga berkongsi hubungan yang kuat ($r = .88$), menunjukkan bahawa pelajar yang berkomunikasi dengan berkesan lebih mampu menangani cabaran berkaitan perniagaan.

Kepimpinan menunjukkan korelasi sederhana dengan konstruk lain ($r = .52$ hingga $r = .70$), mencadangkan bahawa walaupun kepimpinan berkait positif dengan pembangunan keusahawanan secara keseluruhan, ia mungkin memerlukan aktiviti yang lebih khusus untuk pengukuhan yang lebih mendalam. Inovasi mengekalkan korelasi yang tinggi secara konsisten dengan kebanyakan konstruk, terutamanya Penyertaan ($r = .88$), Kreativiti ($r = .82$), dan Penyelesaian Masalah ($r = .83$), mengukuhkan peranannya sebagai hasil utama penglibatan dalam inkubator.

Secara keseluruhan, peta haba ini menunjukkan ekosistem kompetensi yang bersepadu, di mana penyertaan program dan pembelajaran pengalaman memacu pembangunan menyeluruh dalam semua domain keusahawanan.



Rajah 3: Peta Haba Matriks Korelasi

Perbincangan

Keputusan menunjukkan bahawa program inkubator keusahawanan di politeknik Sarawak dianggap sangat bermanfaat merentas pelbagai dimensi pembangunan kompetensi. Skor min yang konsisten tinggi dalam aspek kreativiti, inovasi, kepimpinan, dan komunikasi menunjukkan bahawa pelajar mengiktiraf inkubator sebagai persekitaran pembelajaran pengalaman yang berkesan yang meningkatkan kesiapsiagaan mereka untuk aktiviti



keusahawanan. Penemuan ini sejajar dengan kajian terdahulu yang menunjukkan bahawa inkubator mengukuhkan kompetensi keusahawanan melalui penglibatan secara langsung, bimbingan, dan pendedahan kepada industri (Rukmana et al., 2023; Rosli et al., 2024).

Skor inovasi yang tinggi ($M = 4.58$) menunjukkan bahawa pelajar melihat inkubator sebagai platform penting untuk mencuba idea baharu dan menerapkan teknologi—suatu hasil yang selaras dengan penekanan Malaysia terhadap kesiapsiagaan keusahawanan digital. Kreativiti dan komunikasi juga mencatat skor yang tinggi, mencerminkan manfaat kerja projek secara kolaboratif dan aktiviti berasaskan idea dalam ekosistem inkubator.

Keputusan korelasi mengukuhkan peranan penting bimbingan dan penyertaan berstruktur. Konstruk yang berkaitan dengan bimbingan, pemahaman objektif program, dan pendedahan kepada cabaran sebenar menunjukkan hubungan yang kukuh dengan kompetensi penyelesaian masalah dan inovasi. Ini menyokong hujah bahawa inkubator adalah paling berkesan apabila ia menggabungkan penglibatan berterusan, hala tuju program yang jelas, dan panduan berterusan daripada mentor serta pengamal industri.

Walaupun bagaimanapun, keputusan juga menyorot bidang yang memerlukan pengukuhan. Walaupun secara keseluruhan hasilnya positif, beberapa pelajar menunjukkan penguasaan yang tidak mencukupi dalam pengurusan perniagaan lanjutan dan perancangan jangka panjang—komponen penting untuk menukar idea menjadi perniagaan yang berdaya maju. Jurang ini mencerminkan kebimbangan negara mengenai tahap kesiapsiagaan keusahawanan pelajar Malaysia dan menunjukkan keperluan untuk integrasi kurikulum yang lebih luas, pendedahan praktikal yang lebih mendalam, serta penambahbaikan rangka kerja latihan mentor dalam inkubator politeknik.

Secara keseluruhan, penemuan ini mengesahkan bahawa program inkubator menyumbang secara signifikan kepada pembangunan kompetensi, tetapi ia perlu terus berkembang terutamanya dalam aspek kewangan keusahawanan, kelestarian perniagaan, dan pengesahan pasaran untuk mempersiapkan pelajar sepenuhnya bagi penciptaan perusahaan sebenar.

Kesimpulan dan Kerja Masa Hadapan

Kajian ini memberikan bukti empirikal bahawa inkubator keusahawanan di politeknik Zon Sarawak menyumbang secara positif kepada pembangunan kompetensi keusahawanan pelajar. Melalui penyertaan berstruktur, bimbingan, dan pembelajaran berasaskan projek, pelajar membangunkan kemahiran yang penting untuk inovasi dan penciptaan perusahaan. Keputusan kajian menyorot peluang untuk memperkukuh reka bentuk program dengan memperkenalkan latihan perniagaan lanjutan, memperluas kerjasama industri, dan meningkatkan komponen inovasi digital.

Kajian masa hadapan boleh memperluas kerja ini dengan membandingkan pelbagai kawasan, memasukkan penjejakan longitudinal terhadap hasil start-up pelajar, serta mengintegrasikan pandangan kualitatif daripada mentor dan pengurus program.



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PENGGUNAAN MINECRAFT DALAM PEMBELAJARAN DAN PENGAJARAN SERTA KREATIVITI MENGAJAR TERHADAP PELAJAR: SATU KAJIAN LITERATUR SISTEMATIK

Noor Yunizza Bahar¹ Muhammad Syawal Amran² Shahlan Surat³

¹Fakulti Psikologi Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (p144970@siswa.ukm.edu.my)

² Fakulti Psikologi Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (syawal@ukm.edu.my)

³ Fakulti Psikologi Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (drshahlan@ukm.edu.my)

Abstrak: *Isu kajian ini bertujuan untuk menganalisis penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti mengajar terhadap pelajar dalam pendidikan. Kajian literatur sistematik telah dijalankan dengan menggunakan pendekatan PRISMA bagi mengenalpasti dan menilai kajian-kajian terdahulu yang berkaitan. Sebanyak 24 artikel telah dianalisis berdasarkan metodologi, dapatan kajian, dan implikasi terhadap pedagogi digital. Dapatan kajian menunjukkan bahawa Minecraft Education Edition dapat membantu guru dalam mengadaptasi teknik pengajaran inovatif, merangsang kreativiti pelajar, dan meningkatkan pembelajaran kolaboratif. Walau bagaimanapun, kajian juga mengenalpasti beberapa cabaran utama, termasuk kekurangan latihan khusus untuk guru, kekangan teknologi, serta kesukaran menyelaraskan penggunaan Minecraft dengan standard kurikulum. Oleh itu, kajian ini mencadangkan perlunya program latihan profesional yang lebih sistematik bagi meningkatkan kefahaman dan kesiapsiagaan guru dalam menggunakan Minecraft sebagai alat bantu pembelajaran. Implikasi kajian ini turut menekankan keperluan untuk lebih banyak kajian yang menilai keberkesanan strategi pembelajaran dan pengajaran menggunakan Minecraft dalam konteks pendidikan formal.*

Kata Kunci: *Minecraft Education, Pedagogi Digital, Kreativiti, Pembelajaran Berasaskan Permainan, Pendidikan Abad Ke-21.*

Pengenalan

Minecraft adalah sebuah permainan digital berbentuk kotak pasir (sandbox game) yang membolehkan pemain membina, meneroka, dan berinteraksi dalam dunia maya yang luas (Ramadhaniasari, 2022; Ramdhani, & Imanda, 2024). Sejak diperkenalkan oleh Mojang pada tahun 2009, Minecraft telah berkembang menjadi salah satu permainan paling popular di dunia, bukan sahaja dalam kalangan pemain kasual tetapi juga dalam bidang pendidikan (Ramadhaniasari, 2022; Ramdhani, & Imanda, 2024). Versi pendidikan permainan ini, Minecraft Education Edition, telah direka khas untuk membantu pelajar dan guru mengintegrasikan elemen permainan dalam proses pembelajaran dan pengajaran sekaligus merangsang kreativiti, pemikiran kritis, dan pembelajaran kolaboratif (Fung, Smith & Gandolfi, 2022). Keunikan Minecraft dalam pendidikan terletak pada fleksibilitinya yang membolehkan guru mereka bentuk aktiviti pembelajaran yang menarik serta membolehkan pelajar meneroka konsep-konsep akademik secara visual dan interaktif (Partridge, 2022). Di



Malaysia, penggunaan Minecraft dalam pendidikan semakin mendapat perhatian, terutamanya dalam konteks pembelajaran abad ke-21 yang menekankan aspek kreativiti dan inovasi. Kajian-kajian terdahulu menunjukkan bahawa permainan digital seperti Minecraft mampu meningkatkan motivasi pelajar serta membolehkan mereka memahami konsep yang kompleks melalui pengalaman langsung dan aplikasi dunia nyata (Jiea et al., 2021). Sebagai contoh, kajian oleh Ming (2024) menunjukkan bahawa Minecraft Education Edition telah membantu guru meningkatkan keupayaan pedagogi digital mereka dalam menangani keperluan generasi milenial yang lebih cenderung kepada pendekatan pembelajaran interaktif dan berbentuk permainan. Begitu juga, kajian oleh Sulaiman et al. (2024) mendapati bahawa Minecraft boleh digunakan untuk mengajar konsep sains seperti *photovoltaic solar technology* dengan lebih berkesan, kerana ia membolehkan pelajar membina dan menguji model maya dalam persekitaran yang selamat dan fleksibel. Selain itu, kajian di Malaysia turut menunjukkan bahawa penggunaan Minecraft dalam bilik darjah bukan sahaja memberi manfaat kepada pelajar, tetapi juga kepada guru dalam membangunkan strategi pengajaran yang lebih kreatif. Sebagai contoh, Shuhaimi et al. (2023) telah mengkaji bagaimana Minecraft Education Edition boleh digunakan dalam pendidikan Islam bagi meningkatkan kefahaman pelajar melalui idea-idea kreativiti yang lebih baik dengan penggunaan Minecraft dalam pembelajaran mereka. Walaupun pelbagai kajian menunjukkan keberkesanan Minecraft dalam meningkatkan kreativiti dan pemahaman pelajar, masih terdapat jurang penyelidikan yang perlu diterokai, terutamanya mengenai kaedah pembelajaran dan pengajaran serta kreativiti mengajar guru dalam mengintegrasikan Minecraft ke dalam pengajaran mereka terhadap pelajar. Kajian ini bertujuan untuk meneliti semua artikel yang berkaitan dengan penggunaan Minecraft digital dalam pembelajaran dan pengajaran dan kreativiti terhadap pelajar. Dengan menggunakan pendekatan kajian literatur sistematik, kajian ini akan mengkaji kajian-kajian terdahulu untuk memahami sejauh mana guru bersedia dan mampu menggunakan Minecraft dalam pembelajaran dan pengajaran dalam bilik darjah, serta cabaran yang mereka hadapi dalam mengadaptasi teknologi ini untuk meningkatkan kreativiti dalam kalangan pelajar di sekolah.

Sorotan Literatur

Pembelajaran dan pengajaran berasaskan *Minecraft* adalah satu strategi pembelajaran dan pengajaran yang memberi ruang dan peluang kepada guru dan pelajar di sekolah untuk meneroka pelbagai kreativiti dalam PdPc (Renate Andersen & Mikkel Rustad, 2022). Bagaimana Minecraft boleh digunakan sebagai alat pendidikan untuk pembelajaran kemahiran khusus dalam mata pelajaran yang diajar oleh guru seperti mata pelajaran matematik untuk membina rumah dengan kiraan luas persegi berdasarkan daripada kotak-kotak pasir, permainan Minecraft yang digunakan dalam kursus kajian sosial memberi peluang kepada murid untuk membina aset bersejarah dan memeriksa aset yang sedia ada, sekali gus membolehkan murid membina pemahaman yang mendalam tentang struktur dan tamadun yang dipelajari melalui pembinaan ditempat maya, iaitu satu proses yang memerlukan perancangan terperinci dan pengetahuan sedia ada (Baek, et al., 2020). Selain itu, pembinaan dunia dan penerokaan dalam Minecraft meningkatkan kemahiran penglibatan global murid (Balnaves, 2018). Selain dari itu perkembangan dalam industri permainan dan minat mendalam pelajar terhadap permainan digital Minecraft telah mendedahkan keperluan di dalam elemen permainan dunia pendidikan (Say & Bağ, 2017; İşçi & Yeşiltaş, 2020). Menurut Bayırtepe dan

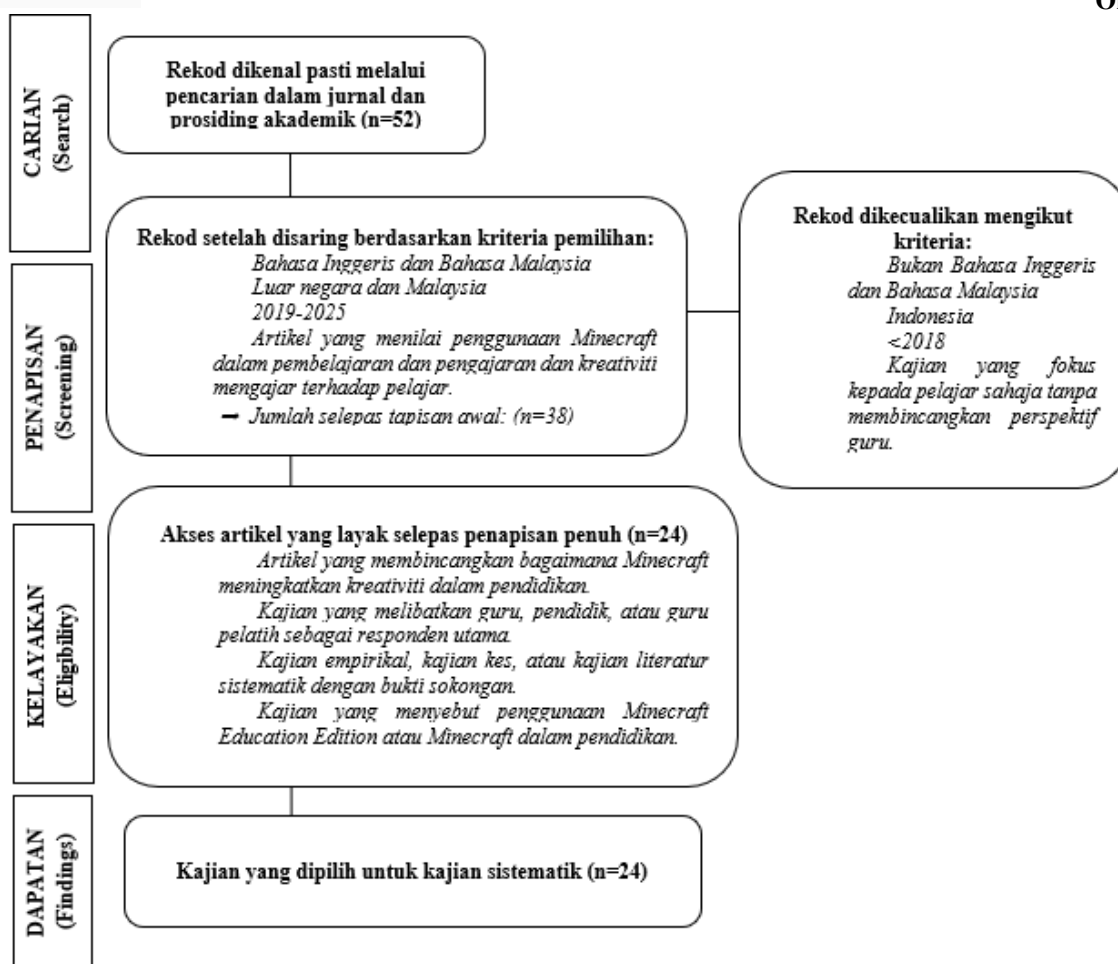


Tüzün (2007), permainan digital Minecraft jugak dapat meningkatkan motivasi, pencapaian akademik, dan persepsi sendiri murid secara positif; selain itu, menurut hasil kajian Mayo (2009), permainan digital pendidikan juga menyokong pencapaian akademik dan pembelajaran kekal.

Minecraft, khususnya Minecraft: Education Edition, telah diakui sebagai alat pedagogi yang berharga, direka khusus untuk memupuk kemahiran abad ke-21 yang penting seperti kreativiti, penyelesaian masalah, dan pemikiran kritis dan kreatif di kalangan pelajar (Sánchez-López et al., 2022). Persekitaran pembelajaran secara terbuka ini menggalakkan eksperimen dan ekspresi diri, sekali gus memupuk generasi muda iaitu pelajar sekolah dalam proses pendidikan permainan digital, yang merupakan elemen kritikal untuk kejayaan akademik (Hébert & Jenson, 2021; Razilu & Iskandar, 2025). Ini termasuk keputusan pedagogi sama ada pelajar akan bekerjasama dalam platform atau di luar platform permainan (Hébert & Jenson, 2021). Guru yang menyediakan aktiviti pembelajaran yang bermakna dapat menyokong penglibatan pelajar dalam pemikiran kritis dan kreativiti (Hébert & Jenson, 2021). Walaupun begitu, penggunaan pedagogi Minecraft mempromosikan keadaan yang sesuai untuk pembelajaran, bukan sahaja berkaitan dengan kreativiti tetapi juga kolaborasi (Steier & Davidsen, 2021). Seterusnya perlu meningkatkan ilmu pengetahuan guru dalam pembelajaran dan pengajaran di dalam kelas dengan penggunaan Minecraft yang terancang dengan aktiviti yang menarik serta dapat menarik minat pelajar untuk fokus dalam PdPc dan secara tidak langsung dapat meningkatkan gred pencapaian pelajar dalam pelajaran. Minecraft merupakan alat bantu mengajar Ia juga menyokong pembangunan kecekapan abad ke-21 yang penting serta permainan yang bersifat kolaborasi. Selain itu, Minecraft juga dapat meningkatkan motivasi, pembangunan bahasa, dan pembelajaran akademik merentasi pelbagai subjek seperti sains dan sejarah (Alawajee & Delafield-Butt, 2021).

Metod Kajian

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) ialah satu rangka kerja yang digunakan dalam kajian literatur sistematik bagi memastikan proses penyelidikan dijalankan dengan telus, teratur, dan berstruktur. Dalam kajian ini, PRISMA digunakan untuk menapis dan memilih artikel yang berkaitan dengan penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti mengajar terhadap pelajar. Kajian ini melalui tiga fasa utama iaitu perancangan tinjauan, menjalankan tinjauan, dan melaporkan hasil tinjauan. Fasa perancangan melibatkan pembentukan soalan kajian, kriteria pemilihan artikel, dan strategi carian pangkalan data. Seterusnya, fasa menjalankan tinjauan melibatkan proses pencarian, penapisan, dan pemilihan kajian berdasarkan kriteria yang ditetapkan. Akhirnya, fasa pelaporan membentangkan dapatan yang diperoleh melalui analisis sistematik, termasuk penerangan tentang kajian yang dipilih dan hasil utama yang berkaitan dengan objektif penyelidikan. Melalui pendekatan PRISMA, kajian ini memastikan bahawa pemilihan sumber adalah sahih, relevan, dan dapat menyumbang kepada pemahaman yang lebih mendalam mengenai peranan Minecraft dalam pendidikan.



Rajah 1: PRISMA aliran kajian carian yang dicadangkan

Rajah 1 menunjukkan aliran kajian PRISMA yang digunakan untuk menapis dan memilih artikel yang relevan dalam kajian ini. Sebanyak 52 rekod dikenal pasti melalui pencarian dalam jurnal dan prosiding akademik. Selepas proses tapisan awal berdasarkan kriteria seperti bahasa, negara, tahun penerbitan, dan fokus kepada penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti mengajar terhadap pelajar, hanya 38 artikel dipilih. Kemudian, 14 artikel dikecualikan kerana tidak memenuhi syarat, termasuk yang hanya menumpukan kepada pelajar tanpa mempertimbangkan perspektif guru. Akhirnya, 24 artikel yang membincangkan bagaimana Minecraft meningkatkan kreativiti dalam pendidikan serta melibatkan kajian empirikal atau sistematik dimasukkan dalam analisis. Pendekatan PRISMA ini memastikan pemilihan artikel yang sahih dan relevan dengan objektif kajian.

Fasa Perancangan Tinjauan

Langkah pertama dalam menjalankan kajian sistematik adalah menyediakan perancangan yang sistematik dan teliti bagi memastikan kajian dijalankan secara teratur dan bebas daripada bias. Perancangan tinjauan dimulai dengan mengenal pasti keperluan utama kajian, termasuk



menetapkan objektif, soalan kajian, serta menentukan skop kajian berdasarkan literatur terdahulu. Seterusnya, protokol tinjauan dibangunkan bagi memastikan konsistensi dalam pemilihan kajian serta analisis data. Protokol ini merangkumi strategi carian pangkalan data, kata kunci, kriteria inklusi dan eksklusi, serta metodologi analisis data. Dalam memastikan kebolehpercayaan hasil kajian, proses penapisan literatur akan dilakukan secara sistematik dengan menggunakan rangka kerja PRISMA. Selain itu, perancangan ini turut mempertimbangkan kaedah pengekstrakan data yang berstruktur bagi menjamin dapatan kajian adalah tepat dan relevan dengan objektif yang ditetapkan. Dengan pelaksanaan perancangan tinjauan yang komprehensif, kajian ini dapat memastikan ketelusan serta kebolehpercayaan dalam memperoleh penemuan yang signifikan.

Fasa Menjalankan Tinjauan

Dalam menjalankan kajian literatur sistematik ini, strategi carian yang teliti digunakan bagi memastikan setiap artikel yang dipilih adalah relevan dengan objektif penyelidikan. Carian artikel dilakukan melalui beberapa pangkalan data akademik utama seperti Google Scholar, Scopus, Web of Science, dan ScienceDirect. Selain itu, sumber lain termasuk pangkalan data jurnal akses terbuka seperti ResearchGate, Academia.edu, dan laman web universiti turut dirujuk. Kata kunci yang digunakan dalam proses carian ini merangkumi gabungan istilah utama seperti Minecraft Education, game-based learning, teacher knowledge and perception, digital pedagogy, creativity in education, dan systematic review on Minecraft in education. Kombinasi kata kunci ini digunakan bersama operator Boolean (AND, OR) untuk menapis hasil carian secara lebih spesifik. Bagi memastikan kualiti dan kredibiliti sumber, hanya artikel yang diterbitkan dalam jurnal berindeks atau prosiding persidangan akademik antara tahun 2019 hingga 2025 dipilih.

Artikel yang terpilih melalui proses penapisan lanjut bagi memastikan kesahihan dan ketepatan metodologi yang digunakan. Kajian yang mengaplikasikan pendekatan empirikal, kajian kes, atau tinjauan literatur sistematik dengan bukti sokongan akan diberikan keutamaan. Kajian yang hanya bersifat teori tanpa data sokongan atau kajian dengan metodologi lemah akan dikecualikan daripada analisis ini. Selain itu, hanya artikel yang menyatakan penggunaan Minecraft Education Edition atau sekurang-kurangnya mengaitkan Minecraft dengan pendidikan akan diterima. Bagi memastikan analisis yang berstruktur dan sistematik, artikel yang memenuhi kriteria pemilihan akan dianalisis menggunakan rangka kerja PRISMA untuk mengesan corak dan trend penyelidikan berkaitan. Melalui pendekatan ini, kajian ini dapat memastikan bahawa hanya sumber yang relevan dan berkualiti digunakan dalam memahami pengetahuan dan kefahaman guru mengenai penggunaan Minecraft dalam meningkatkan kreativiti dalam pendidikan.

Jadual 1: Kriteria Pemilihan Yang Dicari

Kriteria	Penerimaan	Pengecualian
Bahasa	Bahasa Inggeris; Bahasa Melayu	Bahasa lain termasuk Bahasa Indonesia
Negara	Malaysia dan negara luar	Indonesia
Had Masa	2019–2025	



Fokus Kajian	Penggunaan <i>Minecraft</i> dalam PdP dan kreativiti guru	Kajian fokus pelajar sahaja
Sampel	Guru; pendidik; guru pelatih	Hanya pelajar
Metodologi	Empirikal; kajian kes; tinjauan sistematik	Teori tanpa data empirikal
Platform	<i>Minecraft Education Edition</i> atau <i>Minecraft</i> dalam pendidikan	Perbincangan teknikal tanpa kaitan pendidikan

Fasa Pengekstrakan Data

Fasa pengekstrakan data merupakan langkah penting dalam kajian literatur sistematik bagi memastikan maklumat yang diperolehi adalah relevan dan berkualiti tinggi. Dalam fasa ini, data daripada kajian yang telah dipilih melalui proses penapisan akan diekstrak secara sistematik untuk dianalisis. Proses pengekstrakan data dilakukan berdasarkan kriteria yang telah ditetapkan dan merangkumi maklumat utama seperti pengarang dan tahun penerbitan, negara kajian, tajuk kajian, pendekatan kajian, sumber data utama, sasaran responden, bilangan responden, serta instrumen kuantitatif yang digunakan dalam kajian tersebut. Jadual 2 menunjukkan proses pengekstrakan data ialah mengenal pasti kajian yang memenuhi kriteria inklusi yang telah ditetapkan dalam fasa sebelumnya. Kajian-kajian yang terpilih kemudian dikategorikan berdasarkan pendekatan kajian yang digunakan, sama ada kuantitatif, kualitatif, campuran, atau kajian literatur. Pendekatan ini membantu dalam memahami corak dan metodologi yang digunakan dalam kajian terdahulu mengenai penggunaan *Minecraft* dalam pendidikan.

Instrumen kuantitatif yang digunakan dalam kajian turut dikenalpasti bagi menilai keberkesanan penggunaan *Minecraft* dalam pengajaran dan pembelajaran. Beberapa kajian menggunakan ujian pra dan pasca untuk mengukur peningkatan kefahaman pelajar, manakala kajian lain menggunakan soal selidik yang disesuaikan daripada model sedia ada seperti STEM Career Interest Survey (STEM-CIS) dan Scientific Creativity Scale (SCS). Kajian-kajian yang menggunakan analisis statistik seperti SPSS, ANOVA, dan ujian-t juga memberikan sokongan empirikal yang kukuh terhadap keberkesanan *Minecraft* dalam pendidikan. Secara keseluruhannya, fasa pengekstrakan data ini membolehkan analisis sistematik dilakukan terhadap kajian-kajian terdahulu dengan memastikan setiap elemen yang relevan dikumpulkan dan disusun secara sistematik. Dengan cara ini, dapatan kajian dapat dirumuskan secara lebih terperinci bagi memahami sejauh mana pengetahuan dan kefahaman guru dalam kreativiti penggunaan *Minecraft* dalam pendidikan serta cabaran yang dihadapi dalam mengintegrasikan teknologi ini dalam pengajaran.

Jadual 2: Penemuan Artikel Penyelidikan Berdasarkan Kriteria Carian Yang Di Analisis

ID	Pengarang (Tahun)	Negara	Tajuk	Jenis Kajian / Dapatan Ringkas
A1	Al-Haqbani (2023)	Arab Saudi	Implementing Minecraft as a Tool to Teach Vocabulary	Eksperimen; peningkatan skor kosa kata
A2	Andersen & Rustad (2022)	Norway	Using Minecraft for collaboration Teachers	Mixed-methods; sokong pembelajaran kolaboratif
A3	Bar-El & Ringland (2021)	USA	designing lessons with MEE	Kualitatif; analisis 159 pelan pembelajaran
A4	Baek et al. (2020)	—	Minecraft for subject-specific skills	Kajian; pembinaan aset sejarah meningkatkan pemahaman
A5	Balnaves (2018)	—	Global engagement through Minecraft	Kajian; peningkatan penglibatan global pelajar
A6	Bayırtepe & Tüzün (2007)	—	Educational game effects	Kajian; motivasi dan pencapaian meningkat
A7	Fung et al. (2022)	USA	MEE pedagogical affordances	Kajian literatur; pedagogi digital disokong
A8	Hébert & Jenson (2021)	—	Open learning environments in Minecraft	Kajian; sokong kreativiti dan kolaborasi
A9	Jiea et al. (2021)	Malaysia	MEE and STREAM education	Kajian kes; peningkatan penglibatan pelajar
A10	Jensen & Hanghøj (2020)	Denmark	Math in Minecraft	DBR; pengalaman matematik pelajar bertambah baik
A11	Kjartansdóttir & Thorsteinsson (2022)	Iceland	Makerspace and ideation	Kualitatif; galakkan ideation dan kolaborasi
A12	Lincenberg & Eynon (2023)	Multinasional	Educator roles in Minecraft	Etnografi; peranan pendidik penting
A13	Ming (2024)	Malaysia	Evaluating MEE via Kirkpatrick	Mixed-methods; reaksi positif guru
A14	Nkadimeng & Ankiewicz (2022)	South Africa	Minecraft for atomic structure	Kualitatif; visualisasi konsep abstrak
A15	Partridge (2022)	Canada	Digital games-based learning review	Kajian literatur; 4Cs disokong
A16	Ritella & Marcone (2024)	Italy	Boundary-crossing practice	Kualitatif; integrasi formal dan tidak formal

A17	Sarı & Karakuş (2024)	Turkey	Minecraft in social studies	Kuasi-eksperimen; motivasi meningkat
A18	Saricam & Yildirim (2021)	Turkey	STEM and scientific creativity	Mixed-methods; minat STEM meningkat
A19	Shuhaimi et al. (2023)	Malaysia	MEE in Islamic education	Kuantitatif; kebolegunaan tinggi
A20	Slattery et al. (2023)	Ireland	Primary students' experiences	Mixed-methods; peluang kreativiti
A21	Slattery et al. (2024)	Ireland	Teachers' experiences with MEE	Kualitatif; cabaran teknikal dan kurikulum
A22	Sulaiman et al. (2024)	Malaysia	Teaching solar PV with Minecraft	Mixed-methods; pemahaman PV meningkat
A23	Tangkui & Keong (2021)	Malaysia	Conceptual framework for fractions	Kajian literatur; rangka kerja DGBL
A24	Zamziba et al. (2024)	Malaysia	Minecraft for Arabic learning	Tinjauan literatur; potensi pembelajaran bahasa

Jadual 3 memperincikan metodologi yang digunakan dalam kajian-kajian berkaitan dengan penggunaan Minecraft dalam pendidikan, dengan memberi tumpuan kepada sumber data utama, pendekatan kajian, serta instrumen kuantitatif yang digunakan. Sumber data utama yang digunakan dalam kajian ini merangkumi soal selidik, temu bual, gabungan soal selidik dan temu bual, serta tinjauan literatur meta-analisis dan tinjauan literatur bersistematik. Soal selidik merupakan salah satu instrumen yang paling kerap digunakan, terutamanya dalam kajian kuantitatif yang bertujuan untuk mengukur kefahaman, sikap, dan motivasi peserta terhadap penggunaan Minecraft dalam pendidikan. Temu bual pula sering digunakan dalam kajian kualitatif yang menumpukan kepada pengalaman serta persepsi guru dan pelajar terhadap aplikasi permainan ini dalam proses pembelajaran. Gabungan soal selidik dan temu bual digunakan dalam kajian campuran yang menggabungkan elemen kuantitatif dan kualitatif untuk mendapatkan data yang lebih menyeluruh mengenai impak Minecraft dalam pendidikan. Kajian kualitatif pula menumpukan kepada pemerhatian dan temu bual bagi mendapatkan perspektif mendalam mengenai pengalaman penggunaannya dalam bilik darjah. Kajian campuran menggabungkan elemen kedua-dua pendekatan ini bagi memperoleh dapatan yang lebih komprehensif. Dalam kajian kuantitatif, beberapa instrumen digunakan untuk mengukur pelbagai aspek pendidikan, antaranya STEM Career Interest Survey (STEM-CIS) bagi mengukur minat pelajar dalam bidang STEM, Scientific Creativity Scale (SCS) untuk menilai kreativiti saintifik, serta skala sikap dan motivasi dalam subjek tertentu. Analisis statistik seperti ujian-t dan ANOVA sering digunakan untuk menilai perbezaan signifikan antara kumpulan eksperimen dan kawalan. Kajian literatur pula menilai kajian-kajian terdahulu bagi mengenal pasti trend serta kelebihan dan cabaran dalam mengintegrasikan Minecraft dalam pendidikan. Gabungan pelbagai pendekatan ini menunjukkan bahawa penggunaan Minecraft

dalam pendidikan dikaji dari pelbagai sudut metodologi, sekali gus memberikan kefahaman yang lebih mendalam terhadap keberkesanannya sebagai alat pedagogi digital.

Jadual 3: Analisis Metodologi Dan Pendekatan Penyelidikan

ID	Pengarang (Tahun)	Negara	Metodologi Kajian	Pendekatan Penyelidikan	Instrumen / Sumber Data	Bilangan Responden
A1	Al-Haqbani (2023)	Arab Saudi	Eksperimen kuantitatif	Ujian pra & pasca	Soal selidik, pemerhatian	18 pelajar lelaki
A2	Andersen & Rustad (2022)	Norway	Kaedah campuran	Analisis rangkaian sosial & interaksi	Rakaman skrin, transkrip video	400 guru pelatih
A3	Bar-El & Ringland (2021)	USA	Kualitatif (grounded theory)	Analisis kandungan pelan pembelajaran	159 pelan pembelajaran guru	16 guru
A4	Baek et al. (2020)	Korea	Kajian kes	Projek pembinaan sejarah	Analisis hasil kerja pelajar	30 pelajar
A5	Balnaves (2018)	Australia	Kajian kes	Global engagement	Pemerhatian kelas, refleksi pelajar	25 pelajar
A6	Bayırtepe & Tüzün (2007)	Turki	Eksperimen kuantitatif	Game-based learning	Soal selidik motivasi & pencapaian	60 pelajar
A7	Fung, Smith & Gandolfi (2022)	USA	Kualitatif	Penerimaan guru pelatih	Temu bual, analisis kandungan	20 guru pelatih
A8	Hébert & Jenson (2021)	Kanada	Kajian kes	Open learning environments	Pemerhatian, analisis interaksi	40 pelajar
A9	Jiea et al. (2021)	Malaysia	Kajian kes	STREAM education	Temu bual guru, soal selidik pelajar	50 pelajar
A10	Jensen & Hanghøj (2020)	Denmark	Design-based research	Matematik dalam Minecraft	Analisis tugasan pelajar	35 pelajar
A11	Kjartansdóttir & Thorsteinsson (2022)	Iceland	Kualitatif	Makerspace ideation	Temu bual, pemerhatian	15 pelajar
A12	Lincenberg & Eynon (2023)	Multinasional	Etnografi	Peranan pendidik	Pemerhatian kelas, nota lapangan	12 guru
A13	Ming (2024)	Malaysia	Mixed-methods	Kirkpatrick model	Soal selidik, temu bual	80 guru
A14	Nkadimeng & Ankiewicz (2022)	Afrika Selatan	Kualitatif	Visualisasi struktur atom	Pemerhatian, analisis tugasan	25 pelajar
A15	Partridge (2022)	Kanada	Kajian literatur	4Cs dalam pendidikan	Analisis dokumen	—



A16	Ritella & Marcone (2024)	Itali	Kualitatif	Boundary-crossing practice	Temu bual, analisis interaksi	20 pelajar
A17	Sarı & Karakuş (2024)	Turki	Kuasi-eksperimen	Kajian sosial	Ujian pra & pasca, soal selidik	45 pelajar
A18	Saricam & Yildirim (2021)	Turki	Mixed-methods	STEM & kreativiti saintifik	STEM-CIS, SCS	100 pelajar
A19	Shuhaimi et al. (2023)	Malaysia	Kuantitatif	Pendidikan Islam	Soal selidik kebolehgunaan	120 pelajar
A20	Slaterry et al. (2023)	Ireland	Mixed-methods	Pengalaman murid sekolah rendah	Temu bual, soal selidik	60 pelajar
A21	Slaterry et al. (2024)	Ireland	Kualitatif	Pengalaman guru	Temu bual mendalam	25 guru
A22	Sulaiman et al. (2024)	Malaysia	Mixed-methods	Tenaga solar PV	Ujian pra & pasca, soal selidik	80 pelajar
A23	Tangkui & Keong (2021–2024)	Malaysia	Kajian literatur & eksperimen	Matematik (pecahan, perimeter, HOTS)	Ujian pra & pasca, analisis literatur	100 pelajar
A24	Zamziba et al. (2024)	Malaysia	Kajian literatur	Bahasa Arab	Analisis dokumen	—

Dapatan Kajian

Dapatan kajian literatur sistematik ini menganalisis penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti mengajar terhadap pelajar, meningkatkan kreativiti dalam pendidikan. Berdasarkan 24 artikel yang dikaji, beberapa tema utama dapat dikenalpasti. Secara keseluruhan, kajian seperti Ming (2024) dan Jiea et al. (2021) menunjukkan bahawa Minecraft Education Edition telah membantu meningkatkan kemahiran pedagogi digital dalam kalangan guru dan membangunkan kreativiti dalam pembelajaran pelajar. Selain itu, Slaterry et al. (2024) menegaskan bahawa guru melihat Minecraft sebagai alat yang dapat menyokong pembelajaran abad ke-21, terutama dalam aspek kolaborasi dan inovasi pedagogi. Namun, walaupun banyak kajian membincangkan kelebihan Minecraft dalam pendidikan, terdapat kekurangan kajian yang menilai sejauh mana tahap pemahaman dan kesiapsiagaan guru dalam mengadaptasi teknologi ini ke dalam kurikulum mereka secara berkesan. Sebahagian besar kajian seperti Bar-El dan Ringland (2021) dan Fung, Smith dan Gandolfi (2022) hanya meneliti bagaimana guru menggunakan Minecraft sebagai alat pengajaran tetapi tidak membincangkan secara mendalam kefahaman penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti yang bersesuaian dengan pendekatan pedagogi mereka untuk menyokong pembelajaran berasaskan permainan. Selain itu, kajian oleh Slaterry et al. (2023) dan Andersen dan Rustad (2022) membincangkan bagaimana Minecraft boleh menyokong pembelajaran kolaboratif dan komunikasi, tetapi masih belum jelas sejauh mana penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti mengajar terhadap pelajar dengan mengenali strategi terbaik untuk memanfaatkan permainan ini dalam pendidikan formal.



Kesimpulannya, kajian ini mendapati bahawa walaupun banyak penyelidikan membincangkan manfaat Minecraft dalam meningkatkan kreativiti dan pembelajaran kolaboratif, terdapat jurang dalam kajian mengenai penggunaan Minecraft dalam pembelajaran dan pengajaran dan kreativiti mengajar terhadap pelajar dengan kefahaman guru dalam menggunakan Minecraft secara berkesan. Sebilangan besar kajian seperti Al-Haqbani (2023), Nkadimeng dan Ankievicz (2022), dan Ritella dan Marcone (2024) hanya menumpukan kepada pengalaman pelajar tanpa membincangkan persiapan atau latihan yang diperlukan oleh guru untuk menggunakan Minecraft dalam pembelajaran. Oleh itu, Kajian masa depan juga perlu menilai keberkesanan latihan profesional bagi guru dalam meningkatkan kefahaman guru mengenai pedagogi digital serta bagaimana Minecraft boleh disepadukan secara lebih sistematik dalam pendidikan formal bagi meningkatkan kreativiti mengajar terhadap pelajar.

Perbincangan

Berdasarkan analisis sistematik terhadap 24 kajian terdahulu mengenai penggunaan Minecraft dalam pendidikan, dapatan menunjukkan bahawa permainan digital ini mempunyai potensi besar dalam meningkatkan kreativiti, pemikiran kritis, dan pembelajaran kolaboratif dalam kalangan pelajar. Kajian seperti Jiea et al. (2021) dan Ming (2024) mendapati bahawa Minecraft Education Edition membantu guru menguasai kemahiran pedagogi digital dan menyesuaikan diri dengan pendekatan pembelajaran berasaskan permainan, terutamanya dalam era pendidikan abad ke-21. Kajian oleh Slattery et al. (2024) juga menunjukkan bahawa guru melihat Minecraft sebagai alat yang berkesan dalam membangunkan kemahiran pelajar, namun terdapat jurang pengetahuan dalam memahami kefahaman dan persediaan guru dalam menggunakannya secara sistematik dalam bilik darjah. Walaupun banyak kajian menekankan manfaat permainan ini, terdapat kekurangan kajian yang secara langsung menilai bagaimana latihan dan bimbingan boleh meningkatkan kreativiti guru dalam mengintegrasikan Minecraft ke dalam kurikulum dan seterusnya terhadap pelajar. Implikasi kajian ini adalah keperluan untuk menyediakan latihan profesional yang lebih mendalam kepada pendidik agar mereka dapat memanfaatkan Minecraft dengan lebih berkesan. Oleh itu, kajian masa depan perlu menumpukan kepada aspek pembangunan profesional guru serta strategi terbaik untuk memastikan integrasi Minecraft dalam bilik darjah dapat berjalan dengan lancar dan memberikan impak yang positif kepada kreativiti guru dan pelajar.

Kesimpulan

Kajian ini meneliti penggunaan Minecraft dalam pembelajaran dan pengajaran serta kreativiti mengajar terhadap pelajar sebagai alat pembelajaran untuk meningkatkan kualiti kreativiti guru dalam pendidikan. Dapatan daripada 24 artikel menunjukkan bahawa Minecraft Education Edition mempunyai potensi besar dalam membantu guru mengadaptasi pendekatan pengajaran berasaskan permainan serta membangunkan kemahiran pedagogi digital mereka. Guru mendapati Minecraft berkesan dalam merangsang kreativiti guru dan pelajar, meningkatkan pemikiran kritis pelajar, dan menyokong pembelajaran kolaboratif. Pada masa yang sama penggunaan Minecraft di dalam bilik darjah dapat meningkatkan motivasi pelajar untuk belajar dengan medium baru serta meningkatkan kreativiti pelajar dalam penghasilan pelbagai inovasi baru dalam dunia pendidikan serta melahirkan pelajar yang boleh berkolaboratif dan



komunikasi. Kajian ini juga mendapati bahawa kebanyakan kajian terdahulu lebih menumpukan kepada perspektif pelajar dan keberkesanan Minecraft dalam pendidikan, berbanding menilai secara mendalam kefahaman guru serta kesiapsiagaan mereka dalam menggunakannya secara sistematik. Oleh itu, kajian masa depan perlu memberi tumpuan kepada strategi latihan profesional yang lebih efektif bagi meningkatkan kecekapan guru dalam mengintegrasikan Minecraft dalam bilik darjah serta mengkaji cabaran sebenar yang dihadapi dalam pelaksanaan pedagogi digital berasaskan permainan.

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MASALAH DAN PUNCA KEBIMBANGAN (ANXIETY) DALAM KALANGAN PELAJAR SEKOLAH MENENGAH: TINJAUAN LITERATUR SISTEMATIK

Halimatul Fatimah Ibrahim^{1,2}, Faridah Mydin Kutty¹, Shahlan Surat¹

¹Fakulti Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia,
(faridah_mydin@ukm.edu.my, drshahlan@ukm.edu.my, p145074@siswa.ukm.edu.my)

²Lembaga Peperiksaan, Kementerian Pendidikan Malaysia

Abstract: *Kebimbangan (anxiety) dalam kalangan pelajar sekolah menengah merupakan isu kesihatan mental global yang kritikal, menyumbang secara signifikan kepada beban penyakit serta menjejaskan pencapaian akademik dan kesejahteraan psikososial remaja. Kajian Tinjauan Literatur Sistemik (SLR) ini dilaksanakan dengan mengaplikasikan pendekatan Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) bagi mengenal pasti masalah, punca, dan pola kebimbangan berdasarkan 27 artikel empirikal terpilih yang diterbitkan antara tahun 2020 hingga 2025. Analisis kritis dilakukan terhadap lima domain utama iaitu lokasi geografi kajian, profil demografi sampel, reka bentuk metodologi, dapatan utama berkaitan etiologi kebimbangan, serta keberkesanan strategi intervensi. Dapatan kajian mendedahkan bahawa etiologi kebimbangan adalah multifaktorial, merangkumi tekanan akademik dan ketakutan kegagalan peperiksaan, dinamika sosial seperti buli dan mangsa siber (cyber-victimization), ketidakfungsian keluarga, serta faktor makro-persekitaran seperti pandemik COVID-19 dan konflik geopolitik. Selain itu, kebimbangan teknologi (AI anxiety) muncul sebagai dimensi baharu seiring dengan integrasi Kecerdasan Buatan dalam pendidikan. Dari aspek intervensi, pendekatan seperti Terapi Tingkah Laku Emotif Rasional (REBT) dan program kesedaran (mindfulness) menunjukkan keberkesanan yang signifikan. Kajian ini merumuskan bahawa pendekatan holistik yang mengintegrasikan sokongan keluarga, sekolah, dan dasar pendidikan diperlukan untuk menangani krisis ini dengan lebih berkesan*

Keywords: *Kebimbangan; Pelajar Sekolah Menengah; PRISMA; Punca Kebimbangan; Intervensi Psikologi*

Abstract: *Anxiety among secondary school students is a critical global mental health issue, contributing significantly to the disease burden and adversely affecting adolescents' academic achievement and psychosocial well-being. This Systematic Literature Review (SLR) employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach to identify problems, causes, and patterns of anxiety based on 27 selected empirical articles published between 2020 and 2025. Critical analysis was conducted across five key domains: geographic location of studies, demographic profiles of samples, methodological designs, key findings related to the etiology of anxiety, and the effectiveness of intervention strategies. The findings reveal that the etiology of anxiety is multifactorial, encompassing academic pressure and fear of failure, social dynamics such as bullying and cyber-victimization, family dysfunction, as well as macro-environmental factors like the COVID-19 pandemic and*



geopolitical conflicts. Furthermore, technological anxiety (AI anxiety) has emerged as a new dimension accompanying the integration of Artificial Intelligence in education. In terms of interventions, approaches such as Rational Emotive Behavior Therapy (REBT) and mindfulness programs have demonstrated significant effectiveness. This study concludes that a holistic approach integrating family, school, and educational policy support is required to address this crisis effectively.

Keywords: *Anxiety, Secondary School Students, PRISMA, Causes of Anxiety, Psychological Intervention*

Pengenalan

Kesihatan mental remaja kini menjadi agenda utama dalam wacana kesihatan awam di peringkat global. Kebimbangan atau *anxiety* dilaporkan sebagai gangguan psikiatri yang paling lazim dalam kalangan pelajar sekolah menengah dan sering kali bertindak sebagai gerbang kepada masalah kesihatan mental yang lebih serius, termasuk kemurungan dan tingkah laku bunuh diri. Secara klinikal, kebimbangan merujuk kepada respons emosi dan fisiologi yang berlebihan terhadap persepsi ancaman atau ketidakpastian yang berpotensi melumpuhkan fungsi harian individu. Dalam konteks pendidikan, manifestasi kebimbangan sering dilihat melalui ketakutan melampau terhadap penilaian akademik, interaksi sosial, dan ketidaktentuan masa depan (Liu et al., 2024).

Data empirikal daripada kajian *Global Burden of Disease* (GBD) yang menganalisis trend sepanjang 30 tahun (1990-2019) menunjukkan bahawa walaupun terdapat variasi mengikut wilayah, insiden gangguan kebimbangan dalam kalangan remaja di kebanyakan negara terus mencatatkan peningkatan. Peningkatan ini didorong oleh faktor sosial dan persekitaran yang berubah dengan pantas. Isu ini bukan lagi sekadar masalah individu, tetapi telah menjadi penyumbang utama kepada tahun hayat pelarasan tunaupaya (*Disability-Adjusted Life Years* atau DALYs) dalam kalangan golongan muda (Liu et al., 2024).

Di Malaysia, status kesihatan mental pelajar sekolah menengah berada pada tahap yang membimbangkan. Statistik terkini bagi tahun 2024 dan 2025 daripada Kementerian Pendidikan Malaysia (KPM) serta agensi berkaitan menggambarkan krisis yang sedang memuncak. Kajian persepsi mendedahkan bahawa sebahagian besar responden menganggap kesihatan mental sebagai cabaran utama generasi muda negara ini. Lebih kritikal lagi, laporan mengenai calon Sijil Pelajaran Malaysia (SPM) mendapati sebahagian besar pelajar gagal melepasi saringan kesihatan mental dengan tahap normal, manakala bakinya menunjukkan tanda-tanda stres, kebimbangan, atau kemurungan yang memerlukan intervensi segera.

Walaupun terdapat pelbagai kajian mengenai kebimbangan, literatur sedia ada sering bersifat terpecah-pecah (*fragmented*). Kajian tempatan cenderung memfokuskan kepada aspek spesifik seperti kebimbangan pembelajaran bahasa (*Language Learning Anxiety*) (Idrus, 2021), manakala kajian antarabangsa meneroka dimensi baharu seperti kebimbangan perubahan iklim (*Eco-Anxiety*) dan kebimbangan teknologi (*AI Anxiety*). Oleh itu, terdapat keperluan mendesak untuk mensintesis bukti-bukti empirikal terkini (2020-2025) melalui Tinjauan Literatur



Sistematik (SLR) bagi memahami spektrum penuh etiologi kebimbangan pasca-pandemik. Kajian ini bertujuan untuk mengisi jurang tersebut dengan menganalisis secara kritis corak, punca, dan intervensi yang berkesan sebagai panduan kepada pemegang taruh pendidikan.

Tinjauan Literatur

Kebimbangan dalam kalangan remaja sering dikaitkan dengan pelbagai faktor ekstrinsik dan intrinsik. Teori Ekologi Bronfenbrenner sering diaplikasikan sebagai kerangka untuk memahami bagaimana interaksi antara individu dengan persekitaran mikrosistem (keluarga, sekolah) dan makrosistem (budaya, dasar kerajaan) mempengaruhi kesihatan mental.

Dalam konteks akademik, "kebimbangan ujian" (*Test Anxiety*) adalah fenomena yang didokumentasikan secara meluas di mana pelajar mengalami ketakutan kegagalan yang melumpuhkan sebelum atau semasa penilaian (Alhassan et al., 2025). Kajian terdahulu juga menunjukkan hubungan timbal balik antara buli (termasuk buli siber) dengan kebimbangan sosial. Pelajar yang menjadi mangsa buli cenderung mempunyai harga diri yang rendah dan tahap kebimbangan yang tinggi, yang seterusnya menjadikan mereka sasaran mudah untuk penderaan lanjut (Álvarez-García et al., 2025).

Selain itu, kemunculan teknologi baharu telah memperkenalkan konsep "kebimbangan teknologi". Dengan penggunaan Kecerdasan Buatan (AI) yang semakin meluas dalam pendidikan, wujud kegelisahan dalam kalangan pelajar mengenai keupayaan mereka untuk mengadaptasi alat baharu ini, yang dikenali sebagai *AI anxiety* (Wen et al., 2024). Faktor kefungsi keluarga (*Family Functioning*) juga sering dibincangkan sebagai pemboleh ubah moderator yang kritikal; keluarga yang harmoni dapat bertindak sebagai pelindung, manakala konflik keluarga memburukkan lagi simptom kebimbangan (Cruzado-Gálvez & Tirado Bocanegra, 2025).

Metodologi

Kajian ini menggunakan pendekatan *Systematic Literature Review* (SLR) berpandukan garis panduan PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*). PRISMA dipilih kerana ia menyediakan kerangka kerja yang sistematik dan telus untuk pengenalan, penyaringan, dan kelayakan artikel, bagi memastikan kebolehpercayaan dapatan kajian.

Strategi Carian

Proses carian dilakukan secara komprehensif menggunakan pangkalan data elektronik utama termasuk Scopus, Web of Science (WoS), ScienceDirect, dan Google Scholar. Kata kunci carian dibina menggunakan Operator Boolean untuk memaksimumkan relevansi, antaranya gabungan istilah "anxiety", "secondary school students", "causes", "factors", dan "intervention".

Kriteria Pemilihan



Kriteria penerimaan artikel dihadkan kepada penerbitan antara tahun 2020 hingga 2025 bagi memastikan data yang diperoleh adalah terkini dan relevan dengan konteks pasca-pandemik. Artikel yang dipilih mestilah merupakan kajian empirikal (kuantitatif, kualitatif, atau kaedah gabungan) yang mempunyai teks penuh dan diterbitkan dalam Bahasa Melayu atau Bahasa Inggeris. Artikel berbentuk ulasan buku, pendapat, atau prosiding yang tidak melalui proses wasit dikecualikan. Daripada hasil carian awal, sebanyak 27 artikel telah melepasi proses penyaringan dan penilaian kualiti untuk dianalisis dalam sintesis akhir.

Dapatan Kajian

Analisis terhadap 27 artikel terpilih menunjukkan bahawa kebimbangan pelajar sekolah menengah adalah fenomena global dengan nuansa tempatan yang tersendiri. Dapatan dibahagikan kepada profil kajian dan tema-tema utama etiologi serta intervensi.

Profil Kajian dan Taburan Geografi

Penyelidikan mengenai kebimbangan pelajar dijalankan secara meluas di pelbagai benua. Kajian di Asia (Malaysia, China, India, Vietnam) sangat dominan dan sering memfokuskan kepada tekanan akademik akibat sistem peperiksaan berpusat (Dao, 2025; Rehman, 2025). Di Eropah (Sepanyol, Norway), penyelidikan lebih tertumpu kepada aspek kesejahteraan psikososial dan buli siber (Hafstad et al., 2021). Manakala kajian di kawasan konflik (Ukraine, Palestin) memberikan data kritikal mengenai kebimbangan reaktif (Reactive Anxiety) akibat ancaman keselamatan fizikal (Budnyk et al., 2024).

Tekanan Akademik dan Ketakutan Kegagalan

Faktor akademik kekal sebagai penyumbang utama kebimbangan. Kajian mendapati korelasi positif yang signifikan antara kebimbangan ujian dengan prestasi akademik yang rendah. Di India dan Nigeria, "fobia matematik" dikenal pasti sebagai punca utama kebimbangan spesifik. Guru melaporkan bahawa gaya pengajaran berpusatkan guru dan beban sukatan pelajaran menyumbang kepada ketakutan pelajar terhadap subjek ini (Begum, 2024; Mosimege et al., 2024). Di Malaysia, kebimbangan pembelajaran bahasa Inggeris dalam kalangan pelajar luar bandar berpunca daripada rasa takut terhadap penilaian negatif rakan sebaya (Idrus, 2021).

Dinamika Sosial dan Keluarga

Hubungan interpersonal memainkan peranan kritikal dalam membentuk kesihatan mental remaja. Kajian membuktikan hubungan timbal balik antara kebimbangan dan mangsa siber (Cyber-Victimization). Kebimbangan tinggi menjadikan pelajar sasaran mudah, dan menjadi mangsa meningkatkan lagi kebimbangan (Álvarez-García et al., 2025). Di Peru, dapatan menunjukkan bahawa fungsi keluarga yang positif dicirikan oleh komunikasi baik dan sokongan emosi bertindak sebagai moderator yang melindungi pelajar daripada kesan negatif buli (Cruzado-Gálvez & Tirado Bocanegra, 2025). Sebaliknya, konflik keluarga dan status ibu bapa tunggal dikenal pasti sebagai faktor risiko utama.



Faktor Persekitaran dan Krisis Global

Kajian pasca-2020 menangkap impak peristiwa makro terhadap psikiatri remaja. Penutupan sekolah dan pembelajaran dalam talian semasa pandemik COVID-19 meningkatkan rasa terasing (Radwan et al., 2021). Di kawasan konflik seperti Ukraine, pelajar mengalami peningkatan mendadak dalam kebimbangan reaktif. Selain itu, satu dimensi baharu dikesan di Kenya, di mana remaja melaporkan gangguan emosi akibat kebimbangan terhadap perubahan iklim atau eco-anxiety (Mutua et al., 2023).

Teknologi dan Kebimbangan AI

Dalam era digital, teknologi turut menjadi punca kebimbangan. Kajian di China mendapati wujudnya kebimbangan terhadap Kecerdasan Buatan dalam pembelajaran (AI anxiety). Analisis menunjukkan bahawa faktor Jangkaan Usaha (Effort Expectancy), iaitu persepsi tentang betapa sukarnya menggunakan sistem dan Keadaan Kemudahan (Facilitating Conditions) mempengaruhi tahap kebimbangan dan penerimaan teknologi ini (Wen et al., 2024).

Jadual 1: Ringkasan Artikel Terpilih

Pengarang (Tahun)	Negara	Sampel	Dapatan Utama
Alhassan et al. (2025)	Ghana	354 Pelajar	Hubungan negatif signifikan antara kebimbangan ujian dan prestasi akademik.
Álvarez-García et al. (2025)	Sepanyol	268 Pelajar	Hubungan timbal balik antara kebimbangan dan mangsa buli siber (<i>cyber-victimization</i>).
Begum (2024)	India	30 Guru	Fobia matematik berpunca daripada gaya pengajaran berpusatkan guru.
Cruzado-Gálvez & Tirado (2025)	Peru	555 Pelajar	Fungsi keluarga bertindak sebagai moderator mengurangkan kesan buli terhadap kebimbangan.
Idrus (2021)	Malaysia	311 Pelajar	Kebimbangan bahasa Inggeris tinggi dalam kalangan pelajar luar bandar.



Mosimege et al. (2024)	Nigeria	118 Pelajar	Terapi REBT berkesan mengurangkan kebimbangan matematik.
Nurhidayah et al. (2025)	Malaysia	Literatur	<i>Mindfulness</i> berkesan mengurangkan stres akademik pelajar.
Wen et al. (2024)	China	293 Pelajar	Kebimbangan AI (<i>AI Anxiety</i>) dipengaruhi oleh jangkaan usaha dan pengaruh sosial.

Sumber: Analisis Penulis (2025)

Perbincangan

Dapatan kajian menunjukkan bahawa punca kebimbangan pelajar adalah kompleks dan berlapis, tidak boleh dilihat dari sudut akademik semata-mata. Interaksi mikrosistem seperti gaya pengajaran guru dan sokongan keluarga bergabung dengan faktor makrosistem seperti pandemik dan perubahan teknologi untuk membentuk tahap kebimbangan pelajar.

Di Malaysia, dapatan ini selari dengan laporan media dan statistik KPM yang menunjukkan peningkatan isu kesihatan mental. Tekanan peperiksaan SPM bertembung dengan peningkatan kes buli dan ketidaktentuan masa depan, menghasilkan persekitaran yang kondusif untuk gangguan kebimbangan. Pelajar yang mengalami kebimbangan tinggi cenderung mengamalkan strategi daya tindak penghindaran (*Avoidance Coping*), seperti ponteng sekolah atau menangguhkan tugas, yang memburukkan lagi pencapaian akademik mereka.

Dari aspek intervensi, dapatan kajian menonjolkan potensi Terapi Tingkah Laku Emotif Rasional (REBT) dan *mindfulness*. REBT berfungsi dengan mencabar kepercayaan tidak rasional pelajar, manakala *mindfulness* melatih pelajar untuk fokus pada masa kini dan mengurangkan ruminasi (Nurhidayah et al., 2025). Kedua-dua pendekatan ini boleh diintegrasikan dalam persekitaran sekolah. Selain itu, dalam konteks teknologi, memahami faktor "Jangkaan Usaha" adalah kritikal; pelajar perlu dibekalkan dengan kemahiran dan sokongan infrastruktur yang mencukupi untuk mengurangkan kebimbangan berkaitan penggunaan AI dalam pendidikan.

Kesimpulan

Kajian ini menyimpulkan bahawa kebimbangan dalam kalangan pelajar sekolah menengah adalah isu multifaktorial yang memerlukan perhatian serius. Punca utamanya merangkumi tekanan akademik, ketidakfungsian keluarga, dinamika sosial negatif seperti buli, dan ancaman persekitaran global. Kebimbangan ini memberi impak negatif terhadap pencapaian akademik dan boleh membawa kepada masalah kesihatan mental jangka panjang.



Berdasarkan dapatan, adalah dicadangkan supaya Kementerian Pendidikan Malaysia memperkukuhkan pelaksanaan Program Minda Sihat di semua sekolah dengan saringan berkala yang lebih komprehensif. Sekolah disarankan mengintegrasikan teknik pengurusan stres seperti latihan pernafasan dan *mindfulness* ke dalam rutin harian. Selain itu, program keibubapaan perlu menekankan peranan fungsi keluarga sebagai pelindung emosi, dan guru perlu dilatih untuk mengenali simptom kebimbangan serta membezakannya daripada masalah disiplin. Kajian lanjutan berbentuk longitudinal amat diperlukan dalam konteks tempatan untuk memahami trajektori kebimbangan pelajar Malaysia dari masa ke masa.

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HUBUNGAN TAHAP SELF-ESTEEM DAN STATUS SOSIOEKONOMI TERHADAP KEBIMBANGAN MURID SEKOLAH RENDAH

Nur Umairah Nazirah Mazlan^{1,2}, Faridah Mydin Kutty¹, Shahlan Surat¹

¹Fakulti Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia,
(faridah_mydin@ukm.edu.my, drshahlan@ukm.edu.my, p145075@siswa.ukm.edu.my)

²SK Bandar UDA 2, Johor Bahru, Johor.

Abstract: Kajian ini bertujuan untuk meneliti hubungan antara tahap self-esteem dan status sosioekonomi (SES) terhadap tahap kebimbangan murid sekolah rendah di Malaysia. Reka bentuk kajian kuantitatif berbentuk korelasi digunakan melibatkan seramai 350 orang murid Tahun 5 dan Tahun 6 dari beberapa buah Sekolah Kebangsaan di daerah Johor Bahru. Instrumen soal selidik digunakan bagi mengukur tahap self-esteem, status sosioekonomi dan kebimbangan murid, manakala data dianalisis menggunakan statistik deskriptif, korelasi Pearson dan regresi linear berganda. Dapatan kajian menunjukkan bahawa tahap self-esteem murid berada pada tahap sederhana, manakala tahap kebimbangan berada pada tahap sederhana ke rendah. Analisis korelasi Pearson menunjukkan wujud hubungan yang signifikan dan negatif antara self-esteem dan kebimbangan murid, serta antara status sosioekonomi dan kebimbangan murid. Analisis korelasi berganda menunjukkan bahawa self-esteem dan status sosioekonomi secara serentak mempunyai hubungan yang signifikan dengan kebimbangan murid dengan nilai pekali korelasi berganda $R = 0.53$ dan nilai signifikan $p < .001$. Nilai $R^2 = 0.28$ menunjukkan bahawa 28% varians dalam tahap kebimbangan murid dapat dijelaskan secara bersama oleh tahap self-esteem dan status sosioekonomi. Kesimpulannya, kajian ini menegaskan bahawa faktor psikologi dalaman dan faktor struktur keluarga memainkan peranan penting dalam membentuk kesejahteraan emosi murid sekolah rendah, sekali gus menyokong keperluan intervensi awal yang menumpukan kepada pengukuhan self-esteem serta sokongan kepada murid daripada latar belakang sosioekonomi rendah bagi mengurangkan kebimbangan dan meningkatkan kesejahteraan psikososial murid.

Keywords: Harga Diri; Status Sosioekonomi; Kebimbangan; Murid Sekolah Rendah; Kesejahteraan Emosi

Abstract: This study aimed to examine the relationship between self-esteem, socioeconomic status (SES), and anxiety levels among Malaysian primary school students. A quantitative correlational research design was employed involving 350 Year 5 and Year 6 students from several national primary schools in Johor Bahru. A questionnaire survey was used to measure self-esteem, socioeconomic status, and students' anxiety, while the data were analyzed using descriptive statistics, Pearson correlation, and multiple linear regression. The findings revealed that students' self-esteem levels were at a moderate level, while their anxiety levels ranged from moderate to low. Pearson correlation analysis indicated a significant and negative relationship between self-esteem and anxiety, as well as between socioeconomic status and anxiety. Multiple correlation analysis showed that self-esteem and socioeconomic status jointly had a significant relationship with students' anxiety, with a multiple correlation



coefficient of $R = 0.53$ and a significance value of $p < .001$. The coefficient of determination ($R^2 = 0.28$) indicated that 28% of the variance in students' anxiety could be explained collectively by self-esteem and socioeconomic status. In conclusion, this study highlights the importance of both internal psychological factors and structural family factors in shaping the emotional well-being of primary school students and supports the need for early interventions focusing on strengthening self-esteem and providing support for students from lower socioeconomic backgrounds to reduce anxiety and enhance their psychosocial well-being.

Keywords: *Self-Esteem; Socioeconomic Status; Anxiety; Primary School Students; Emotional Well-Being*

Pengenalan

Kesejahteraan emosi murid sekolah rendah semakin menjadi fokus utama dalam landskap pendidikan semasa yang menekankan pembangunan murid secara holistik. Kebimbangan yang dialami sejak usia awal boleh menjejaskan tumpuan pembelajaran, hubungan sosial dan perkembangan sendiri murid (Weems & Stickle, 2022). Walaupun kebimbangan sering dikaitkan dengan faktor dalaman seperti temperamen dan regulasi emosi, kajian kontemporari menunjukkan bahawa self-esteem dan status sosioekonomi (SES) merupakan faktor penting yang mempengaruhi kebimbangan murid secara signifikan (Orth & Robins, 2022; Reardon, 2019).

Self-esteem merujuk kepada penilaian sendiri individu terhadap nilai dan kebolehan diri (Rosenberg, 1965). Murid dengan self-esteem rendah cenderung mentafsir situasi akademik dan sosial sebagai mengancam, sekali gus meningkatkan risiko kebimbangan. Dalam masa yang sama, SES keluarga membentuk konteks perkembangan murid melalui akses kepada sumber pembelajaran, kestabilan emosi keluarga dan kualiti sokongan ibu bapa (Bradley & Corwyn, 2002).

Dalam konteks Malaysia, kajian yang meneliti hubungan serentak antara self-esteem, SES dan kebimbangan murid sekolah rendah masih terhad. Kebanyakan kajian lebih menumpukan pencapaian akademik berbanding kesejahteraan emosi murid. Oleh itu, kajian ini dijalankan untuk mengisi jurang penyelidikan dengan meneliti hubungan antara self-esteem, status sosioekonomi dan kebimbangan murid sekolah rendah secara empirik.

Tinjauan Literatur

Sorotan literatur menunjukkan bahawa kebimbangan murid sekolah rendah merupakan konstruk psikologi multidimensi yang merangkumi kebimbangan akademik, sosial dan emosi umum (Weems & Stickle, 2022). Kebimbangan yang berpanjangan boleh menjejaskan kesejahteraan emosi dan pencapaian murid (Essau & Ollendick, 2013).

Self-esteem dikenal pasti sebagai faktor pelindung psikologi yang penting. Murid dengan self-esteem tinggi menunjukkan keupayaan regulasi emosi yang lebih baik dan kurang cenderung



mengalami kebimbangan (Orth & Robins, 2022). Kajian empirik menunjukkan hubungan negatif yang signifikan antara self-esteem dan kebimbangan (Muris et al., 2003).

Status sosioekonomi pula mempengaruhi persekitaran perkembangan murid melalui tekanan keluarga, sokongan pembelajaran dan kestabilan emosi (Conger & Donnellan, 2007). Murid daripada keluarga ber-SES rendah didapati lebih terdedah kepada kebimbangan akibat tekanan persekitaran dan keterbatasan sumber (Reiss, 2013).

Literatur kontemporari turut menekankan bahawa self-esteem dan SES saling berkait dalam membentuk kesejahteraan emosi murid. Self-esteem bertindak sebagai mekanisme psikologi yang menerjemahkan pengalaman sosioekonomi kepada pengalaman emosi murid (Yoshikawa et al., 2012). Walau bagaimanapun, kajian yang menilai ketiga-tiga konstruk ini secara serentak dalam konteks murid sekolah rendah masih terhad, khususnya di Malaysia.

Metodologi

Kajian ini menggunakan reka bentuk kuantitatif berbentuk korelasi. Sampel kajian terdiri daripada 350 orang murid Tahun 5 dan Tahun 6 dari beberapa buah Sekolah Kebangsaan di daerah Johor Bahru. Teknik pensampelan rawak berkelompok digunakan bagi memilih sekolah dan responden kajian. Prosedur pengumpulan data dimulakan dengan mendapatkan kelulusan daripada pihak pentadbiran sekolah serta kebenaran bertulis daripada ibu bapa atau penjaga murid. Pengkaji seterusnya menjalankan sesi taklimat ringkas kepada murid bagi menerangkan tujuan kajian, cara menjawab soal selidik serta jaminan kerahsiaan maklumat. Soal selidik diedarkan secara bersemuka kepada murid di dalam bilik darjah dan dikumpulkan semula pada hari yang sama selepas selesai dijawab bagi memastikan kadar maklum balas yang tinggi dan mengurangkan risiko kehilangan data.

Instrumen kajian ini terdiri daripada tiga komponen utama, iaitu skala self-esteem, soal selidik status sosioekonomi keluarga dan skala kebimbangan kanak-kanak. Skala self-esteem diadaptasi daripada Rosenberg Self-Esteem Scale yang dibangunkan oleh Rosenberg (1965) bagi mengukur penilaian sendiri murid terhadap nilai dan harga diri mereka secara keseluruhan. Soal selidik status sosioekonomi keluarga pula dibina untuk mengumpul maklumat berkaitan latar belakang sosioekonomi murid, merangkumi pendapatan isi rumah, tahap pendidikan ibu bapa dan status pekerjaan penjaga, yang mencerminkan kedudukan sosioekonomi keluarga murid. Sementara itu, skala kebimbangan kanak-kanak diadaptasi daripada Revised Children's Manifest Anxiety Scale (RCMAS) yang dibangunkan oleh Reynolds dan Richmond (2008), yang digunakan secara meluas untuk menilai tahap kebimbangan dalam kalangan kanak-kanak. Kesemua instrumen ini telah melalui proses pengubahsuaian bahasa dan kesesuaian konteks bagi memastikan kefahaman murid sekolah rendah di Malaysia, serta mengekalkan kesahan dan kebolehpercayaan pengukuran. Data dianalisis menggunakan perisian SPSS melibatkan statistik deskriptif, korelasi Pearson dan regresi linear berganda bagi menilai hubungan dan sumbangan peramal.



Dapatan Kajian **Profil Responden**

Jadual 1 menunjukkan taburan responden mengikut jantina. Daripada keseluruhan 350 orang murid, majoriti adalah murid perempuan, diikuti oleh murid lelaki.

Jadual 1: Taburan Responden Mengikut Jantina (N = 350)

Jantina	Kekerapan	Peratus (%)
Lelaki	170	48.6
Perempuan	180	51.4
Jumlah	350	100.0

Tahap Self-Esteem

Jadual 2 menunjukkan statistik deskriptif tahap self-esteem murid sekolah rendah. Dapatan menunjukkan bahawa skor min self-esteem berada pada tahap sederhana.

Jadual 2: Statistik Deskriptif Tahap Self-Esteem

Pemboleh Ubah	N	Min	Sisihan Piawai
Self-esteem	350	3.42	0.58

Jadual 3 menunjukkan pengelasan tahap self-esteem murid sekolah rendah. Majoriti murid berada pada tahap self-esteem sederhana.

Jadual 3 : Pengelasan Tahap Self-Esteem

Tahap	Kekerapan	Peratus (%)
Rendah	72	20.6
Sederhana	208	59.4
Tinggi	70	20.0
Jumlah	350	100.0

Status Sosioekonomi (SES)

Jadual 4 menunjukkan statistik deskriptif status sosioekonomi murid sekolah rendah.

Jadual 4: Statistik Deskriptif Status Sosioekonomi

Pemboleh Ubah	N	Min	Sisihan Piawai
SES	350	2.96	0.67

Jadual 5 menunjukkan pengelasan tahap status sosioekonomi murid sekolah rendah.

Jadual 5: Pengelasan Status Sosioekonomi

Tahap	Kekerapan	Peratus (%)
Rendah	104	29.7
Sederhana	176	50.3
Tinggi	70	20.0
Jumlah	350	100.0

Tahap Kebimbangan

Jadual 6 menunjukkan statistik deskriptif tahap kebimbangan murid sekolah rendah.

Jadual 6: Statistik Deskriptif Tahap Kebimbangan

Pemboleh Ubah	N	Min	Sisihan Piawai
Anxiety	350	2.89	0.61

Jadual 7 menunjukkan tahap kebimbangan murid mengikut dimensi.

Jadual 7: Tahap Kebimbangan Mengikut Dimensi

Dimensi	Min	Sisihan Piawai	Tahap
Kebimbangan Akademik	3.02	0.64	Sederhana
Kebimbangan Sosial	2.87	0.59	Sederhana
Kebimbangan Emosi	2.79	0.58	Sederhana
Keseluruhan	2.89	0.61	Sederhana

Hubungan Antara Self-Esteem dan Kebimbangan

Jadual 8 menunjukkan keputusan analisis korelasi Pearson antara self-esteem dan kebimbangan murid.

Jadual 8: Korelasi Pearson Antara Self-Esteem dan Kebimbangan

Pemboleh Ubah	r	Nilai-p
Self-esteem – Kebimbangan	-0.49	< .001

Dapatan menunjukkan wujud hubungan yang signifikan dan negatif antara self-esteem dan kebimbangan murid sekolah rendah. Sehubungan itu, Hipotesis Nol pertama (H_{01}) adalah ditolak.

Hubungan Antara Status Sosioekonomi dan Kebimbangan

Jadual 9 menunjukkan keputusan analisis korelasi Pearson antara status sosioekonomi dan kebimbangan murid.



Jadual 9: Korelasi Pearson Antara Status Sosioekonomi dan Kebimbangan

Pemboleh Ubah	r	Nilai-p
SES – Kebimbangan	-0.41	< .001

Dapatan menunjukkan wujud hubungan yang signifikan dan negatif antara status sosioekonomi dan kebimbangan murid sekolah rendah. Sehubungan itu, Hipotesis Nol kedua (H_{02}) adalah ditolak.

Korelasi Berganda Antara Self-Esteem, Status Sosioekonomi dan Kebimbangan

Jadual 10 menunjukkan keputusan analisis korelasi berganda antara self-esteem, status sosioekonomi dan kebimbangan murid.

Jadual 10: Korelasi Berganda Antara Self-Esteem, Status Sosioekonomi dan Kebimbangan (N = 350)

Pemboleh Ubah Bebas	R	R ²	F	Nilai-p
Self-esteem & SES → Kebimbangan	0.53	0.28	67.42	< .001

Dapatan menunjukkan bahawa terdapat hubungan serentak yang signifikan antara tahap self-esteem dan status sosioekonomi dengan tahap kebimbangan murid sekolah rendah. Nilai $R^2 = 0.28$ menunjukkan bahawa 28% varians dalam tahap kebimbangan murid dapat dijelaskan secara bersama oleh kedua-dua pemboleh ubah bebas tersebut. Sehubungan itu, Hipotesis Nol ketiga (H_{03}) adalah ditolak.

Perbincangan

Dapatan kajian ini menyokong literatur sedia ada yang menunjukkan hubungan negatif antara self-esteem dan kebimbangan murid (Orth & Robins, 2022). Murid dengan self-esteem yang lebih tinggi menunjukkan keupayaan regulasi emosi yang lebih baik dan kurang mentafsir situasi akademik dan sosial sebagai mengancam.

Hubungan signifikan antara SES dan kebimbangan juga selari dengan Model Tekanan Keluarga (Conger et al., 1992), yang menjelaskan bahawa tekanan ekonomi keluarga boleh meningkatkan tekanan emosi murid. Dapatan ini menegaskan bahawa kebimbangan murid perlu difahami sebagai hasil gabungan faktor psikologi dalaman dan faktor struktur keluarga. Analisis korelasi berganda menunjukkan bahawa kedua-dua pemboleh ubah ini secara serentak merupakan peramal signifikan kepada kebimbangan murid, dengan 28% varians kebimbangan dapat dijelaskan oleh gabungan self-esteem dan SES. Ini menunjukkan kepentingan pendekatan intervensi yang menyeluruh merangkumi aspek psikologi dan sokongan sosioekonomi.



Kesimpulan

Kajian ini menunjukkan bahawa tahap self-esteem dan status sosioekonomi merupakan peramal signifikan kepada kebimbangan murid sekolah rendah. Dapatan kajian menyokong keperluan intervensi awal yang menumpukan kepada pengukuhan self-esteem serta sokongan kepada murid daripada latar belakang sosioekonomi rendah bagi meningkatkan kesejahteraan emosi murid secara holistik.

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KAJIAN LITERATUR SISTEMATIK: TAHAP KESEDARAN DIRI DAN KEMAHIRAN MEMBUAT KEPUTUSAN KERJAYA MURID SEKOLAH RENDAH

Nurul Ain Nabilah Ismail^{1,2}, Shahlan Surat¹

¹Fakulti Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (p144360@siswa.ukm.edu.my)

²Sekolah Kebangsaan Seksyen 27(2), Malaysia

Abstrak: Pemilihan laluan kerjaya murid sekolah rendah lazimnya dipengaruhi oleh keputusan ibu bapa berbanding kefahaman sendiri murid. Ini berpotensi menimbulkan ketidakpuasan dan kekeliruan terhadap hala tuju masa hadapan mereka. Tambahan pula, pembangunan kerjaya murid pada peringkat sekolah rendah kurang diberi perhatian, walaupun asas kesedaran diri dan kemahiran membuat keputusan mula terbentuk sejak usia awal persekolahan. Kekurangan sintesis kajian yang sistematik berkaitan tahap kesedaran diri dan kemahiran membuat keputusan kerjaya dalam kalangan murid sekolah rendah telah mewujudkan jurang pengetahuan dalam bidang psikologi pendidikan dan bimbingan kerjaya awal. Sehubungan itu, kajian ini bertujuan meneliti secara sistematik tahap kesedaran diri dan kemahiran membuat keputusan kerjaya melalui pendekatan Kajian Literatur Sistematik (Systematic Literature Review, SLR) berasaskan garis panduan Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Carian artikel dijalankan menggunakan pangkalan data Scopus, ERIC, Web of Science dan Google Scholar bagi tempoh 2010 hingga 2024. Daripada 812 artikel yang dikenal pasti, sebanyak 20 artikel memenuhi kriteria inklusi dan dianalisis menggunakan sintesis tematik. Dapatan sintesis tematik menunjukkan bahawa murid sekolah rendah memiliki tahap kesedaran diri asas yang berkait secara konsisten dengan kemahiran membuat keputusan kerjaya awal, termasuk kejelasan minat dan efikasi sendiri. Kajian juga mencadangkan elemen kesedaran diri diintegrasikan secara eksplisit dalam kurikulum dan program bimbingan serta kaunseling sekolah rendah melalui aktiviti reflektif, pendidikan sosial-emosi dan sokongan persekitaran. Cadangan ini berpotensi menyokong pembangunan murid secara holistik dan kesiapsiagaan kerjaya sejak peringkat awal persekolahan.

Kata Kunci: Kesedaran diri, Keputusan kerjaya, Murid sekolah rendah, Kajian literatur sistematik, Pendidikan bimbingan dan kaunseling

Pengenalan

Perkembangan murid sekolah rendah bukan sahaja melibatkan pencapaian akademik, malah turut merangkumi aspek psikososial yang menyokong pembentukan identiti dan kesejahteraan emosi mereka. Salah satu aspek penting dalam perkembangan psikososial ialah kesedaran diri, iaitu keupayaan murid memahami emosi, pemikiran, tingkah laku serta potensi sendiri secara beransur-ansur. Kesedaran diri pada peringkat awal pendidikan dikenal pasti sebagai asas kepada pembentukan kawalan emosi dan penyesuaian sosial murid dalam persekitaran sekolah.



Aydin (2023) menjelaskan bahawa kesedaran diri kanak-kanak berkembang secara progresif melalui pengalaman pembelajaran dan refleksi sendiri yang berterusan. Selman et al. (2024) mendapati bahawa murid yang memiliki tahap kesedaran diri yang baik menunjukkan kestabilan emosi dan hubungan sosial yang lebih positif di sekolah rendah. Isik dan Sahin Taskin (2023) turut melaporkan bahawa kesedaran diri yang tinggi berkait rapat dengan kesejahteraan emosi dan kemahiran sosial murid pada peringkat pendidikan awal.

Seiring dengan perkembangan sendiri tersebut, murid juga mula membentuk kefahaman awal tentang pilihan, minat dan aspirasi masa hadapan, termasuk berkaitan kerjaya. Walaupun murid sekolah rendah belum berada pada tahap membuat keputusan kerjaya secara muktamad, proses eksplorasi awal terhadap minat dan kebolehan diri telah bermula sejak usia kanak-kanak. Hartung (2021) menegaskan bahawa perkembangan sendiri pada peringkat awal menjadi asas kepada pembentukan aspirasi dan hala tuju masa hadapan individu. Proses ini melibatkan interaksi antara pengalaman pembelajaran, persepsi sendiri dan pengaruh persekitaran. Porfeli et al. (2022) mendapati bahawa pemahaman terhadap minat dan kebolehan diri menyokong proses eksplorasi kerjaya secara berperingkat dalam kalangan kanak-kanak. Keupayaan mengenal diri ini seterusnya mempengaruhi cara murid menilai pilihan dan membuat keputusan awal yang berkaitan dengan masa hadapan mereka.

Kemahiran membuat keputusan kerjaya merujuk kepada keupayaan individu menilai pilihan secara rasional berdasarkan pemahaman terhadap diri dan persekitaran. Dalam konteks murid sekolah rendah, kemahiran ini bersifat asas dan eksploratif, namun memainkan peranan penting dalam pembentukan efikasi sendiri dan keyakinan membuat pilihan. Ramadhani dan Suharso (2021) menunjukkan bahawa kesedaran diri yang tinggi menyumbang kepada peningkatan keyakinan individu dalam membuat keputusan berkaitan hala tuju masa hadapan. Kefahaman terhadap kekuatan dan kelemahan diri juga membantu murid menyesuaikan jangkaan mereka terhadap pilihan yang ada. Guo et al. (2023) mendapati bahawa individu yang kurang kesedaran diri lebih mudah dipengaruhi oleh faktor luaran seperti tekanan sosial dan jangkaan persekitaran dalam proses membuat keputusan. Keadaan ini menunjukkan bahawa kesedaran diri merupakan elemen penting yang perlu dipupuk bagi menyokong kemahiran membuat keputusan yang lebih bermakna.

Dari sudut teori perkembangan kerjaya, pembentukan kesedaran diri sejak peringkat awal dilihat sebagai asas kepada perkembangan aspirasi dan keputusan kerjaya yang lebih konsisten pada peringkat seterusnya. Hartung dan Santilli (2022) menegaskan bahawa pengalaman awal kanak-kanak dalam mengenal minat, nilai dan kebolehan diri mempengaruhi pembentukan konsep sendiri yang berkait dengan kerjaya. Proses ini berlaku secara berperingkat dan selari dengan perkembangan psikososial murid. Lent dan Brown (2023) menyatakan bahawa konsep sendiri yang jelas membantu individu menilai pilihan kerjaya dengan lebih realistik dan selaras dengan potensi diri. Oleh itu, pembangunan kesedaran diri dalam kalangan murid sekolah rendah boleh dilihat sebagai landasan awal kepada pembentukan kemahiran membuat keputusan kerjaya yang berkesan.

Walau bagaimanapun, dalam konteks pendidikan formal, pembangunan kesedaran diri dalam pendidikan kerjaya sekolah rendah masih kurang diberi penekanan secara sistematik. Program



sedia ada lazimnya lebih tertumpu kepada pendedahan jenis pekerjaan tanpa memberi ruang yang mencukupi kepada refleksi sendiri dan eksplorasi potensi murid. Muna et al. (2023) melaporkan bahawa aspirasi kerjaya kanak-kanak sering dibentuk berdasarkan pengaruh luaran seperti keluarga dan persekitaran tanpa bimbingan sendiri yang terarah. Keadaan ini berpotensi menyebabkan murid kurang kejelasan terhadap potensi sebenar diri mereka. Selman et al. (2024) mendapati bahawa kekurangan sokongan sendiri pada peringkat awal boleh menjejaskan kesejahteraan emosi dan keyakinan diri murid dalam jangka panjang.

Sehubungan itu, kajian bebas sistematik ini dijalankan bagi mensintesis dapatan kajian-kajian lepas berkaitan kesedaran diri dan kemahiran membuat keputusan kerjaya dalam kalangan murid sekolah rendah. Kajian ini diharapkan dapat memberikan gambaran yang lebih jelas tentang peranan kesedaran diri sebagai asas kepada perkembangan keputusan kerjaya awal serta menyumbang kepada pembangunan pendidikan kerjaya yang lebih berstruktur dan bersesuaian dengan keperluan perkembangan murid.

Objektif utama kajian sistematik ini adalah untuk (1) mengenal pasti tema-tema utama dalam kajian yang melibatkan kesedaran diri dan pemilihan kerjaya dalam kalangan murid sekolah rendah, (2) mengenal pasti pendekatan intervensi serta instrumen yang digunakan dalam kajian ini.

Kajian Literatur

Sorotan literatur menunjukkan bahawa penyelidikan berkaitan perkembangan keputusan kerjaya kebanyakannya memberi tumpuan kepada pelajar sekolah menengah dan golongan dewasa, manakala peringkat sekolah rendah masih kurang diberi perhatian dalam kajian kerjaya awal. Penekanan terhadap peringkat perkembangan lewat ini menyebabkan pemahaman tentang pembentukan asas keputusan kerjaya dalam kalangan murid sekolah rendah masih terhad. Keadaan ini turut diperhatikan dalam konteks tempatan apabila kajian bimbingan kerjaya di Malaysia lebih banyak memfokuskan murid remaja berbanding murid sekolah rendah (Nawi, 2015).

Dalam usaha memahami perkembangan kerjaya awal, kesedaran diri dikenal pasti sebagai elemen penting yang menyokong pembentukan identiti dan kefahaman murid terhadap potensi sendiri. Kesedaran diri yang dibina sejak peringkat awal pendidikan membantu murid mengenal emosi, minat dan kebolehan diri secara berperingkat. Aydın (2023) menegaskan bahawa intervensi kesedaran diri yang dilaksanakan pada peringkat awal pendidikan adalah lebih berkesan kerana murid berada dalam fasa perkembangan yang lebih fleksibel dan mudah dibentuk. Dapatan ini selari dengan kajian tempatan yang menunjukkan bahawa pembangunan sendiri murid sekolah rendah memberi kesan positif terhadap kesejahteraan emosi serta tingkah laku pembelajaran mereka (Mohd Afifi et al., 2019).

Selain kesedaran diri, pengalaman eksplorasi awal turut memainkan peranan penting dalam membentuk asas perkembangan kerjaya individu. Pendedahan awal terhadap aktiviti penerokaan minat dan kebolehan diri membantu murid membina kefahaman awal tentang aspirasi dan hala tuju masa hadapan. Porfeli et al. (2022) menyatakan bahawa pengalaman



eksplorasi awal menyokong pembentukan asas perkembangan kerjaya yang lebih realistik dan berterusan. Dalam konteks Malaysia, kajian oleh Nordin dan Talib (2021) mendapati bahawa pendedahan awal terhadap penerokaan sendiri dan peranan pekerjaan membantu murid membentuk kefahaman awal tentang masa hadapan mereka.

Kemahiran membuat keputusan kerjaya awal merujuk kepada keupayaan murid menilai pilihan secara asas berdasarkan pemahaman terhadap diri dan persekitaran. Walaupun keputusan kerjaya murid sekolah rendah masih bersifat awal dan belum muktamad, proses membuat pilihan berkaitan minat dan kecenderungan diri telah mula terbentuk pada peringkat ini. Ramadhani dan Suharso (2021) mendapati bahawa kesedaran sendiri yang tinggi menyumbang kepada peningkatan keyakinan individu dalam membuat keputusan berkaitan hala tuju masa hadapan. Dapatan ini disokong oleh kajian tempatan yang menunjukkan bahawa murid yang mempunyai kefahaman sendiri yang baik lebih berkeyakinan dalam menyatakan aspirasi dan pilihan awal mereka (Sidek & Jamaludin, 2020).

Walaupun bagaimanapun, kajian yang meneliti secara khusus hubungan antara kesedaran diri dan kemahiran membuat keputusan kerjaya dalam kalangan murid sekolah rendah masih terhad, khususnya dalam konteks tempatan. Kebanyakan kajian di Malaysia meneliti aspek sendiri dan kerjaya secara berasingan tanpa memberi perhatian kepada hubungan antara kedua-dua konstruk tersebut. Muna et al. (2023) melaporkan bahawa aspirasi kerjaya kanak-kanak sering dibentuk berdasarkan pengaruh luaran seperti keluarga dan persekitaran tanpa bimbingan sendiri yang sistematik, selari dengan dapatan tempatan yang menekankan keperluan pendekatan bimbingan kerjaya yang lebih terancang di sekolah rendah (Nawi, 2015).

Secara keseluruhannya, sorotan literatur ini menunjukkan wujud jurang pengetahuan yang ketara berkaitan perkembangan kerjaya awal dalam kalangan murid sekolah rendah. Kekurangan kajian sistematik yang meneliti peranan kesedaran diri sebagai asas kepada kemahiran membuat keputusan kerjaya awal menunjukkan keperluan untuk penyelidikan yang lebih menyeluruh dan berfokus. Aydın (2023) menegaskan bahawa intervensi awal yang menekankan kesedaran diri adalah lebih berkesan berbanding intervensi yang dilaksanakan pada peringkat lewat. Sehubungan itu, pengukuhan pendidikan kerjaya sekolah rendah dengan elemen kesedaran sendiri dilihat sebagai langkah penting bagi menyokong perkembangan murid secara holistik, khususnya dalam konteks pendidikan di Malaysia (Nordin & Talib, 2021).

Metodologi Kajian

Kajian ini menggunakan pendekatan Kajian Literatur *Sistematik* (*Systematic Literature Review*, SLR) berpandukan garis panduan *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) bagi memastikan proses sorotan literatur dilaksanakan secara telus, sistematik dan boleh diulang (Moher et al., 2009; Page et al., 2021). Pendekatan ini dipilih kerana ia membolehkan penyelidik menyusun dan menilai secara kritikal hasil-hasil kajian terdahulu yang berkaitan dengan kesedaran diri dan kemahiran membuat keputusan kerjaya dalam kalangan murid sekolah rendah. Berbanding kajian literatur biasa, pendekatan sistematik ini bersifat lebih menyeluruh, telus dan berstruktur, sekaligus membolehkan



penyelidik mengenal pasti corak, jurang dan sumbangan sebenar yang terdapat dalam bidang yang dikaji (Liberati et al., 2009).

Pemilihan artikel dilakukan secara sistematik dengan menetapkan kriteria inklusi dan eksklusi yang jelas seperti yang dinyatakan dalam jadual 1. Artikel yang dipilih mestilah merupakan artikel jurnal yang telah disemak oleh rakan sebaya (*peer-reviewed*), diterbitkan dalam tempoh 2010 hingga 2024 dan ditulis dalam Bahasa Melayu atau Bahasa Inggeris. Artikel tersebut juga perlu memberi fokus kepada murid sekolah rendah yang berumur antara 6 hingga 12 tahun serta menyentuh aspek kesedaran diri, pembangunan kerjaya atau intervensi pendidikan sendiri. Sebaliknya, artikel yang bersifat bukan ilmiah, tidak mempunyai metodologi kajian yang jelas atau memfokuskan kepada remaja iaitu pelajar sekolah menengah dan dewasa telah dikecualikan daripada analisis.

Jadual 1: Kriteria Pemilihan Artikel Untuk Melaksanakan Kajian

Kategori	Kriteria Inklusi	Kriteria Eksklusi
Jenis Dokumen	Artikel jurnal yang disemak rakan sebaya (<i>peer-reviewed</i>)	Tesis, ulasan buku, laporan tidak rasmi
Tahun Terbitan	2010–2024	Sebelum 2010
Bahasa	Bahasa Inggeris atau Melayu	Bahasa lain
Subjek	Kanak-kanak atau murid sekolah rendah (6–12 tahun)	Remaja, dewasa, atau pelajar menengah
Fokus Kajian	Kesedaran diri, perkembangan kerjaya awal, intervensi pendidikan	Hanya fokus kepada keputusan kerjaya dewasa atau pemilihan IPT

Bagi memastikan keberkesanan proses pencarian artikel, carian telah dijalankan di empat pangkalan data utama iaitu *Scopus*, *ERIC*, *WoS* dan *Google Scholar*. Pemilihan pangkalan data ini adalah sejajar dengan saranan penyelidikan sistematik dalam bidang pendidikan dan sains sosial yang menekankan penggunaan sumber akademik berautoriti dan komprehensif (Gough, Oliver & Thomas, 2017). Artikel yang memenuhi kriteria inklusi dianalisis secara teks penuh, sebelum maklumat utama diekstrak secara berstruktur. Pengekstrakan data ini merangkumi fokus kajian, reka bentuk penyelidikan, instrumen yang digunakan serta dapatan utama berkaitan kesedaran diri dan kemahiran membuat keputusan kerjaya. Artikel yang ditemui sebanyak 812 artikel, namun setelah melalui proses carian artikel seperti yang dinyatakan dalam jadual 2, hanya 20 artikel yang dimasukkan ke dalam sintesis.

Jadual 2: Proses Carian Artikel

Langkah	Bilangan Artikel
Ditemui melalui carian pangkalan data (Scopus, ERIC, WoS, Google Scholar)	812
Dibuang pendua (<i>duplicates removed</i>)	154
Disaring berdasarkan tajuk dan abstrak	658
Artikel penuh dinilai untuk kelayakan	87
Artikel akhir yang dimasukkan ke dalam sintesis	20

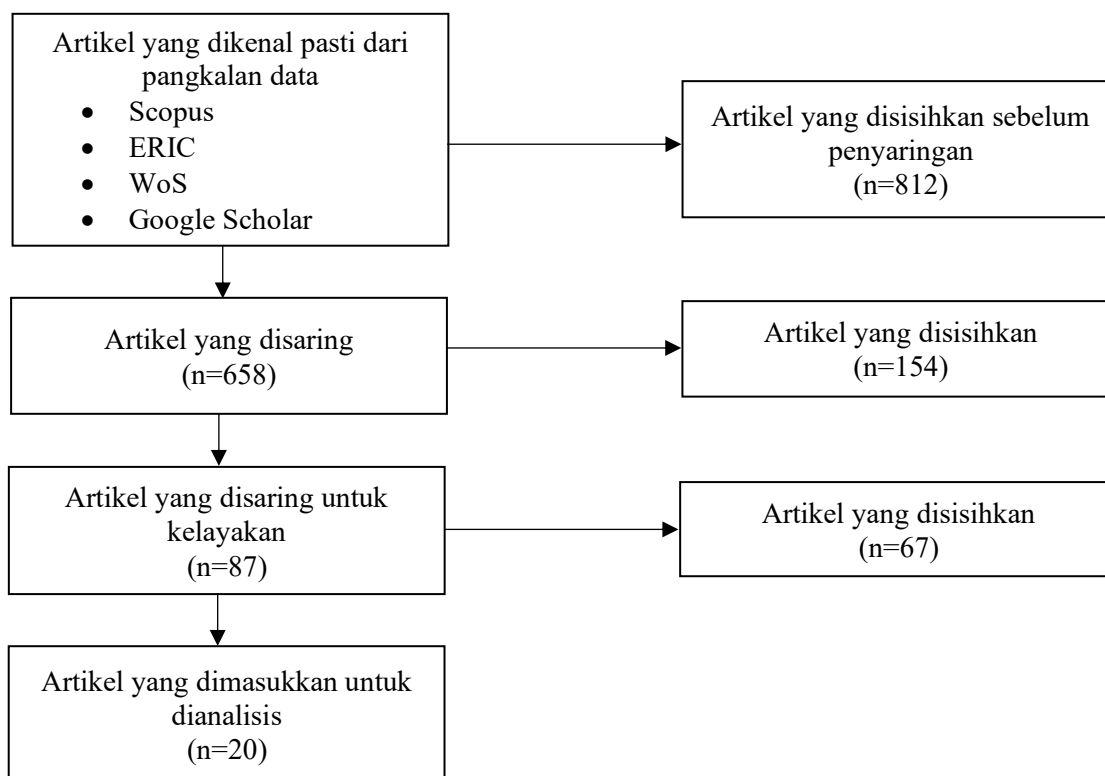


Maklumat penting daripada setiap artikel yang dipilih telah diekstrak dan dimasukkan ke dalam jadual matriks literatur. Elemen utama yang dianalisis meliputi nama penulis dan tahun penerbitan, negara kajian, populasi atau sampel kajian, reka bentuk kajian, jenis instrumen yang digunakan dan dapatan utama. Sebagai contoh, kajian oleh Takishima-Lacasa et al. (2014) menilai kesahan dan kebolehpercayaan alat ukur kesedaran diri dalam kalangan murid sekolah rendah, manakala kajian oleh Chaves et al. (2018) menekankan hubungan antara konsep sendiri dengan keputusan kerjaya. Jadual matriks ini membantu penyelidik mengenal pasti pola dan kecenderungan penyelidikan dalam bidang berkaitan serta membandingkan pelbagai pendekatan yang digunakan.

Bagi menganalisis data yang telah diekstrak, penyelidik menggunakan pendekatan sintesis tematik bagi mengenal pasti tema dominan, persamaan dapatan dan jurang penyelidikan yang wujud merentas kajian (Braun & Clarke, 2006; Snyder, 2019). Tema pertama ialah tahap kesedaran diri kanak-kanak, yang menunjukkan bahawa murid seawal usia 8 tahun sudah mula menunjukkan kefahaman terhadap emosi, kekuatan dan kelemahan diri. Tema kedua ialah hubungan antara kesedaran diri dan aspirasi kerjaya, di mana didapati murid yang lebih sedar tentang kekuatan dan minat mereka menunjukkan arah kerjaya yang lebih konsisten. Tema ketiga melibatkan intervensi pendidikan awal, seperti latihan reflektif, aktiviti bercerita dan lukisan kerjaya, yang terbukti dapat meningkatkan tahap kesedaran diri murid. Akhir sekali, tema keempat mengenal pasti jurang kajian dalam konteks Asia Tenggara, khususnya di Malaysia, di mana kajian mengenai pembangunan sendiri dalam kalangan murid sekolah rendah masih terhad dan perlu diberikan perhatian yang lebih serius.

Bagi menjamin kesahan dan kebolehpercayaan dalam proses sintesis sistematik ini, hanya artikel jurnal akademik yang telah melalui proses semakan digunakan. Pemilihan artikel dilakukan secara berstruktur, melalui saringan berlapis yang turut melibatkan pembacaan penuh kandungan artikel bagi menilai kesesuaian konteks dan metodologi. Selain itu, penyelidik turut memastikan bahawa semua proses pelaporan adalah mengikut kerangka PRISMA, yang membolehkan proses ini direplikasi oleh penyelidik lain dan mengurangkan risiko bias atau kesilapan tafsiran (Moher et al., 2009).

Secara keseluruhannya, pendekatan sistematik yang digunakan dalam kajian ini membolehkan penyelidik menyusun dan menganalisis secara kritikal dapatan-dapatan penyelidikan lepas dalam bidang kesedaran diri dan keputusan kerjaya awal murid. Kajian ini bukan sahaja membekalkan bukti empirikal yang berguna kepada guru dan kaunselor sekolah, malah menyediakan asas kukuh untuk pembangunan kurikulum pendidikan kerjaya yang lebih menyeluruh dan berpaksikan murid.



Rajah 1: Kriteria Pemilihan Artikel Kajian

(Sumber: Adaptasi daripada carta alir PRISMA (A. Liberati, 2009))

Dapatan Kajian

Berdasarkan analisis terhadap 20 artikel yang dipilih dalam kajian literatur sistematik ini, dapatan menunjukkan bahawa penyelidikan berkaitan kesedaran diri dan kemahiran membuat keputusan kerjaya awal dalam kalangan murid sekolah rendah lebih banyak dijalankan di luar negara berbanding dalam konteks tempatan. Seperti yang ditunjukkan dalam Jadual 3, sebanyak 19 artikel (95%) merupakan kajian luar negara, manakala hanya satu artikel (5%) dijalankan di Malaysia. Taburan ini menunjukkan bahawa literatur sedia ada masih didominasi oleh perspektif antarabangsa, sekali gus mencerminkan kekurangan kajian empirikal yang berfokus kepada konteks pendidikan dan budaya tempatan. Keadaan ini selari dengan pandangan Page et al. (2021) yang menyatakan bahawa ketidakseimbangan lokasi kajian merupakan isu lazim dalam kajian literatur sistematik dan berpotensi menghadkan kebolehlaksanaan dapatan dalam konteks setempat.

Jadual 3: Ringkasan Lokasi Kajian Berdasarkan 20 Artikel yang Dipilih

Lokasi kajian	Bilangan artikel	Peratusan
Luar negara	19	95
Dalam negara	1	5

Selain lokasi kajian, dapatan turut menunjukkan kepelbagaian dari segi reka bentuk dan kaedah kajian yang digunakan dalam artikel-artikel yang dianalisis. Berdasarkan Jadual 4, majoriti kajian menggunakan pendekatan kuantitatif, iaitu sebanyak 65%, diikuti oleh kajian kualitatif (25%) dan kajian literatur sistematik (10%). Dominasi pendekatan kuantitatif ini mencerminkan kecenderungan penyelidik untuk menilai konstruk kesedaran diri dan kemahiran membuat keputusan kerjaya melalui instrumen berstandar dan analisis statistik. Menurut Creswell dan Poth (2018), pendekatan kuantitatif sering digunakan bagi mengukur pembolehubah psikososial secara objektif, khususnya apabila melibatkan konstruk sendiri dan efikasi.

Jadual 4: Reka bentuk kajian

Kaedah Kajian	Jumlah (%)
Kuantitatif	65
Kualitatif	25
Literatur sistematik	10

Walau bagaimanapun, kehadiran kajian kualitatif dalam literatur menunjukkan bahawa terdapat usaha untuk meneroka pengalaman dan proses pembentukan kesedaran sendiri murid secara lebih mendalam dan kontekstual. Kajian kualitatif lazimnya menggunakan kaedah temu bual, pemerhatian dan analisis reflektif bagi memahami makna dan pengalaman subjektif murid dalam proses membuat keputusan awal. Pendekatan ini disarankan oleh Braun dan Clarke (2006) kerana ia membolehkan penyelidik mengenal pasti pola dan tema yang tidak dapat ditangkap sepenuhnya melalui data kuantitatif semata-mata.

Secara keseluruhannya, pola dapatan yang ditunjukkan dalam Jadual 3 dan Jadual 4 menyediakan konteks penting kepada dapatan tematik yang diringkaskan dalam Jadual 5. Dominasi kajian luar negara serta kecenderungan penggunaan reka bentuk kuantitatif menunjukkan bahawa dapatan tematik yang dikenal pasti dalam Jadual 5 banyak dibentuk oleh perspektif antarabangsa dan pendekatan pengukuran berasaskan instrumen. Keadaan ini mempengaruhi jenis tema yang muncul, khususnya tema-tema berkaitan kesedaran diri, eksplorasi sendiri dan kemahiran membuat keputusan kerjaya awal yang lebih bersifat umum dan universal. Oleh itu, tema-tema utama yang dikenal pasti dalam Jadual 5 bukan sahaja mencerminkan fokus penyelidikan sedia ada, malah turut menonjolkan jurang kajian dari segi konteks tempatan dan pendekatan kualitatif yang lebih mendalam dalam memahami pengalaman murid sekolah rendah.

Jadual 5: Ringkasan Sorotan Artikel Tahap Kesedaran Diri dan Kemahiran Membuat Keputusan Kerjaya

No.	Penulis (Tahun)	Tajuk Kajian	Fokus Kajian	Dapatan Utama (Ringkas)	Tema Sintesis
1	Takishima-Lacasa et al. (2014)	<i>Revised Self-Consciousness Scale for Children (R-SCS-C)</i>	Pengukuran kesedaran diri	Kesedaran diri kanak-kanak boleh diukur secara sah dan reliabel	Kesedaran diri sebagai asas sendiri



2	Andre et al. (2017)	<i>Children's Career Development</i>	Aspirasi kerjaya awal	Kanak-kanak membentuk kefahaman kerjaya melalui pengalaman	Eksplorasi sendiri awal
3	Howard & Walsh (2011)	<i>Children's Conceptualization of Career Choice</i>	Model perkembangan kerjaya	Murid berada pada fasa eksplorasi dan imaginasi kerjaya	Eksplorasi sendiri awal
4	Chaves et al. (2018)	<i>The Role of Self-Concept in Career Decision-Making</i>	Konsep sendiri	Konsep sendiri positif meningkatkan keyakinan membuat keputusan	Kesedaran diri & keputusan
5	Eryilmaz (2011)	<i>Future Orientation and Self-Awareness</i>	Intervensi pendidikan	Intervensi awal meningkatkan kesedaran diri murid	Intervensi kesedaran diri
6	Isik & Sahin Taskin (2023)	<i>Parents' Views on Children's Social-Emotional Skills</i>	Sokongan keluarga	Sokongan ibu bapa mempengaruhi kesedaran emosi murid	Peranan persekitaran
7	Chalkiadaki (2018)	<i>21st Century Skills in Primary Education</i>	Kemahiran abad ke-21	Kesedaran diri asas kepada kemahiran membuat keputusan	Kesedaran diri sebagai asas sendiri
8	Muna et al. (2023)	<i>Parental Support and Career Decision-Making Efficacy</i>	Sokongan ibu bapa	Sokongan sosial meningkatkan efikasi keputusan kerjaya	Kesedaran diri & keputusan
9	Retnam et al. (2018)	<i>Parental Support and Career Efficacy</i>	Sokongan sosial	Sokongan guru & ibu bapa meningkatkan keyakinan kerjaya	Peranan persekitaran
10	Chasanah & Salim (2019)	<i>Career Exploration Behavior</i>	Eksplorasi kerjaya	Kesedaran sendiri menggalakkan eksplorasi kerjaya	Eksplorasi sendiri awal
11	Ramadhani & Suharso (2021)	<i>Proactive Personality and Career Decision Efficacy</i>	Efikasi keputusan	Kesedaran sendiri meningkatkan efikasi membuat keputusan	Kesedaran diri & keputusan
12	Selman et al. (2024)	<i>Daily Routines and Children's Development</i>	Faktor persekitaran	Rutin harian menyokong kesedaran sendiri murid	Peranan persekitaran
13	Aydın (2023)	<i>Development of a Self-Awareness Scale for Children</i>	Instrumen kesedaran diri	Instrumen sah menyokong penilaian kesedaran sendiri	Kesedaran diri sebagai asas sendiri
14	Baydan (2010)	<i>Self-Awareness and Social Adjustment</i>	Penyesuaian sosial	Kesedaran diri berkait dengan penyesuaian sosial	Kesedaran diri sebagai asas sendiri
15	Esen Aygün & Şahin Taşkın (2017)	<i>Impact of SEL Programs</i>	Program SEL	Program SEL meningkatkan kesedaran diri dan empati	Intervensi kesedaran diri

16	Guo et al. (2023)	<i>Social Anxiety and Self-Awareness</i>	Kesejahteraan psikologi	Kesedaran diri rendah menjejaskan keputusan	Kesedaran diri & keputusan
17	Merter (2013)	<i>Self-Awareness and Social Adjustment</i>	Penyesuaian sosial	Kesedaran diri menyokong hubungan interpersonal	Kesedaran diri sebagai asas sendiri
18	Totan (2011)	<i>Self-Awareness and Psychological Well-being</i>	Kesejahteraan psikologi	Kesedaran diri meningkatkan kesejahteraan emosi	Kesedaran diri sebagai asas sendiri
19	Yılmaz (2014)	<i>Academic Achievement and Self-Awareness</i>	Prestasi akademik	Kesedaran diri berkait motivasi dan pencapaian	Kesedaran diri sebagai asas sendiri
20	Oliveira et al. (2023)	<i>Social Anxiety and Self-Awareness in Teenagers</i>	Kebimbangan sosial	Kesedaran diri rendah menjejaskan keyakinan diri	Kesedaran diri & keputusan

Perbincangan **Tahap Kesedaran Diri**

Kesedaran diri merujuk kepada keupayaan murid mengenal dan memahami emosi, kekuatan, kelemahan serta nilai diri yang dimiliki sebagai asas kepada pembentukan sendiri. Dapatan kajian menunjukkan bahawa murid sekolah rendah telah mula mempamerkan tahap refleksi sendiri yang sederhana dan berpotensi untuk diperkukuh melalui pengalaman pembelajaran yang terarah. Takishima-Lacasa et al. (2014) mendapati bahawa kanak-kanak mampu mengenal proses dalaman diri mereka secara asas, manakala Aydın (2023) menunjukkan bahawa tahap kesedaran diri murid boleh ditingkatkan melalui aktiviti yang mendorong refleksi sendiri. Murid yang mampu mengenal pasti reaksi emosi terhadap situasi tertentu didapati lebih cenderung menunjukkan pengawalan diri yang lebih baik dalam konteks sosial dan akademik, selaras dengan dapatan Selman et al. (2024) yang menekankan peranan kesedaran emosi dalam penyesuaian sosial murid.

Selain itu, dimensi kesedaran diri turut merangkumi keupayaan murid melihat diri mereka dalam perspektif masa hadapan. Dalam kajian oleh Eryılmaz (2011), orientasi masa hadapan dikenal pasti mempunyai hubungan positif dengan tahap kesedaran diri, khususnya dalam membantu murid membayangkan implikasi jangka panjang terhadap tindakan semasa. Murid yang dibimbing untuk berfikir secara prospektif menunjukkan kecenderungan membuat pertimbangan yang lebih mendalam terhadap keperluan dan matlamat diri mereka. Dapatan ini menunjukkan bahawa kesedaran diri bukan sahaja berkaitan dengan kesedaran emosi semasa, tetapi turut melibatkan keupayaan reflektif yang menyokong pembentukan matlamat dan hala tuju sendiri sejak peringkat awal (Hartung, 2021).

Tambahan pula, beberapa kajian turut menunjukkan bahawa tahap kesedaran diri murid boleh dipupuk melalui pendekatan pembelajaran bukan formal yang melibatkan pengalaman aktif. Andre et al. (2017) melaporkan bahawa aktiviti berbentuk penerokaan, bermain dan interaksi



sosial membantu murid mengenal nilai serta kecenderungan diri secara semula jadi. Dapatan ini disokong oleh Suryadi et al. (2019) yang mendapati bahawa aktiviti seni dan bermain berperanan meningkatkan ekspresi emosi dan refleksi sendiri murid. Pendekatan ini selari dengan pandangan konstruktivis yang menegaskan bahawa pembelajaran bermakna berlaku apabila murid terlibat secara aktif dalam pengalaman yang membolehkan mereka membina pemahaman sendiri. Secara keseluruhannya, tahap kesedaran diri murid sekolah rendah tidak bersifat statik, sebaliknya dinamik dan boleh dipertingkatkan melalui intervensi yang sesuai serta persekitaran pembelajaran yang kondusif.

Kemahiran Membuat Keputusan Kerjaya

Kemahiran membuat keputusan kerjaya merujuk kepada kebolehan murid menilai dan memilih hala tuju kerjaya berdasarkan pengetahuan tentang diri, peluang persekitaran serta keupayaan memproses maklumat secara rasional dan bermakna. Pada peringkat sekolah rendah, kemahiran ini masih bersifat awal dan eksploratif, namun berfungsi sebagai asas kepada pembentukan aspirasi dan keyakinan diri murid terhadap masa hadapan. Ramadhani dan Suharto (2021) mendapati bahawa murid yang memiliki personaliti proaktif dan terlibat dalam program bimbingan kerjaya menunjukkan tahap efikasi membuat keputusan kerjaya yang lebih tinggi. Dapatan ini disokong oleh Lent dan Brown (2023) yang menegaskan bahawa efikasi sendiri dan sokongan persekitaran merupakan faktor penting dalam proses membuat keputusan kerjaya. Hal ini menunjukkan bahawa kemahiran membuat keputusan kerjaya bukan sahaja bergantung kepada keupayaan kognitif, malah turut dipengaruhi oleh ciri personaliti dan pengalaman sokongan yang bermakna.

Dalam konteks sokongan sosial, kajian tempatan oleh Retnam et al. (2018) mendapati bahawa penglibatan aktif murid dalam aktiviti kokurikulum, disertai bimbingan guru dan sokongan ibu bapa, memberi kesan positif terhadap perancangan masa hadapan kerjaya. Pengalaman pembelajaran di luar bilik darjah membantu murid membina keyakinan diri serta kefahaman terhadap potensi dan minat mereka secara lebih realistik. Dapatan ini selari dengan kajian Muna et al. (2023) yang menunjukkan bahawa sokongan sosial awal memainkan peranan penting dalam membentuk aspirasi dan hala tuju kerjaya kanak-kanak. Selain itu, Porfeli et al. (2022) turut menegaskan bahawa pengalaman eksplorasi awal yang disokong oleh persekitaran positif membantu murid membina kefahaman sendiri yang lebih mantap dalam proses membuat keputusan awal.

Selain itu, Howard dan Walsh (2011) membangunkan satu kerangka konseptual yang menunjukkan bahawa murid sekolah rendah berada pada fasa awal dalam memahami hubungan antara pekerjaan, identiti dan matlamat masa hadapan. Pada peringkat ini, murid mula membina imaginasi kerjaya dan kefahaman asas tentang peranan pekerjaan dalam kehidupan seharian. Hartung (2021) menjelaskan bahawa pendedahan awal terhadap konsep kerjaya menyokong pembentukan konsep sendiri dan menyediakan asas kepada proses membuat keputusan yang lebih kompleks pada peringkat perkembangan seterusnya. Sehubungan itu, pengenalan pendidikan kerjaya secara berperingkat sejak sekolah rendah dilihat berpotensi menyokong penyesuaian akademik dan sosial murid secara menyeluruh.



Kesedaran Diri Dan Kemahiran Membuat Keputusan Kerjaya

Kesedaran diri dan kemahiran membuat keputusan kerjaya dapat difahami sebagai hubungan yang saling memperkuat antara satu sama lain. Kesedaran diri berperanan sebagai asas kepada proses membuat keputusan yang lebih berfokus, bermakna dan autentik terhadap laluan kerjaya individu. Chaves et al. (2018) menunjukkan bahawa murid yang mempunyai konsep sendiri yang positif lebih berupaya mengenal pasti minat, kebolehan dan potensi kerjaya mereka secara realistik. Dapatan ini selari dengan pandangan Lent dan Brown (2023) yang menegaskan bahawa kefahaman sendiri membantu individu menilai pilihan kerjaya secara lebih selaras dengan nilai peribadi dan matlamat jangka panjang. Dalam konteks ini, murid yang mampu mengenal pasti nilai peribadi didapati lebih yakin untuk memilih laluan kerjaya yang sejajar dengan prinsip hidup mereka.

Selain itu, kajian sistematik oleh Muna et al. (2023) mengesahkan bahawa individu yang mempunyai tahap kesedaran diri yang tinggi turut menunjukkan efikasi kerjaya yang lebih mantap. Individu tersebut bukan sahaja mampu mengaitkan minat peribadi dengan peluang dan keperluan pasaran kerja, malah menunjukkan tahap komitmen yang lebih tinggi terhadap pilihan kerjaya yang dibuat. Hubungan ini menyokong pandangan klasik Super (1990) yang menyatakan bahawa proses membuat keputusan kerjaya bermula dengan pemahaman sendiri dan pembentukan konsep sendiri sejak peringkat awal perkembangan. Dapatan ini turut disokong oleh Porfeli et al. (2022) yang menegaskan bahawa eksplorasi sendiri yang berkesan memerlukan tahap kesedaran diri yang jelas agar pilihan kerjaya yang dibuat bersifat realistik dan berterusan.

Oleh itu, hubungan antara kesedaran diri dan kemahiran membuat keputusan kerjaya wajar dipupuk secara serentak dan bersepadu dalam konteks pendidikan awal. Intervensi yang hanya menumpukan kepada eksplorasi maklumat kerjaya tanpa membantu murid membina refleksi sendiri berisiko menjadi bersifat mekanikal dan kurang berkesan dalam jangka panjang. Hartung (2021) menegaskan bahawa pendidikan kerjaya yang berkesan perlu berasaskan pembangunan konsep sendiri dan kesedaran psikososial murid. Sehubungan itu, program pembangunan kerjaya di sekolah rendah perlu dirancang dengan mengambil kira elemen kesedaran sendiri pada setiap peringkat pelaksanaan agar dapat menyokong perkembangan murid secara holistik dan berterusan.

Kepentingan Kajian

Kajian ini menyumbang kepada pengukuhan kefahaman konseptual tentang hubungan antara kesedaran diri dan kemahiran membuat keputusan kerjaya dalam kalangan murid sekolah rendah, khususnya dalam konteks perkembangan psikososial awal. Dapatan kajian ini menyokong pandangan bahawa pembentukan konsep sendiri merupakan asas kepada keupayaan individu membuat keputusan yang bermakna dan berfokus terhadap hala tuju hidup. Hal ini selari dengan kerangka perkembangan kerjaya sepanjang hayat yang menekankan peranan kesedaran sendiri sebagai teras kepada perkembangan kerjaya dan kesejahteraan individu sejak peringkat awal (Porfeli et al., 2022). Selain itu, kajian ini turut menyokong keperluan pendidikan abad ke-21 yang menekankan pembangunan kemahiran sendiri dan



keupayaan membuat keputusan sebagai elemen penting selain pencapaian akademik (OECD, 2021).

Dari sudut amalan dan dasar pendidikan, kajian ini memberikan implikasi penting kepada perancangan program pembangunan murid dan pendidikan kerjaya di sekolah rendah. Dapatan kajian ini boleh dijadikan asas kepada pembinaan modul pembangunan sendiri dan pendidikan kerjaya yang lebih holistik, berasaskan keperluan perkembangan emosi, sosial dan sendiri murid. Penekanan terhadap peranan guru bimbingan dan kaunseling dalam memupuk kesedaran sendiri serta kemahiran membuat keputusan awal selari dengan keperluan memperkukuh sokongan psikososial di sekolah (Hartung, 2021). Dalam konteks tempatan, kajian ini turut menyokong aspirasi Pelan Pembangunan Pendidikan Malaysia yang menekankan pembangunan murid secara menyeluruh dan seimbang merangkumi aspek akademik, emosi dan sosial (Kementerian Pendidikan Malaysia, 2013).

Limitasi Kajian Dan Cadangan Kajian Lanjutan

Walaupun kajian bebas sistematik ini menyumbang kepada kefahaman yang lebih jelas tentang hubungan antara kesedaran diri dan kemahiran membuat keputusan kerjaya dalam kalangan murid sekolah rendah, beberapa kekangan metodologi perlu diakui. Pertama, jumlah artikel yang dianalisis adalah terhad kepada 20 kajian, yang berpotensi mengehadkan kebolehan untuk membuat generalisasi menyeluruh merentas konteks budaya dan sistem pendidikan yang berbeza. Page et al. (2021) menegaskan bahawa bilangan kajian yang terhad dalam kajian sistematik boleh mempengaruhi kekuatan inferens dapatan, terutamanya apabila konteks kajian adalah heterogen. Selain itu, walaupun terdapat beberapa kajian tempatan yang dimasukkan, bilangannya masih tidak mencukupi untuk menggambarkan keadaan sebenar dalam konteks Malaysia secara menyeluruh (Nordin & Talib, 2021).

Selain itu, kekangan turut wujud dari segi reka bentuk kajian dan liputan literatur. Tidak semua artikel yang dianalisis menggunakan reka bentuk empirikal, sebaliknya sebahagian daripadanya menggunakan pendekatan konseptual atau sorotan literatur, sekali gus mengehadkan keupayaan kajian ini untuk menjalankan analisis statistik lanjutan seperti meta-analisis (Borenstein et al., 2021). Ketidakseimbangan bilangan kajian antarabangsa berbanding kajian tempatan turut berpotensi menjejaskan kesesuaian dapatan dalam konteks pendidikan Malaysia. Di samping itu, penggunaan artikel dalam bahasa Inggeris dan Melayu sahaja mungkin menyebabkan pengecualian kajian berkualiti dalam bahasa lain seperti Jepun, Sepanyol atau Perancis, yang berpotensi menyumbang perspektif tambahan terhadap bidang ini (Petticrew & Roberts, 2006). Oleh itu, penyelidikan lanjutan disarankan agar melibatkan skop kajian yang lebih luas dari segi bahasa, lokasi dan reka bentuk bagi memperkukuh dapatan dan kebolehgunaan hasil kajian.

Kesimpulan

Kesedaran diri dan kemahiran membuat keputusan kerjaya merupakan dua konstruk yang saling berkait dan saling menguatkan dalam membentuk jati diri murid sekolah rendah. Analisis terhadap 20 artikel terpilih menunjukkan bahawa murid yang memiliki tahap



kesedaran diri yang lebih tinggi cenderung membuat keputusan kerjaya yang lebih realistik, matang dan sejajar dengan potensi sebenar mereka, sekali gus menegaskan kepentingan pembinaan kesedaran diri sebagai komponen teras dalam program pembangunan kerjaya sejak peringkat awal persekolahan. Dapatan kajian ini turut mengesahkan bahawa bimbingan berstruktur yang melibatkan peranan guru, ibu bapa dan komuniti sekolah berupaya mempercepat pembangunan sendiri serta meningkatkan efikasi kerjaya murid. Secara keseluruhan, kajian ini menyumbang kepada pengukuhan kerangka teori dan amalan pendidikan kerjaya awal dengan menekankan keseimbangan antara pengetahuan diri dan pengetahuan kerjaya, agar murid bukan sahaja mencapai kecemerlangan akademik, malah berupaya membuat keputusan yang bermakna dan memberi impak positif sepanjang hayat.

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AMALAN PEMANASAN SEMULA MAKANAN: TAHAP KESEDARAN KESELAMATAN DALAM KALANGAN PENGGUNA

Nor Helme Padeli¹, Muhammad Nor Hariz Mukhlis Nor Helme²

¹Jabatan Kejuruteraan Mekanikal, Politeknik Kota Bharu (PKB), Malaysia, (norhelme@pkb.edu.my)

²Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia (UKM), Malaysia, (hrzmkhls@gmail.com)

Abstrak: *Penyelidikan ini dijalankan untuk mengkaji tahap kesedaran pengguna terhadap keselamatan makanan dalam amalan pemanasan semula makanan. Objektif kajian adalah untuk menilai tahap kesedaran pengguna mengenai kepentingan pemanasan semula makanan bagi menjamin keselamatan dan menguji pengetahuan pengguna tentang risiko makanan yang tidak dipanaskan semula dengan betul. Kaedah pengumpulan data menggunakan borang soal selidik yang diedarkan kepada 300 orang responden masyarakat di Kelantan yang dipilih secara rawak. Instrumen kajian terdiri daripada 30 soalan yang dibahagikan kepada tiga bahagian: Bahagian A, Bahagian B, dan Bahagian C. Data dianalisis menggunakan perisian SPSS. Hasil kajian menunjukkan bahawa walaupun terdapat pemahaman yang baik terhadap beberapa aspek keselamatan makanan, masih wujud ketidaktahuan yang ketara dalam kalangan responden. Kekurangan kesedaran terhadap amalan asas seperti mencuci perkakas dapur dengan betul, menyimpan makanan pada suhu yang sesuai, serta memanaskan semula makanan dengan tepat dikenal pasti sebagai isu utama. Oleh itu, usaha meningkatkan kesedaran dan pengetahuan masyarakat tentang keselamatan makanan amat penting bagi mengurangkan risiko keracunan makanan dan memastikan kesihatan yang lebih baik.*

Kata Kunci: *Amalan, Pemanasan Semula, Keselamatan Makanan*

Pengenalan

Keselamatan makanan kekal sebagai isu global yang kritikal. Pertubuhan Kesihatan Sedunia (WHO, 2025) melaporkan bahawa antara 638 hingga 720 juta orang di dunia menghadapi masalah kelaparan dan makanan tidak selamat pada tahun 2024, dengan penyakit bawaan makanan terus menjadi ancaman kesihatan awam. Di Malaysia, Kementerian Kesihatan Malaysia melalui Bahagian Keselamatan dan Kualiti Makanan (BKMM) telah melancarkan *Pelan Tindakan Keselamatan Makanan Kebangsaan 2024–2030* untuk memperkukuh kawalan keselamatan makanan di semua peringkat rantai bekalan. Selain itu, *Dasar Sekuriti Makanan Negara 2021–2025* turut menekankan strategi mengurangkan risiko pencemaran makanan dan meningkatkan kesedaran pengguna.

Keracunan makanan adalah berkaitan dengan faktor seperti lokasi, jenis makanan dan titik kawalan kritikal semasa penyediaan makanan (Nur Baizura Aini & Ahmad Filza, 2021). Aspek keselamatan makanan, pengendalian makanan, amalan kebersihan yang sempurna dan persekitaran yang bersih semasa penyediaan makanan perlu diperkukuhkan. Pematuhan garis panduan adalah penting untuk menghalang pertumbuhan bakteria dan mengekalkan kualiti



makanan. Garis Panduan Pengurusan Wabak Keracunan Makanan di Malaysia (2006) menyediakan pelan tindakan bagi mencegah berlakunya lonjakan wabak keracunan makanan.

Pernyataan Masalah

Di Malaysia, Kementerian Kesihatan Malaysia (KKM, 2024) melaporkan bahawa walaupun terdapat penurunan kes keracunan makanan sebanyak 31.6% antara tahun 2020 hingga 2021, isu ini masih berulang setiap tahun. Data rasmi menunjukkan bahawa satu daripada sepuluh rakyat Malaysia pernah mengalami simptom keracunan makanan akibat makanan yang tidak disimpan atau dipanaskan semula dengan betul (DOSM, 2025). Setakat manakah kita mampu bertahan? Antara punca keracunan makanan adalah disebabkan oleh tidak menjaga suhu makanan, kualiti bahan, kebersihan tempat pembuatan dan lain-lain.

Kawalan suhu yang betul adalah asas untuk memastikan keselamatan dan kualiti makanan di seluruh rantai bekalan makanan. Walau bagaimanapun, di sebalik kepentingan kritikal untuk mengekalkan suhu optimum, pelbagai cabaran berterusan dalam menguruskan penjagaan suhu makanan dengan berkesan. Kemudahan penyejukan dan penyimpanan yang tidak mencukupi, amalan pemantauan yang tidak konsisten, dan jurang dalam piawaian peraturan suhu menyumbang kepada risiko penyakit bawaan makanan seperti keracunan makanan, kerosakan dan kerugian ekonomi. Bagaimana dapat memastikan keselamatan makanan semasa proses pemanasan makanan, bagaimana dapat mengenal pasti dan mengatasi potensi risiko pencemaran mikrob atau sebatian berbahaya? Adakah kesedaran pengguna tentang kaedah memanaskan semula yang betul akan dapat mempengaruhi keputusan pembelian dan corak penggunaan makanan sedia atau sisa mereka?

Perkhidmatan katering berkualiti memerlukan perancangan dan penyelarasan yang teliti dalam kalangan profesional itu sendiri, dengan menekankan kepentingan keselamatan pemakanan. Keputusan kajian Mohammed et al. (2021) menunjukkan tahap pengetahuan tentang suhu kawalan makanan dalam kalangan penyelia restoran amat lemah. Laporan kajian juga mengeluarkan kenyataan perlunya pendidikan dan latihan program kawalan suhu makanan bagi menambah baik pengetahuan penyelia restoran. Jika latihan yang betul diberikan, pengetahuan dan amalan mereka akan membawa kepada peningkatan dalam kualiti makanan yang dihidangkan kepada pengguna dan pengurangan dalam kejadian keracunan makanan. Mampukah mereka bersedia meningkatkan kesedaran tentang teknik pemanasan semula yang betul berkaitan dengan pengurangan insiden penyakit bawaan makanan? Seperti laporan UPM, keselamatan makanan bermaksud makanan bersih daripada kuman berbahaya, racun, toksin, najis dan bahan buangan yang lain (Nur Aqilah Amalina, 2022).

Pertumbuhan aktif mikroorganisma di dalam makanan perlu dihalang. Yang pertama mewajibkan makanan panas disimpan tidak kurang pada 5°C dan tidak lebih pada suhu 60°C. Pengurusan suhu masa memberi kesan kepada kualiti pengeluaran dan keselamatan mikrobiologi. Manakala yang kedua, membenarkan makanan sedia untuk dipanaskan disimpan hanya selama maksimum empat (4) jam (UPM, 2022). Apakah peranan yang dimainkan oleh pendidikan pengguna dalam menggalakkan amalan pemanasan semula yang selamat dan meminimumkan sisa makanan dalam isi rumah?



Skop Kajian

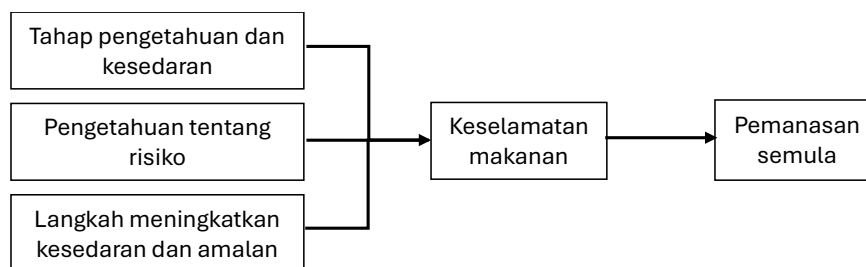
Kaedah pengumpulan data bagi kajian ini dibuat dengan menggunakan Google Form dan kajian tertumpu kepada persepsi pengguna awam di Kelantan. Pandangan responden terbatas kepada cara pemikiran mereka. Kajian ini hanya memfokuskan kepada pandangan dan penerimaan penduduk sekitar sebagai rujukan kajian. Kajian ini dijalankan hanya menilai tahap kesedaran pengguna terhadap pemanasan semula makanan dalam memastikan keselamatan makanan, juga pengetahuan pengguna tentang risiko kesihatan akibat pengambilan makan tidak dipanaskan semula dengan betul. Bahagian laporan ini juga membuat perbincangan serta menganalisis data yang berkaitan dengan amalan pengguna dan hanya dapat memberikan gambaran tingkah laku pengguna.

Objektif Kajian

1. Menilai tahap kesedaran pengguna terhadap pemanasan semula makanan dalam memastikan keselamatan makanan.
2. Menguji pengetahuan pengguna tentang risiko makanan yang tidak dipanaskan semula dengan betul.
3. Mencadangkan langkah-langkah untuk meningkatkan kesedaran dan amalan pengguna dalam memastikan keselamatan makanan melalui pemanasan semula yang betul.

Sorotan Literatur

Kerangka Konseptual Kajian



Rajah 1: Kerangka Konseptual Kajian

Konsep yang digunakan dalam kajian ditunjukkan dalam Rajah 1 untuk menilai hubungan antara tahap pengetahuan dan kesedaran, pengetahuan tentang risiko serta langkah meningkatkan kesedaran dan amalan terhadap keselamatan makanan dan pemanasan semula makanan.

Pemanasan Semula Makanan

Pemanasan semula makanan ada perkara yang biasa dilakukan oleh masyarakat moden. Tambahan pula, disebabkan oleh perkembangan teknologi yang semakin canggih, terdapat lebih banyak kaedah untuk pemanasan semula makanan dilakukan. Pertubuhan Kesihatan Sedunia (WHO) (2020) memetik kenyataan WHO, Department Of Food Safety, Zoonoses And Foodborne Diseases (2006), menasihatkan supaya berhati-hati apabila memanaskan semula



makanan. Memanaskan semula makanan boleh menyebabkan pertumbuhan bakteria jika ia tidak dilakukan dengan betul. Menurut garis panduan WHO berkenaan, apabila memanaskan semula makanan, ia perlu dipanaskan dengan teliti sehingga mencapai suhu dalaman sekurang-kurangnya 165°F (75°C) untuk memastikan sebarang bakteria berbahaya yang terdapat dalam makanan itu terbunuh, ia selari dengan kenyataan Centers For Disease Control & Prevention, U.S. Department Of Health & Human Services (CDC, 2024). Selain itu, adalah disyorkan untuk hanya memanaskan semula makanan sekali dan mengelakkan daripada memanaskannya semula beberapa kali kerana ini boleh meningkatkan risiko pencemaran bakteria. Data rasmi Jabatan Perangkaan Malaysia (DOSM, 2025) menunjukkan bahawa satu daripada sepuluh rakyat Malaysia pernah mengalami simptom keracunan makanan dalam tempoh setahun, kebanyakannya berpunca daripada makanan yang tidak dipanaskan semula dengan betul.

Kepentingan Keselamatan Makanan

Di Malaysia, dilaporkan tiada bukti perubahan dalam pengetahuan tentang kawalan suhu walaupun selepas beberapa siri latihan diberikan. Salah satu kekangan utama untuk penggunaan termometer adalah ketiadaan atau kekurangan termometer untuk pengendali makanan (Soon et al., 2020). Walau bagaimanapun, pengguna Malaysia mempamerkan pengetahuan keselamatan makanan yang tinggi dan menunjukkan sikap dan amalan keselamatan makanan yang positif. Manakala kajian Subashini et al. (2025) mendapati bahawa tahap pengetahuan pengguna Malaysia mengenai keselamatan makanan adalah sederhana, tetapi amalan sebenar masih lemah. Ramai pengguna tidak memahami konsep “Zon Suhu Merbahaya” (5°C–60°C), yang membolehkan bakteria membiak dengan cepat. Soon et al. (2020) pula melaporkan bahawa ketiadaan termometer makanan dalam kalangan pengendali makanan menjadi halangan utama untuk memastikan kawalan suhu yang tepat. Kajian Ahmed (2021), Mohamad Ridzuan (2020) dan Castrica et al. (2020) menyerlahkan isu keselamatan makanan yang berpanjangan, terutamanya mengenai penyakit bawaan makanan, dengan berjuta-juta terjejas setiap tahun di seluruh dunia la menggariskan kepentingan amalan pengendalian makanan yang betul. Kementerian Kesihatan Malaysia (KKM, 2024) telah melancarkan *Pelan Tindakan Keselamatan Makanan Kebangsaan 2024–2030* yang menekankan kepentingan pendidikan pengguna, pemantauan industri makanan, dan penggunaan teknologi kawalan suhu. Pelan ini menunjukkan usaha bersepadu kerajaan untuk memperkukuh keselamatan makanan di peringkat nasional. Penemuan Soon et al. (2020) jelas menunjukkan bahawa pengetahuan keselamatan makanan tidak secara langsung mempengaruhi amalan keselamatan makanan. Responden juga menunjukkan tahap pengetahuan keselamatan makanan yang baik dan sikap positif serta amalan yang dilaporkan sendiri. Selain itu, membuktikan penemuan mengenai penggunaan termometer dalam kalangan pengguna di Malaysia.

Makanan Yang Tidak Dipanaskan Dengan Betul

Di dalam Berita Harian Online (25 April 2021), seorang pensyarah kanan di Jabatan Penjagaan Kesihatan Profesional, Fakulti Sains Hayat & Kesihatan MSU, Dr Sharifah Intan Zainun Sharif Ishak berkata makanan dipanaskan boleh menjadi antara sihat atau tidak sihat bergantung kepada cara penyediaan, kaedah penyimpanan dan pemanasan semula. Beliau juga



menegaskan bahawa sebaiknya, makanan patut dipanaskan sekali sahaja selepas disimpan daripada peti sejuk, tidak kira sama ada makanan sejuk beku atau disediakan sendiri. Jika masak dalam kitaran yang banyak dan merancang untuk makan makanan sama beberapa kali, makanan itu lebih baik diasingkan dalam beberapa bekas dan dilabelkan tarikh penyimpanan sebagai rujukan bila makanan mula disimpan. Bila hendak makan baru dipanaskan mengikut keperluan, bekas yang selebihnya boleh terus disimpan dalam peti sejuk di bahagian sejuk beku dan boleh dimakan kemudian. Ketika hendak memanaskan makanan, individu juga perlu mengetahui suhu yang bersesuaian bagi mengelak pembiakan bakteria yang boleh menghasilkan toksin beracun. Soon et al. (2020) memutuskan bahawa pengetahuan keselamatan makanan mempunyai hubungan yang negatif dan tidak signifikan dengan amalan keselamatan makanan. Penemuan jelas mereka menunjukkan bahawa pengetahuan keselamatan makanan tidak secara langsung mempengaruhi amalan keselamatan makanan.

Pemanasan Makanan Yang Betul

Pemanasan makanan yang betul melibatkan proses memastikan makanan mencapai suhu dalaman yang selamat untuk membunuh bakteria dan patogen berbahaya sambil mengekalkan kualitinya. Ini biasanya memerlukan pemanasan makanan kepada suhu dalaman minimum 75°C (167°F) atau lebih tinggi, bergantung pada jenis makanan, untuk tempoh yang mencukupi. Adalah penting untuk menggunakan termometer makanan untuk mengukur suhu dalaman dengan tepat dan memanaskan makanan secara sekata. Kajian oleh Smith et al. (2020) menunjukkan bahawa mengacau atau memutar makanan semasa pemanasan semula dapat membantu memastikan pemanasan yang merata, yang menyumbang kepada keselamatan makanan yang lebih baik. Selain itu, menutup makanan dengan penutup atau balut selamat gelombang mikro boleh membantu mengekalkan kelembapan dan menggalakkan pemanasan yang sekata. Dan juga, membenarkan makanan direhatkan selama beberapa minit selepas dipanaskan boleh membantu memastikan bakteria yang tinggal dimusnahkan sebelum dimakan.

Bahagian Keselamatan Dan Kualiti Makanan Kementerian Kesihatan Malaysia (2011) mencatatkan panduan yang disarankan untuk memasak daging, ayam dan sayuran. Semasa memanaskan semula daging atau ayam yang telah dikeluarkan dari peti sejuk, pastikan untuk segera memanaskannya hingga suhu di bahagian tengah makanan melebihi 70°C. Bagi sayuran, pastikan suhu makanan mencapai lebih daripada 60°C. Selepas proses pemanasan semula, hidangkan makanan dengan segera dan pastikan suhu sentiasa melebihi 60°C. Amat penting untuk diingat bahawa makanan ini tidak boleh dipanaskan semula untuk kali kedua. Selain itu, pastikan daging atau ayam yang separa masak tidak dipanaskan semula tanpa dimasak dengan secukupnya. Ini adalah langkah-langkah penting untuk memastikan keselamatan makanan dan mencegah pertumbuhan bakteria yang berbahaya. Food Standards Australia New Zealand (2024) menerangkan langkah penting untuk mengurangkan risiko keracunan makanan adalah memanaskan semula makanan dengan tepat. Makanan perlu dipanaskan sehingga mengeluarkan wap, menggagap, atau mendidih dengan sempurna. Amat disyorkan agar makanan dipanaskan pada suhu minimum 75°C dan dibiarkan pada suhu tersebut selama sekurang-kurangnya dua (2) minit. Penting untuk diingatkan bahawa makanan hanya perlu dipanaskan semula sekali sahaja. Mengulangi proses pemanasan makanan untuk



dimakan dalam beberapa hari boleh meningkatkan risiko kesihatan. Selalu dipastikan bahawa makanan dipanaskan semula dengan cepat sebelum disimpan di tempat yang boleh memanaskan makanan. Jika makanan memerlukan masa yang lama untuk dipanaskan seperti dalam periuk masak perlahan (slow cooker), ia akan berada dalam Suhu Zon Bahaya untuk tempoh yang lebih lama. Suhu Zon Bahaya adalah suhu di mana bakteria boleh berkembang biak dengan cepat dalam makanan. Oleh itu, adalah penting untuk memastikan makanan dipanaskan dengan betul untuk mengelakkan pertumbuhan bakteria yang tidak diinginkan.

Langkah Meningkatkan Kesedaran

Keselamatan makanan adalah keperluan asas tetapi terdapat bahaya yang mungkin diabaikan dalam pembangunan proses yang berkesan dan cekap (Mohd Farhan, 2020). Keselamatan makanan kekal sebagai isu kritikal dengan wabak penyakit bawaan makanan yang mengakibatkan kos yang besar kepada individu, industri makanan dan ekonomi. Makanan yang tidak selamat telah menjadi masalah kesihatan manusia sejak itu. Sejarah pertama kali direkodkan dan banyak masalah keselamatan makanan yang dihadapi hari ini bukanlah perkara baru (Fung et al., 2018). Verma et al. (2023) menyatakan bahawa majoriti penjual makanan jalanan adalah golongan yang miskin, tidak berpendidikan dan tidak mempunyai kesedaran tentang penanganan makanan yang selamat, persekitaran, sanitasi, kebersihan, paparan makanan, perkhidmatan makanan, mencuci tangan, sumber bahan mentah dan penggunaan air bersih. Akibatnya, makanan jalanan dianggap sebagai ancaman kesihatan awam yang serius, dan kebanyakan pengguna mengelakkannya.

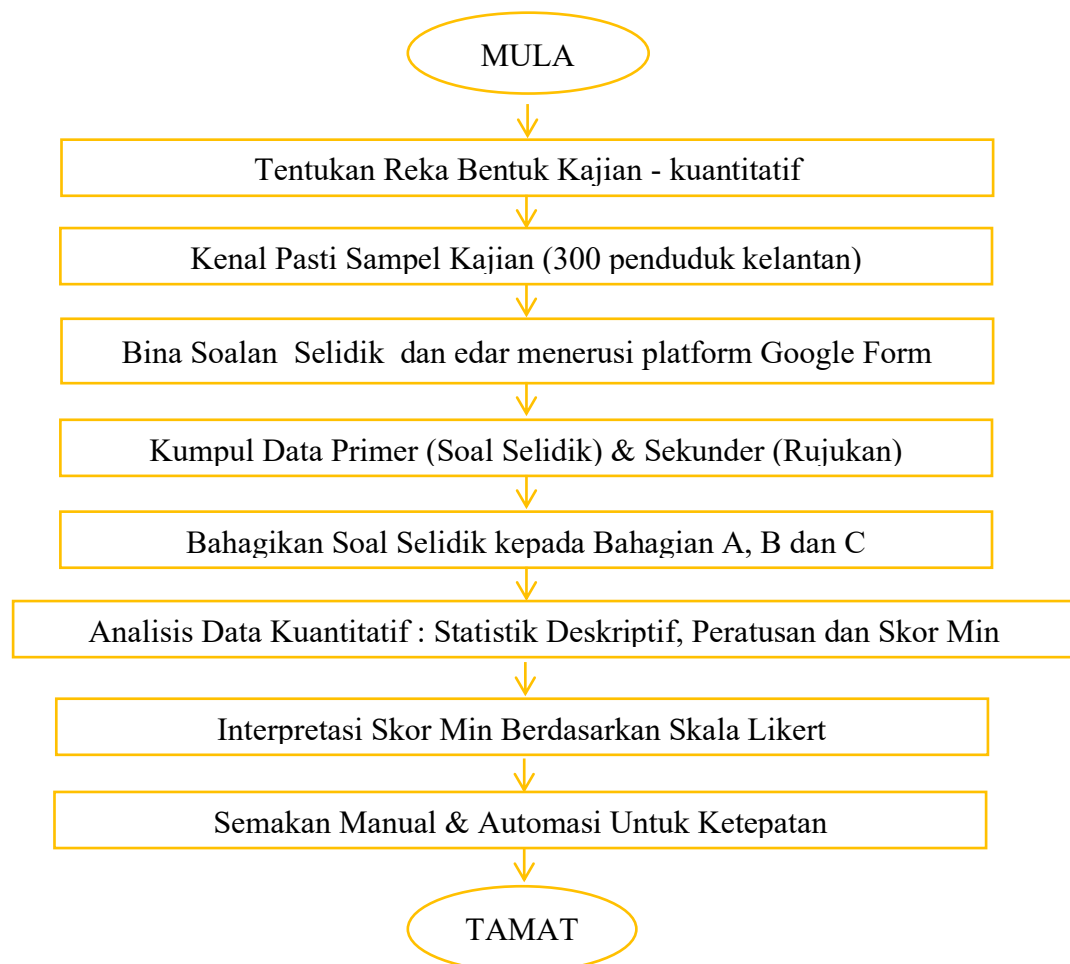
Untuk meningkatkan kesedaran tentang keselamatan makanan, beberapa langkah boleh diambil, menggunakan strategi berasaskan bukti dan inisiatif pendidikan. Pertama sekali, kempen pendidikan yang disasarkan harus dibangunkan untuk memaklumkan pengguna tentang teknik pengendalian, penyimpanan dan penyediaan makanan yang betul melalui pelbagai medium seperti televisyen, radio, media sosial dan bahan cetak. Kajian oleh Berglund et al. (2024) menunjukkan keberkesanan kempen multimedia dalam mempromosikan amalan makanan selamat dalam kalangan pengguna, yang membawa kepada peningkatan pengetahuan dan perubahan tingkah laku. Kedua, kerjasama antara agensi kerajaan, pihak berkepentingan industri dan organisasi masyarakat adalah penting untuk menyelaraskan usaha dan menyebarkan mesej yang konsisten tentang keselamatan makanan. Perkongsian boleh memudahkan pembangunan program latihan untuk pengendali makanan, pelaksanaan piawaian kebersihan dalam pertubuhan makanan dan penubuhan peraturan keselamatan makanan. Kajian oleh Olsen et al. (2019) menekankan kepentingan kerjasama pelbagai sektor dalam meningkatkan kesedaran keselamatan makanan dan mengurangkan kejadian penyakit bawaan makanan dalam masyarakat luar bandar.

Ketiga, memanfaatkan teknologi boleh meningkatkan kesedaran keselamatan makanan dengan menyediakan akses kepada maklumat dan sumber dalam masa nyata (Abass, 2024). Aplikasi mudah alih dan platform dalam talian boleh dibangunkan untuk menyampaikan modul latihan interaktif, idea resipi dan maklumat tentang penarikan semula makanan. Sebagai contoh, kajian oleh Smith et al. (2020) menunjukkan keberkesanan aplikasi mudah alih dalam

meningkatkan pengetahuan dan amalan keselamatan makanan dalam kalangan pekerja restoran, mengakibatkan pengurangan ketara dalam wabak penyakit bawaan makanan.

Reka Bentuk Kajian

Kaedah kuantitatif digunakan untuk mendapatkan hasil kajian. Borang soal selidik digunakan bagi tujuan mengumpul maklumat. Borang soal selidik yang telah disediakan ini telah diolah dan diubah suai daripada kajian-kajian lepas. Sumber instrumen adalah Windsor-Essex County Health Unit (2024), Praxis Health & Safety eLearning Consultancy (2024), Soon et al. (2020), Tac et al. (2020), Mohamad Ridruan et al. (2020), Institut Penyelidikan Tingkahlaku Kesihatan (2017), Papp & Krisch (2015) dan juga Bahagian Keselamatan Dan Kualiti Makanan (2011). Data dikumpul dianalisis melalui Statistical Package For Social Sciene (SPSS). Borang soal selidik diedarkan secara talian melalui platform Google Form kepada responden yang terdiri daripada pelbagai lapisan masyarakat awam di negeri Kelantan., seramai 300 responden dipilih secara rawak dalam kajian ini dan perjalanan kajian adalah seperti Rajah 2. di bawah.



Rajah 2 : Carta Alir Proses

Borang soal selidik ini mengandungi tiga (3) bahagian iaitu Bahagian A untuk menilai tahap kesedaran pengguna terhadap pemanasan semula makanan dalam memastikan keselamatan makanan., Bahagian B untuk menguji pengetahuan pengguna tentang risiko makanan yang tidak dipanaskan semula dengan betul yang boleh.dan Bahagian C adalah cadangan langkah-langkah untuk meningkatkan kesedaran dan amalan pengguna dalam memastikan keselamatan makanan melalui pemanasan semula yang betul. Setiap bahagian mengandungi 10 soalan berkaitan dengan objektif kajian. Skala Likert digunakan bagi Bahagian A adalah Ya, Tidak dan Tidak Pasti. Data dari Bahagian A diterjemahkan menggunakan frekuensi dan peratusan. Manakala, data dari Bahagian B dan Bahagian C dianalisis menggunakan frekuensi, peratusan dan skor min supaya lebih mudah dibuat rujukan dan difahami. Hasil dapatan dari skala jawapan Bahagian B dan Bahagian C dilaporkan mengikut tiga (3) tafsiran skor bagi memudahkan kerja analisis terhadap data yang dikumpulkan seperti dalam Jadual 1. Tahap tafsiran dipilih adalah seperti sumber Nor Hadibah et al. (2020), petikan tulisannya dari tafsiran statistik deskriptif Nurfadzlina & Mohammed (2012):

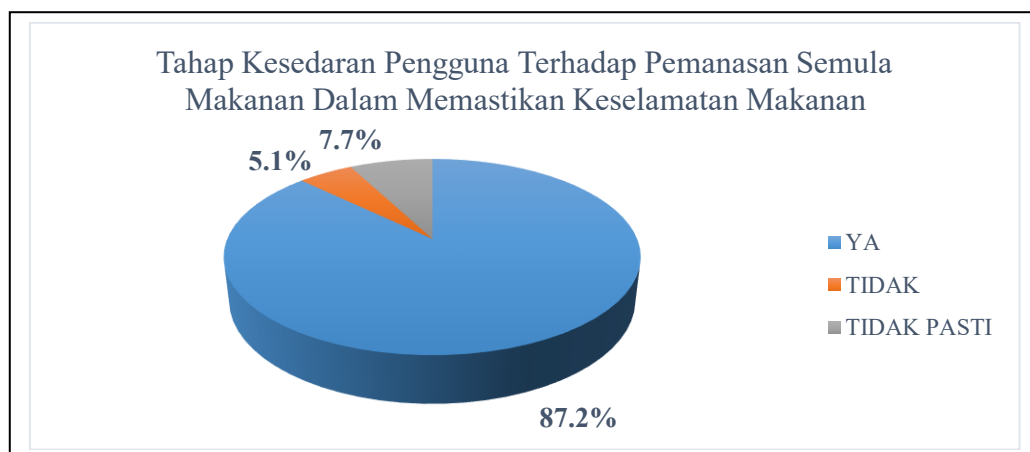
Jadual 1: Tahap Interpretasi

Skor Min	Tahap Interpretasi
1.00-1.99	Rendah
2.00-2.99	Sederhana
3.00-4.00	Tinggi

Dapatan Dan Perbincangan

Rumusan Dan Perbincangan Objektif 1: Tahap Kesedaran Pengguna Terhadap Pemanasan Semula Makanan Dalam Memastikan Keselamatan Makanan

Dapatan kajian seperti Rajah 3 di bawah menunjukkan bahawa majoriti responden, iaitu sebanyak 87.2%, menyatakan bahawa mereka sedar akan kepentingan memanaskan semula makanan dengan betul bagi memastikan keselamatan makanan.



Rajah 3: Rumusan Tahap Kesedaran Pengguna



Peratusan ini menunjukkan tahap kesedaran yang tinggi dalam kalangan pengguna, khususnya berkaitan risiko pencemaran makanan yang tidak dipanaskan semula dengan sempurna. Sebaliknya, hanya 5.1% responden menyatakan bahawa mereka tidak sedar tentang kepentingan amalan ini, manakala 7.7% pula berada dalam kategori tidak pasti. Walaupun peratusan yang tidak sedar dan tidak pasti adalah kecil, ia tetap signifikan kerana menunjukkan wujudnya kelompok pengguna yang berisiko tinggi terhadap amalan pemanasan semula yang tidak selamat. Keputusan ini selari dengan kajian Subashini et al. (2025) yang mendapati bahawa tahap kesedaran pengguna Malaysia terhadap keselamatan makanan berada pada tahap sederhana hingga tinggi, namun masih terdapat kekurangan dalam pemahaman teknikal seperti suhu pemanasan semula yang selamat dan penggunaan termometer makanan. Kajian Soon et al. (2020) turut menyatakan bahawa walaupun pengguna menunjukkan kesedaran umum yang baik, amalan sebenar mereka tidak konsisten, terutamanya dalam aspek kawalan suhu dan pemanasan semula berulang kali.

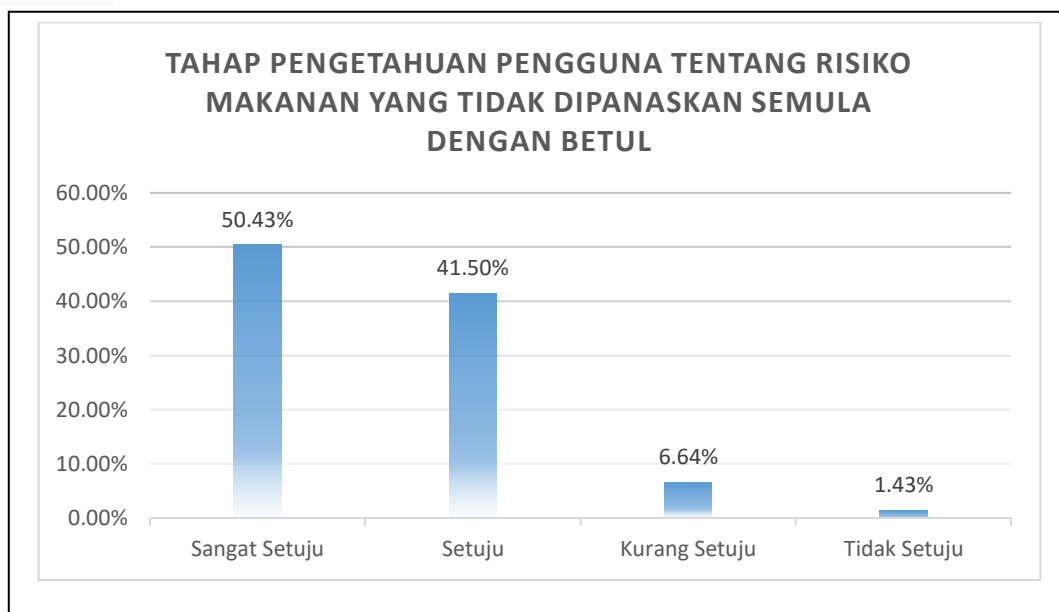
Selain itu, laporan CDC (2024) dan USDA (2025) menekankan bahawa pemanasan semula makanan sehingga suhu dalaman sekurang-kurangnya 74°C adalah penting untuk membunuh bakteria berbahaya seperti Salmonella dan Listeria monocytogenes. Namun, tanpa kesedaran yang kukuh dan pengetahuan yang tepat, pengguna mungkin tidak mengambil langkah yang sepatutnya untuk memastikan makanan yang dipanaskan semula benar-benar selamat dimakan. Secara keseluruhannya, peratusan kesedaran yang tinggi dalam kajian ini adalah petunjuk positif terhadap keberkesanan kempen pendidikan keselamatan makanan yang dijalankan oleh pihak berkuasa seperti KKM (2024). Namun, usaha berterusan masih diperlukan untuk memastikan kesedaran ini diterjemahkan kepada amalan harian yang konsisten dan selamat.

Rumusan Dan Perbincangan Objektif 2: Tahap Pengetahuan Pengguna Tentang Risiko Makanan Yang Tidak Dipanaskan Semula Dengan Betul

Dapatan kajian menunjukkan bahawa tahap pengetahuan pengguna terhadap risiko makanan yang tidak dipanaskan semula dengan betul adalah tinggi (skor min 3.39) seperti jadual 2 di bawah. Sebanyak 50.43% responden menyatakan “Sangat Setuju” bahawa mereka mengetahui risiko tersebut, manakala 41.50% pula memilih “Setuju” yang ditunjukkan dalam Rajah 4 di sebelah. Ini bermakna lebih daripada 91% responden mempunyai kesedaran yang jelas tentang bahaya makanan yang tidak dipanaskan semula dengan sempurna.

Jadual 2: Rumusan Tahap Pengetahuan Pengguna

Perkara	SS (%)	S (%)	KS (%)	TS (%)	Skor Min	Interpretasi
Tahap pengetahuan pengguna tentang risiko makanan yang tidak dipanaskan semula dengan betul.	50.43	41.5	6.64	1.43	3.39	Tinggi



Rajah 4: Rumusan Tahap Pengetahuan Pengguna

Sebaliknya, hanya 6.64% responden menyatakan “Kurang Setuju” dan 1.43% “Tidak Setuju”, menunjukkan bahawa golongan yang kurang pengetahuan adalah sangat kecil. Peratusan ini mengesahkan bahawa pengetahuan asas tentang keselamatan makanan telah tersebar luas dalam kalangan masyarakat, khususnya berkaitan risiko pencemaran bakteria seperti *Salmonella*, *Listeria monocytogenes*, dan *E. coli* yang boleh membiak dalam makanan yang tidak dipanaskan semula dengan betul.

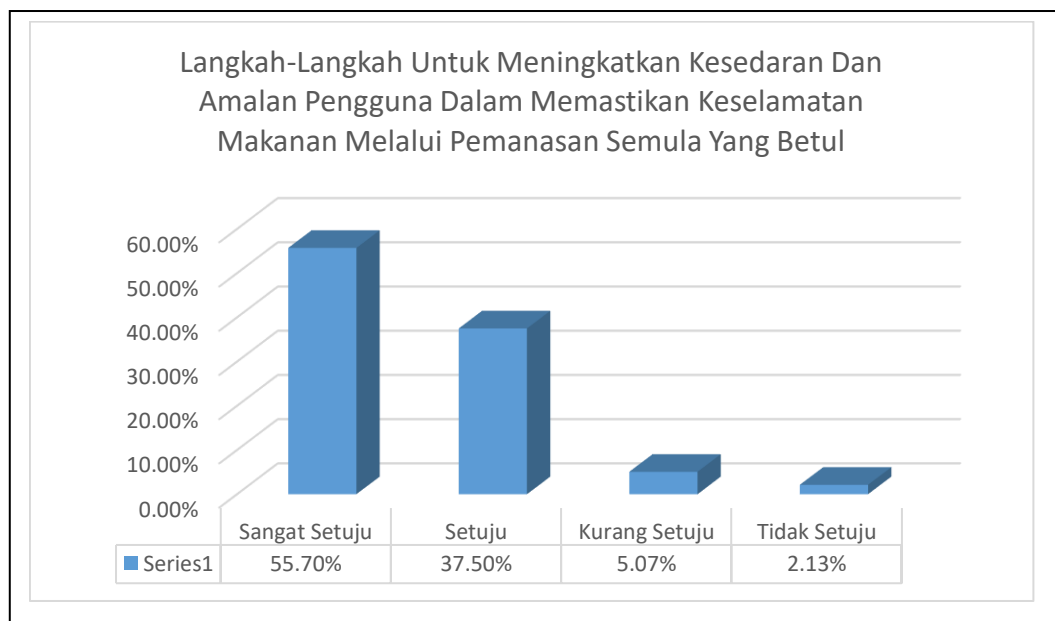
Dapatan ini selari dengan kajian Subashini et al. (2025) yang mendapati bahawa pengguna Malaysia menunjukkan tahap pengetahuan yang baik terhadap risiko pemanasan semula makanan, terutamanya dalam aspek penyimpanan dan pemanasan semula selepas dua jam. Kajian Lopes et al. (2025) turut menyatakan bahawa pengetahuan pengguna tentang suhu kritikal dan risiko bakteria meningkat apabila mereka terdedah kepada pendidikan keselamatan makanan yang berstruktur. Namun begitu, kajian Soon et al. (2020) menegaskan bahawa walaupun tahap pengetahuan tinggi, amalan sebenar pengguna masih tidak konsisten. Ramai pengguna tidak menggunakan termometer makanan untuk memastikan suhu pemanasan semula mencapai tahap selamat $\geq 75^{\circ}\text{C}$ seperti yang disarankan oleh CDC (2024) dan USDA (2025). Ini menunjukkan bahawa pengetahuan sahaja tidak mencukupi untuk menjamin keselamatan makanan, melainkan ia diterjemahkan kepada amalan harian yang betul.

Secara keseluruhannya, keputusan ini menunjukkan bahawa pengguna mempunyai kesedaran yang tinggi tentang risiko makanan yang tidak dipanaskan semula dengan betul. Namun, usaha pendidikan yang lebih mendalam dan berfokus kepada amalan teknikal masih diperlukan bagi memastikan pengetahuan ini dapat dimanfaatkan secara praktikal dalam kehidupan seharian.

Rumusan Dan Perbincangan Objektif 3: Langkah-Langkah Untuk Meningkatkan Kesedaran Dan Amalan Pengguna Dalam Memastikan Keselamatan Makanan Melalui Pemanasan Semula Yang Betul

Jadual 3: Rumusan Langkah Meningkatkan Kesedaran Dan Amalan Pengguna

Perkara	SS (%)	S (%)	KS (%)	TS (%)	Skor Min	Interpretasi
Langkah-langkah untuk meningkatkan kesedaran dan amalan pengguna dalam memastikan keselamatan makanan melalui pemanasan semula yang betul.	55.7	37.1	5.07	2.13	3.487	Tinggi



Rajah 5: Rumusan Langkah Meningkatkan Kesedaran Dan Amalan Pengguna

Dapatan kajian menunjukkan bahawa interpretasi majoriti responden menyokong langkah-langkah untuk meningkatkan kesedaran dan amalan pengguna dalam memastikan keselamatan makanan melalui pemanasan semula yang betul adalah tinggi (skor min 3.487) seperti yang ditunjukkan dalam Jadual 4 di atas. Manakala Rajah 5 menunjukkan sebanyak 55.70% responden menyatakan “Sangat Setuju” manakala 37.50% pula memilih “Setuju”, menjadikan jumlah sokongan keseluruhan sebanyak 93.20%. Ini menunjukkan bahawa pengguna bukan sahaja sedar akan kepentingan keselamatan makanan, tetapi juga bersedia menerima dan menyokong usaha penambahbaikan dalam bentuk pendidikan, teknologi, dan polisi. Sebaliknya, hanya 5.07% responden menyatakan “Kurang Setuju” dan 2.13% “Tidak Setuju”, menunjukkan bahawa penolakan terhadap langkah-langkah tersebut adalah sangat rendah. Peratusan ini mengesahkan bahawa masyarakat umum mempunyai sikap yang positif terhadap usaha memperkukuh amalan keselamatan makanan, khususnya dalam konteks pemanasan semula. Dapatan ini selari dengan kajian Subashini et al. (2025) yang menekankan bahawa



pengguna Malaysia menunjukkan keterbukaan terhadap pendidikan keselamatan makanan, terutamanya apabila pendekatan yang digunakan bersifat praktikal dan mudah diakses. Kajian Lopes et al. (2025) turut menyatakan bahawa sokongan pengguna terhadap inovasi teknologi seperti penggunaan termometer makanan dan aplikasi mudah alih keselamatan makanan adalah tinggi, terutamanya dalam kalangan pengguna muda dan berpendidikan. Selain itu, pelan tindakan yang digariskan oleh Kementerian Kesihatan Malaysia (KKM, 2024) melalui Pelan Tindakan Keselamatan Makanan Kebangsaan 2024–2030 turut menekankan kepentingan penglibatan pengguna dalam menjayakan dasar keselamatan makanan negara. Dapatan kajian ini menunjukkan bahawa sokongan pengguna terhadap pelan tersebut adalah kukuh dan boleh dijadikan asas untuk merangka program intervensi yang lebih berkesan.

Secara keseluruhannya, keputusan ini menunjukkan bahawa pengguna bukan sahaja mempunyai kesedaran dan pengetahuan, tetapi juga bersedia untuk menyokong dan mengamalkan langkah-langkah yang dicadangkan bagi memastikan makanan yang dipanaskan semula adalah selamat untuk dimakan. Ini memberikan petunjuk positif kepada pihak berkuasa, industri makanan, dan penyelidik untuk terus memperkukuh pendekatan pendidikan dan teknologi dalam usaha meningkatkan keselamatan makanan di Malaysia

Kesimpulan

Hasil kajian menunjukkan pengetahuan mereka tentang risiko pemanasan semula makanan adalah tinggi tetapi juga menunjukkan bahawa beberapa aspek kesedaran keselamatan makanan yang tidak betul adalah pada tahap sederhana. Mereka tidak menyedari apa yang perlu dilakukan dalam soal keselamatan makanan ketika proses pemanasan semula makanan. Oleh itu, terdapat jarak yang perlu diperbaiki antara kesedaran dan pengetahuan pengguna. Langkah untuk meningkatkan kesedaran dan amalan pengguna dalam memastikan keselamatan makanan melalui pemanasan semula adalah sangat penting. Cadangan termasuk menyediakan maklumat yang lebih jelas, mengemas kini prosedur secara kerap, memanfaatkan teknologi terkini dan melibatkan pihak berkepentingan. Justeru itu, adalah diharapkan kesedaran dan amalan pengguna dalam memastikan keselamatan makanan dapat dipertingkatkan yang akan menyumbang kepada perlindungan kesihatan seluruh masyarakat.

Kajian menunjukkan bahawa kesedaran pengguna terhadap beberapa aspek keselamatan makanan semasa pemanasan semula adalah rendah. Kebanyakan responden (74%) kurang menyedari kepentingan ini. Tambahan pula, pemahaman terhadap risiko makanan yang tidak dipanaskan semula dengan betul juga rendah, dengan 91% responden kurang menyedari risiko ini. Walau bagaimanapun, kesedaran yang baik diperlihatkan dalam beberapa aspek, seperti kepentingan menyajikan makanan panas (lebih daripada 60°C), di mana 78% responden sedar akan perkara ini. Penyelidikan ini menunjukkan ketidaktahuan umum tentang keselamatan makanan di antara responden. Faktor utamanya, termasuk kurangnya kesedaran akan pentingnya mencuci perkakas dapur, memanaskan kembali makanan beku dengan benar, dan menyimpan makanan pada suhu yang sesuai. Meskipun pemahaman tentang menyajikan makanan pada suhu yang tepat dan menjaga kebersihan saat memanaskan makanan cukup baik, pengetahuan tentang pemisahan makanan mentah dan yang sudah dimasak, serta pembuangan sisa makanan dalam dua jam setelah memasak, masih kurang. Kajian ini juga menegaskan



pentingnya kesedaran dan amalan keselamatan makanan dalam masyarakat. Hal ini didukung oleh kesedaran yang tinggi di kalangan responden terhadap risiko keracunan makanan. Majoriti responden setuju akan pentingnya menyimpan makanan pada suhu yang sesuai dan memanaskan makanan dengan benar untuk mengurangkan risiko pertumbuhan bakteria penyebab penyakit bawaan makanan. Selain itu, penyelidikan ini juga menekankan perlunya meningkatkan kesedaran dan pengetahuan tentang keselamatan makanan di antara responden. Meskipun ada pemahaman yang baik tentang aspek keselamatan makanan, masih terdapat kekurangan dalam mencuci peralatan dapur, menggunakan peralatan makanan, penggunaan barang kemas semasa mengendalikan makanan dan memahami prosedur memanaskan kembali makanan.

Cadangan

Berdasarkan temuan kajian, beberapa langkah dicadangkan untuk meningkatkan kesedaran dan amalan pengguna dalam pemanasan semula makanan yang selamat di antaranya adalah

Pendidikan dan Kesedaran Pengguna

Kementerian Kesihatan Malaysia (KKM, 2024) boleh memperluas kempen pendidikan awam melalui media massa, media sosial, dan program komuniti. Fokus utama ialah mendidik pengguna tentang kepentingan memanaskan semula makanan sehingga mencapai suhu dalaman $\geq 75^{\circ}\text{C}$.

Pendidikan keselamatan makanan perlu dimasukkan dalam kurikulum kesihatan dan sains rumah tangga. Kajian Subashini et al. (2025) menunjukkan bahawa pendidikan formal meningkatkan kesedaran pengguna terhadap risiko makanan yang tidak dipanaskan semula dengan betul.

Selaras dengan Teori Dewey, pengalaman keracunan makanan boleh dijadikan bahan pendidikan untuk meningkatkan kesedaran. Bengkel interaktif dan simulasi kes keracunan makanan boleh membantu pengguna memahami risiko sebenar.

Penggunaan Teknologi

CDC (2024) menekankan bahawa penggunaan termometer makanan adalah kaedah paling tepat untuk memastikan suhu pemanasan semula mencapai tahap selamat. Oleh itu, pengguna digalakkan untuk menggunakan termometer digital yang mudah didapati di pasaran.

Pembangunan aplikasi mudah alih yang memberi panduan suhu pemanasan semula, tips penyimpanan makanan, dan amaran risiko boleh membantu pengguna membuat keputusan yang lebih baik.

Industri peralatan dapur boleh menghasilkan ketuhar gelombang mikro atau periuk elektrik dengan sensor suhu automatik untuk memastikan makanan dipanaskan semula dengan betul (USDA, 2025).



Polisi dan Sokongan Kerajaan

Kerajaan boleh memperkukuh garis panduan keselamatan makanan dengan mewajibkan penggunaan termometer dalam industri makanan dan katering.

Program latihan wajib untuk pengendali makanan perlu diperluas, dengan penekanan kepada kawalan suhu dan pemanasan semula makanan. Kajian Lopes et al. (2025) menunjukkan bahawa latihan berstruktur meningkatkan amalan keselamatan makanan dalam industri makanan.

KKM perlu meningkatkan pemantauan terhadap restoran dan perkhidmatan katering untuk memastikan pematuhan garis panduan keselamatan makanan.

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PENGANGKAT MUDAH ALIH PEMAMPAT PENYAMAN UDARA: INOVASI UNTUK KECEKAPAN & KESELAMATAN

**Muhammad Adam Yusouf Mohammad Hasnul¹, Muhammad Hariz Hamzy Ismadi
Zukarni², Muhammad Naqib HabibMat Hishamuddin³, Nor Helme Padel⁴**

¹Jab Kejuruteraan Mekanikal, Politeknik Kota Bharu (PKB), Malaysia, (muhammad.adam.yusouf@gmail.com)

²Jab Kejuruteraan Mekanikal, Politeknik Kota Bharu (PKB), Malaysia, (harizismadi143@gmail.com)

³Jab Kejuruteraan Mekanikal, Politeknik Kota Bharu (PKB), Malaysia, (qibzhabib27@gmail.com)

⁴Jab Kejuruteraan Mekanikal, Politeknik Kota Bharu (PKB), Malaysia, (norhelme@pkb.edu.my)

Abstrak: Pemasangan dan penyelenggaraan pemampat penyaman udara sering menjadi cabaran utama bagi juruteknik kerana saiz dan berat peralatan. Tujuan projek ini adalah untuk membangunkan alat Pengangkat Mudah Alih Pemampat Penyaman Udara yang direka khas bagi memudahkan proses pemasangan dan servis pemampat rumah, sekali gus meningkatkan keselamatan serta kecekapan kerja. Sistem direka dengan mekanisme pengangkatan kompak dan boleh dilaraskan bagi menampung pemampat sehingga 1.5hp. Struktur utama diperbuat daripada besi untuk memastikan kestabilan, manakala ciri keselamatan seperti had beban maksimum dan mekanisme pengunci ditambah bagi mengelakkan pergerakan tidak terkawal. Ujian prestasi dijalankan bagi menilai keberkesanan sistem dalam operasi sebenar. Hasil ujian menunjukkan sistem ini berupaya mengurangkan beban fizikal juruteknik, mempercepatkan proses pemasangan, serta meningkatkan tahap keselamatan kerja. Penggunaan alat ini dijangka memberi manfaat besar kepada industri pemasangan dan penyelenggaraan penyaman udara dengan meningkatkan kecekapan kerja serta memperkukuh aspek keselamatan.

Kata Kunci Alat Pengangkat Mudah Alih, Pemampat Penyaman Udara, Pemasangan Dan Penyelenggaraan, Mekanisme Keselamatan.

Pengenalan

Penggunaan penyaman udara telah menjadi satu keperluan asas dalam kehidupan moden, khususnya di negara beriklim tropika seperti Malaysia. Peningkatan penggunaan sistem penyaman udara secara meluas dalam sektor kediaman, komersial dan industri secara tidak langsung meningkatkan keperluan terhadap kerja-kerja penyelenggaraan yang cekap dan selamat. Namun demikian, proses pengendalian serta penyelenggaraan pemampat penyaman udara sering melibatkan risiko fizikal kepada juruteknik, terutamanya akibat beban berat, kedudukan pemasangan yang sukar dicapai, serta kebergantungan kepada tenaga manusia sepenuhnya. Cabaran ini bukan sahaja memberi kesan terhadap keselamatan pekerjaan, malah turut mempengaruhi kecekapan kerja dan kos operasi jangka panjang. Kecederaan muskuloskeletal, masa penyelenggaraan yang panjang, serta keperluan tenaga kerja tambahan merupakan antara isu yang sering dilaporkan dalam aktiviti penyelenggaraan pemampat penyaman udara. Oleh itu, satu pendekatan inovatif diperlukan bagi meningkatkan tahap keselamatan, mengurangkan beban fizikal, serta mempertingkatkan produktiviti kerja

juruteknik. Sehubungan itu, pembangunan Pengangkat Mudah Alih Pemampat Penyaman Udara diperkenalkan sebagai satu inovasi mekanikal yang bertujuan untuk memudahkan proses mengangkat, memindahkan dan memasang pemampat penyaman udara dengan lebih selamat dan sistematik. Inovasi ini direka bentuk untuk menyediakan sokongan yang stabil, mudah dikendalikan, serta bersesuaian dengan persekitaran kerja penyelenggaraan sebenar. Penggunaan peralatan ini dijangka dapat mengurangkan kebergantungan kepada tenaga manusia, seterusnya meminimumkan risiko kecederaan dan meningkatkan kecekapan kerja.

Penyataan Masalah



Rajah 1: Kaedah Manual

Pemampat penyaman udara merupakan komponen utama dalam sistem penyaman udara yang mempunyai berat yang tinggi dan perlu diangkat secara manual oleh pekerja semasa proses pemasangan dan penyelenggaraan seperti Rajah 1. Aktiviti ini memerlukan penggunaan tenaga fizikal yang signifikan dan berulang, sekaligus meningkatkan risiko kecederaan pekerjaan seperti sakit belakang, terseliuh dan kecederaan otot berdasarkan fenomena gangguan muskuloskeletal yang sering berlaku akibat tugas pengendalian manual yang tidak ergonomik. Kajian di Malaysia menunjukkan bahawa aktiviti manual handling yang berulang dan beban fizikal yang tinggi adalah antara punca utama ketidakselesaan otot dan risiko gangguan muskuloskeletal dalam kalangan pekerja penyelenggaraan dan mekanik industri tempatan (Mazlina et al.,

2023; Suhimi & Abdol Rahman, 2024).

Selain itu, pemasangan pemampat penyaman udara sering dijalankan di lokasi yang sukar dicapai seperti bumbung bangunan, fasad luar dan ruang sempit, yang menambah cabaran kepada pekerja untuk mengangkat dan meletakkan pemampat dengan ketepatan dan kestabilan yang tinggi. Persekitaran kerja yang terhad ini bukan sahaja meningkatkan risiko kecederaan akibat kedudukan postur yang tidak baik, tetapi juga boleh menjejaskan kualiti pemasangan dan menyebabkan kelewatan kerja (Malaysian ergonomics literature; DOSH ergonomics guidelines 2025). Pada masa kini, kaedah konvensional seperti pengangkatan manual atau penggunaan tali dan takal masih digunakan secara meluas dalam industri penyelenggaraan penyaman udara. Walaupun kaedah ini telah diamalkan sekian lama, ia menunjukkan kekangan dari segi kecekapan dan keselamatan kerja, termasuk keperluan tenaga kerja yang ramai, tempoh kerja yang lebih panjang dan peningkatan risiko kecederaan akibat kehilangan kawalan semasa tugas angkat. Ini menunjukkan bahawa pendekatan tradisional kurang sesuai dan berpotensi memberi risiko keselamatan serius, sekali gus menimbulkan keperluan terhadap inovasi peralatan sokongan yang lebih ergonomik dan efektif (DOSH, Guidelines for Manual Handling at Workplace 2018; ergonomic research Malaysia 2024). Justeru, pembangunan inovasi seperti pengangkat mudah alih pemampat penyaman udara adalah kritikal bagi meningkatkan keselamatan, mengurangkan beban fizikal pekerja, dan meningkatkan kecekapan kerja dalam tugas penyelenggaraan dan pemasangan.



Skop Projek

Skop projek ini tertumpu kepada reka bentuk dan pembuatan sebuah pengangkat mudah alih yang dibangunkan khusus untuk mengangkat unit pemampat penyaman udara bersaiz 1.0 kuasa kuda (hp) - 1.5 kuasa kuda (hp) dengan berat maksimum sehingga 50 kg. Pembangunan inovasi ini memfokuskan kepada penyelesaian masalah pengangkatan manual semasa kerja pemasangan dan penyelenggaraan pemampat, dengan penekanan terhadap peningkatan kecekapan kerja serta tahap keselamatan pekerja. Selain itu, kajian ini merangkumi pembangunan sistem pengangkat mudah alih yang dilengkapi dengan ciri knockdown system, iaitu struktur yang boleh dibuka dan dipasang semula. Ciri ini bertujuan untuk meningkatkan aspek praktikaliti peralatan dari segi kemudahan pemindahan, penyimpanan, serta penggunaan semula, tanpa memerlukan ruang simpanan yang besar.

Skop projek ini juga melibatkan reka bentuk sistem pengangkat yang mampu mencapai ketinggian maksimum sehingga 12 kaki, bagi memenuhi keperluan pemasangan pemampat penyaman udara di lokasi yang sukar dicapai seperti bumbung bangunan dan dinding luar. Walau bagaimanapun, penggunaan pengangkat mudah alih ini dihadkan kepada kawasan kerja yang mempunyai permukaan rata dan stabil sahaja, bagi memastikan keselamatan operasi serta kestabilan struktur semasa proses pengangkatan dijalankan.

Projek ini tidak merangkumi penggunaan pengangkat di permukaan tidak rata, kawasan cerun, atau persekitaran berisiko tinggi yang boleh menjejaskan kestabilan peralatan dan keselamatan pengguna.

Objektif Projek

1. Mereka bentuk alat mengangkat pemampat penyaman udara yang mudah dipasang dan disimpan untuk kegunaan pekerja pemasangan atau penyelenggaraan.
2. Mengubah alat pengangkat pemampat penyaman udara yang sedia ada dengan sistem bermotor.
3. Menilai keberkesanan alat pengangkat bermotor dalam meningkatkan kecekapan dan keselamatan kerja

Kajian Literatur

Kajian Smith et al. (2018) menunjukkan bahawa pemasangan unit luar penyaman udara di bangunan tinggi sering menjadi cabaran kerana memerlukan scaffold, kren kecil, atau alat pengangkat khas. Kajian terkini turut mendapati bahawa sistem winch elektrik dengan kawalan jauh dapat mengurangkan keperluan buruh manual sehingga 40% (Liebherr, 2024; Zhang et al., 2025), penggunaan hydraulic lift mengurangkan risiko kecederaan otot dan sendi pekerja sehingga 30% (Aline Crane Rental, 2024; OHSE, 2026), manakala automasi dalam mekanisme angkatan meningkatkan kecekapan kerja sebanyak 25% serta mengurangkan kos operasi sebanyak 15% (HVAC Laboratory, 2025; OCRAMclima, 2025; CoolAutomation, 2025).

Produk Pengangkat Mudah Alih Pemampat Penyaman Udara Yang Sedia Ada Di Pasaran

Jadual 1 dan 2 dibawah memperlihatkan contoh produk pengangkat mudah alih pemampat penyaman udara yang telah tersedia di pasaran. Berdasarkan analisis terhadap ciri reka bentuk, bahan binaan dan keupayaan operasi produk-produk ini, termasuk mengenal pasti beberapa kekangan dan potensi penambahbaikan. Justeru, produk-produk sedia ada ini telah dijadikan asas rujukan bagi proses reka bentuk semula (redesign) dan pembangunan inovasi baharu yang lebih efisien, modular, dan sesuai untuk aplikasi pemasangan di ketinggian serta persekitaran kerja yang pelbagai.

Jadual 1: Perbandingan Produk Pengangkat Mudah Alih Pemampat Penyaman Udara Termasuk Ciri Produk, Jenis Bahan Binaan, Elemen Reka Bentuk & Dimensi Asas

Jenis Produk	Gambar Produk	Ciri Utama	Jenis Bahan Binaan	Elemen Reka Bentuk	Dimensi Asas (Anggaran)
Locking Mini Crane Manual Winch		Winch manual dengan sistem pengunci automatik	Besi karbon dan keluli tahan lasak	Rangka menegak dengan lengan angkat boleh laras, tapak kaki silang	Tinggi $\pm 1.8\text{m}$, lebar tapak $\pm 0.8\text{m}$, panjang lengan $\pm 0.6\text{m}$, kapasiti $\pm 30\text{--}40\text{kg}$
Ezi-Lift		Struktur menegak dengan tapak 'X', roda 360°, aluminium ringan	Rangka aluminium, kaki keluli tahan karat	Rangka menegak dengan tapak 'X', roda berputar penuh, pelaras ketinggian manual	Tinggi $\pm 2.5\text{m}$, lebar tapak $\pm 1\text{m}$, panjang lengan $\pm 0.7\text{m}$, kapasiti $\pm 80\text{--}100\text{kg}$
Genie Lift (Material Lift)		Rangka menegak dengan tapak 'U', winch manual, aluminium ringan	Aluminium bertetulang dan keluli ringan	Rangka menegak dengan tapak 'U', pelantar angkat manual, roda tetap	Tinggi $\pm 2.2\text{m}$, lebar tapak $\pm 0.9\text{m}$, panjang lengan $\pm 0.6\text{m}$, kapasiti $\pm 80\text{kg}$

**Jadual 2: Perbandingan Produk Pengangkat Mudah Alih Pemampat Penyaman Udara
Termasuk Kelebihan, Kekurangan & Anggaran Kos**

Jenis Produk	Gambar Produk	Kelebihan	Kekurangan	Anggaran Kos	Rujukan
Locking Mini Crane Manual Winch		Kompak, mudah dipindahkan, sesuai untuk ruang sempit	Bergantung kepada tenaga manual, kapasiti beban terhad, tidak sesuai permukaan tidak rata	RM1,000 – RM2,500	https://liediaohoisting.en.made-in-china.com/
Ezi-Lift		Mudah dialihkan, menjimatkan masa, meningkatkan keselamatan	Memerlukan ruang simpanan besar, had ketinggian, tidak sesuai permukaan tidak rata	RM3,000 – RM7,000	www.ksf.com.tw
Genie Lift (Material Lift)		Mudah dikendalikan, ringan, tidak perlukan elektrik	Bergantung sepenuhnya pada tenaga manusia, kapasiti beban terhad, tidak sesuai permukaan tidak rata	RM2,500 – RM6,000	https://www.uptop.com.my/

Isu Dan Cabaran Dalam Pemasangan Pemampat Penyaman Udara

Berat dan Saiz Pemampat Penyaman Udara

Unit pemampat bagi sistem penyaman udara rumah bersaiz 1.0hp hingga 1.5hp lazimnya mempunyai berat sekitar 20–30 kg, yang menyukarkan proses pemasangan secara manual terutama di bangunan bertingkat atau ruang sempit. Menurut Preston Rentals (2024), beban berat dan ruang terhad merupakan antara cabaran utama dalam pemasangan HVAC, yang boleh menjejaskan produktiviti dan keselamatan pekerja. Tanpa sistem pengangkat yang sesuai, pekerja perlu menstabilkan unit secara manual pada ketinggian tertentu, meningkatkan risiko keletihan dan kecederaan.



Risiko Kecelakaan Akibat Pengangkatan Manual

Pengangkatan manual tanpa alat sokongan boleh menyebabkan masalah kesihatan pekerjaan seperti: tekanan pada otot belakang, bahu, dan tangan akibat beban berat, risiko tergelincir atau jatuh sekiranya pekerja kehilangan kawalan semasa mengangkat unit dan ketidakseimbangan postur yang boleh mengakibatkan kecederaan otot.

Kajian oleh ServiceTitan (2023) menekankan bahawa pengendalian manual dalam pemasangan HVAC adalah antara punca utama kecederaan ergonomik, termasuk strain otot dan risiko jatuh dari ketinggian. Tambahan pula, HSE Blog (2025) melaporkan bahawa kecederaan akibat pengendalian manual merupakan salah satu daripada 15 bahaya keselamatan utama dalam industri HVAC, yang memerlukan kawalan melalui penggunaan alat bantu mekanikal dan latihan ergonomik.

Kesukaran dalam Menstabilkan Pemampat Semasa Pemasangan

Semasa pemasangan, unit luar penyaman udara perlu dipasang pada bracket atau dinding dengan tahap kestabilan yang tinggi. Tanpa alat pengangkat yang sesuai, pekerja mungkin:

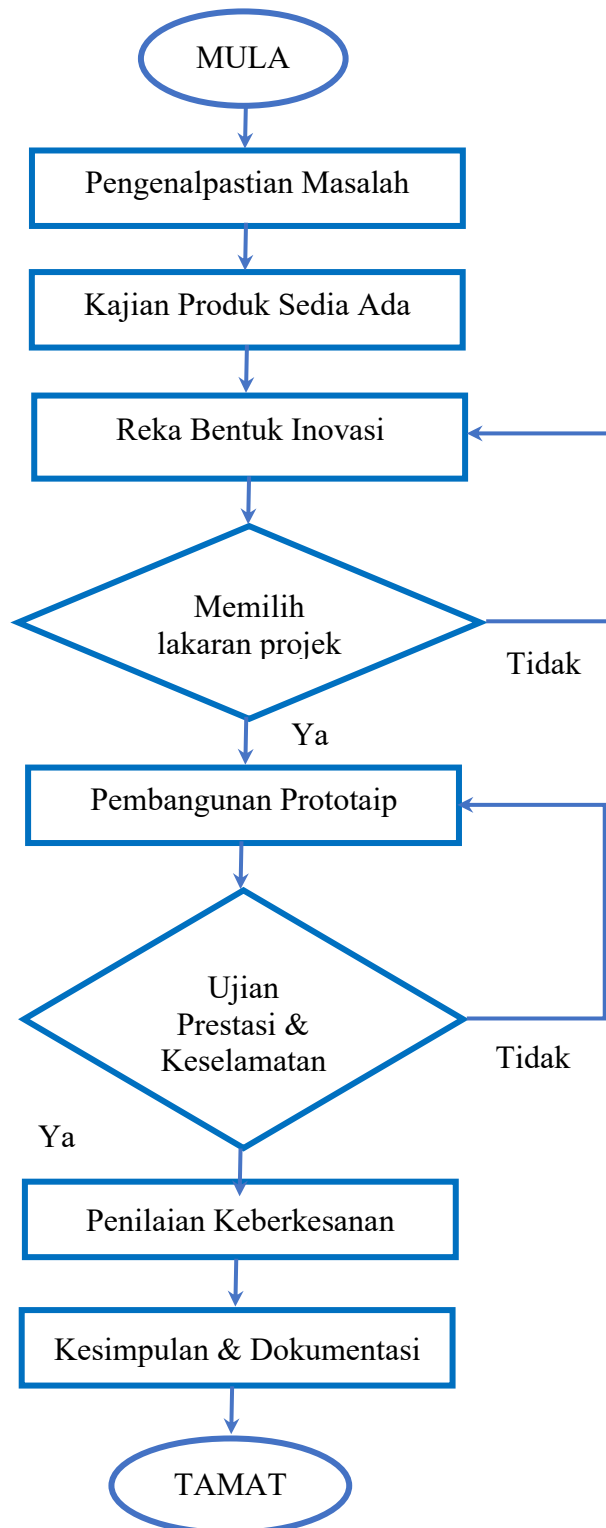
- Menggunakan tali atau sokongan manual yang tidak stabil.
- Menghadapi kesukaran menyesuaikan kedudukan unit sebelum pemasangan selesai.
- Berisiko menjatuhkan unit, menyebabkan kerosakan peralatan dan bahaya kepada orang di bawah.

Menurut QHSE Risk Assessment (2023), kestabilan unit semasa pemasangan adalah kritikal kerana kegagalan dalam menempatkan unit dengan betul boleh menyebabkan kerosakan peralatan dan meningkatkan risiko kemalangan di tapak kerja.

Metodologi

Bagi memastikan pembangunan produk inovasi Pengangkat Mudah Alih Pemampat Penyaman Udara mencapai tahap kecekapan dan keselamatan yang optimum, satu pendekatan metodologi sistematik telah digariskan. Metodologi ini merangkumi proses pengenpastian masalah sebenar di lapangan, kajian terhadap produk sedia ada, serta reka bentuk semula berdasarkan keperluan ergonomik dan teknikal semasa.

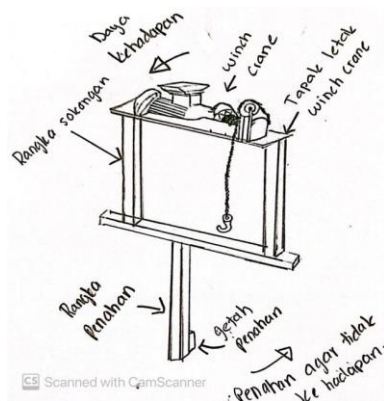
Setiap fasa dalam metodologi ini disusun secara berperingkat seperti Rajah 2, dengan bermula daripada analisis awal sehingga kepada pembangunan prototaip dan penilaian keberkesanan. Pendekatan ini bukan sahaja menekankan aspek fungsi dan keselamatan, tetapi juga mempertimbangkan kebolehgunaan produk dalam pelbagai situasi pemasangan, khususnya di kawasan sempit dan bertingkat tinggi.



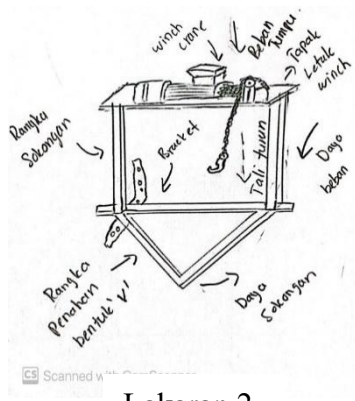
Rajah 2: Carta Alir Bagi Proses Pengangkat Mudah Alih Pemampat Penyaman Udara

Idea Reka Bentuk

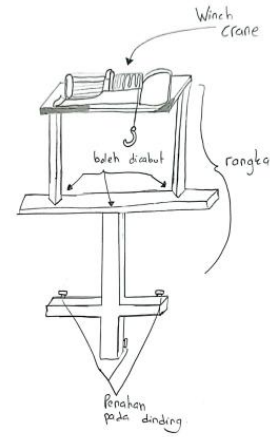
Di peringkat awal, terdapat tiga cadangan reka bentuk untuk Pengangkat mudah alih pemampat penyaman udara yang berpotensi untuk dicipta. Idea seperti rajah 3 di bawah menunjukkan lukisan isometrik yang dilakukan sebagai cadangan rekabentuk projek.



Lakaran 1



Lakaran 2



Lakaran 3

Rajah 3 : Lakaran Idea

Pemilihan Lakaran Projek

Jadual 3 di bawah menunjukkan senarai cadangan lakaran projek pengangkat mudah alih pemampat penyaman udara. Setiap lakaran dinilai berdasarkan kelebihan dan kekurangan reka bentuknya untuk menentukan pilihan terbaik yang memenuhi objektif projek.

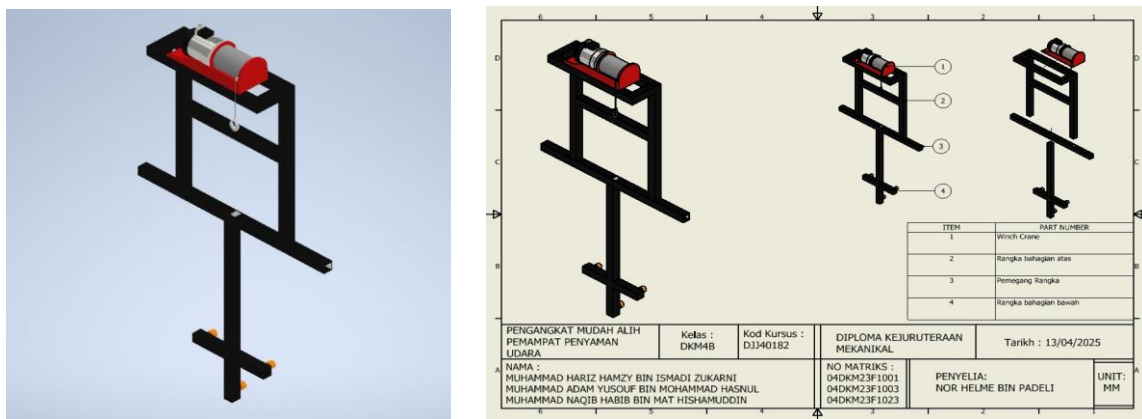
Jadual 3 : Senarai perbandingan cadangan lakaran projek

Cadangan Lakaran	Kelebihan	Kekurangan
Lakaran 1	Lebih mudah dibawa dan disimpan kerana bentuknya lurus.	Kurang stabil pada bahagian penahan kerana kurang tapak untuk disandarkan pada tempat kerja seperti dinding.
Lakaran 2	Pantas dari segi pemasangan.	Kesukaran untuk disimpan kerana bentuknya yang kurang efisien.
Lakaran 3	Lebih stabil dan kukuh apabila digunakan kerana mempunyai tapak penahan yang baik.	Kedudukan <i>winch crane</i> agak tinggi dari tapak penahan .

Lukisan Teknikal

Lukisan teknikal seperti Rajah 4 di bawah ialah satu bentuk lukisan yang digunakan untuk menyampaikan maklumat berkaitan reka bentuk, struktur, dan spesifikasi sesuatu objek atau komponen secara tepat dan terperinci. Lukisan ini disediakan mengikut skala, dengan ukuran yang tepat dan simbol piawai supaya hasil akhir produk dapat dihasilkan mengikut kehendak asal tanpa berlaku kekeliruan.

Selain itu, lukisan ini juga memaparkan pandangan seperti pandangan hadapan, sisi, atas dan kadang kala dalam bentuk isometrik atau perspektif untuk gambaran tiga dimensi. Lukisan ini turut mengandungi maklumat penting seperti jenis bahan, ukuran, serta arahan khas berkaitan proses pembuatan atau pemasangan. Secara ringkasnya, lukisan teknikal sangat penting dalam memastikan sesuatu produk, mesin atau struktur dapat dibina, dipasang, dan digunakan dengan tepat dan selamat mengikut spesifikasi yang telah ditetapkan.



Rajah 4 : pandangan Isometrik

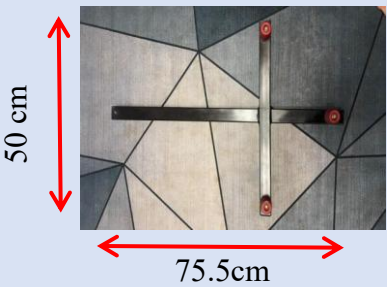
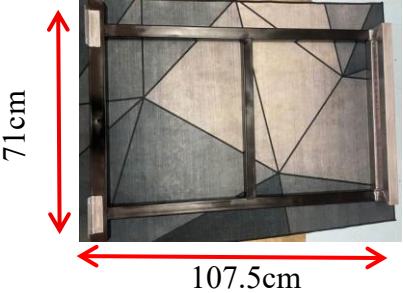
Proses Fabrikasi

Proses fabrikasi projek ini dijalankan secara sistematik bagi memastikan struktur dan fungsi sistem beroperasi dengan baik serta menepati spesifikasi yang ditetapkan seperti Jadual 4. Proses bermula dengan reka bentuk awal menggunakan perisian seperti *Inventor* bagi menentukan saiz dan kedudukan setiap komponen. Seterusnya, bahan seperti besi *mild steel* dipotong mengikut ukuran yang ditetapkan menggunakan mesin pemotong dan grinder. Bahagian struktur utama disambungkan melalui proses kimpalan MIG bagi menghasilkan rangka yang kukuh sebelum diteruskan dengan penggerudian untuk lubang bolt dan komponen lain. Setelah itu, proses pemasangan dijalankan dengan menyambung komponen seperti motor, winch dan pulley pada struktur utama. Peringkat seterusnya ialah komponen kawalan, diikuti dengan ujian fungsi bagi memastikan sistem beroperasi dengan lancar serta selamat. Kemasan akhir dilakukan dengan membersihkan dan mengecat bahagian logam bagi melindungi daripada karat dan memberikan penampilan yang lebih kemas dan profesional.

Jadual 4: Proses Pembinaan Projek

No	Proses	Penerangan	No	Proses	Penerangan
1		Membeli besi yang bersesuaian dan jumlah yang dikehendaki di kedai hardware yang berdekatan.	2		Mengukur panjang besi sebelum membuat pemotongan. Panjang besi yang dibeli adalah 20 kaki.
3		Memotong besi kepada 4 bahagian dengan panjangnya 5 kaki.	4		Membuat pembayang terlebih dahulu sebelum membuat pemotongan kecil dan proses peyambungan.
5		Membuat lubang segi empat sama untuk memasukkan rangka kaki tiga. Pemotongan bahagian kecil juga dilakukan untuk menyambung setiap bahagian seperti peyambungan <i>bracket</i> dan tapak <i>wich crane</i> .	6		Membuat penyambungan melalui proses kimpalan MIG untuk menjadikan rangka bentuk yang telah ditetapkan.
7		Membuat pengujian untuk mengenalpasti sama ada projek ini berjalan lancar atau tidak. Pengujian dijalankan sebanyak dua kali. Pada kali pertama terdapat sedikit masalah pada rangka atas projek dan pengujian kedua dijalankan selepas masalah diselesaikan. Projek berjaya dijalankan.	8		Membuat proses akhir iaitu mengecat bahagian besi untuk menampakan lagi kekemasan.

Jadual 5 : Ukuran Dan Spesifikasi Projek

GAMBAR RAJAH	INFO
	Spesifikasi : Panjang 75.5 cm dan lebar 50cm. Fungsi : Sebagai penahan semasa menaikkan pemampat sewaktu operasi
	Spesifikasi : Panjang 107.5cm dan lebar 71cm. Fungsi : Sebagai rangka untuk menguatkan proses mengangkat dan menurun semasa sewaktu operasi.
	Spesifikasi : Panjang 32cm, tinggi 11cm, lebar 19cm Panjang tali keluli 1500cm Fungsi : Mesin <i>winch crane</i> untuk proses mengangkat dan menurun semasa sewaktu operasi.

Jadual 6 : Ukuran dan Berat Keseluruhan

Data	Keputusan
Berat	14kg
Tinggi	182cm
Lebar	71 cm

Ukuran dan berat projek secara keseluruhan adalah seperti Jadual 5 dan Jadual 6 di atas

Analisi Keberfungsian Projek

Analisis kefungsian projek Pengangkat Mudah Alih Pemampat Penyaman Udara menunjukkan bahawa semua komponen utama berfungsi dengan baik dan mencapai objektif yang ditetapkan. Sistem angkat menggunakan motor winch DC 12V mampu mengangkat beban sehingga 50 kg dengan stabil, manakala penggunaan wayar tembaga bersaiz 6mm² memastikan bekalan arus yang mencukupi tanpa kehilangan voltan. *Wireless control* berfungsi dengan baik untuk mengawal arah pergerakan serta menghentikan operasi bagi tujuan keselamatan. Struktur rangka keluli lembut (*mild steel*) 1.2 inci pula kukuh dan stabil ketika menampung beban,

sementara roda memudahkan pergerakan sistem. Secara keseluruhan, projek ini beroperasi dengan baik dan memenuhi keperluan kefungsiian yang dirancang seperti Rajah 5 di bawah

Analisis untuk objektif mengubah alat pengangkat pemampat yang sudah sedia ada dengan sistem bermotor



Rajah 5 : Gambar Projek Inovasi

Hasil pengubahsuaian alat pengangkat pemampat yang sedia ada kepada sistem bermotor menunjukkan peningkatan yang ketara dari segi kecekapan dan kemudahan operasi. Sistem motor yang dipasang berfungsi sebagai mekanisme utama untuk menggerakkan *winch* bagi proses pengangkatan dan penurunan pemampat penyaman udara tanpa memerlukan tenaga manual yang tinggi. Penggunaan motor ini membolehkan pergerakan beban menjadi lebih stabil dan terkawal, sekali gus mengurangkan risiko kecederaan serta meningkatkan keselamatan semasa operasi. Selain itu, sistem kawalan motor yang direka secara mudah membolehkan pengguna mengawal kelajuan dan arah pergerakan dengan lebih tepat. Secara keseluruhannya, pengubahsuaian kepada sistem bermotor ini telah berjaya meningkatkan keberkesanan dan kebolehgunaan alat pengangkat, menjadikannya lebih efisien untuk digunakan oleh juruteknik dalam kerja pemasangan dan penyelenggaraan pemampat penyaman udara.

Analisis untuk objektif menilai keberkesanan alat pengangkat bermotor dalam meningkatkan kecekapan dan keselamatan kerja.

Jadual 7 : Ringkasan Keputusan Ujian Pengangkat Pemampat

Parameter	Manual (Purata)	Bermotor (Purata)	Perubahan (%)
Masa pemasangan (minit)	8.2	7.4	-9.8%
Bilangan pekerja yang diperlukan	2	1	-50%
Skor tahap kesakitan (likert 1 - 5)	3	1	-66.7%

Dengan merujuk kepada Jadual 7, penggunaan kaedah bermotor dalam pemasangan HVAC terbukti lebih efisien berbanding manual. Ia mempercepatkan proses dengan penjimatan masa hampir 10%, mengurangkan separuh keperluan tenaga kerja, serta menurunkan tahap kesakitan

pekerja sebanyak dua pertiga. Secara keseluruhan, mekanisasi meningkatkan produktiviti organisasi dan mengurangkan risiko kecederaan muskuloskeletal yang sering dikaitkan dengan kerja manual.

Analisis Kos

Analisis kos seperti Jadual 8 adalah aspek penting buntuk menilai kebolehlaksanaan ekonomi projek. Kos yang terlibat dalam projek ini termasuk kos bahan, kos pembuatan dan kos buruh. Berikut adalah pecahan kos yang ditanggung untuk meghasilkan projek ini:

Jadual 8 : Jenis Kos	
JENIS KOS	KOS (RM)
Kos Bahan	374.06
Kos Buruh	150.00
Kos Operasi	160.64
Jumlah	684.70

Risiko Keselamatan

Jadual 9 adalah susunan sistematik bagi risiko dan langkah kawalan berkaitan penggunaan winch: yang dijangkan.

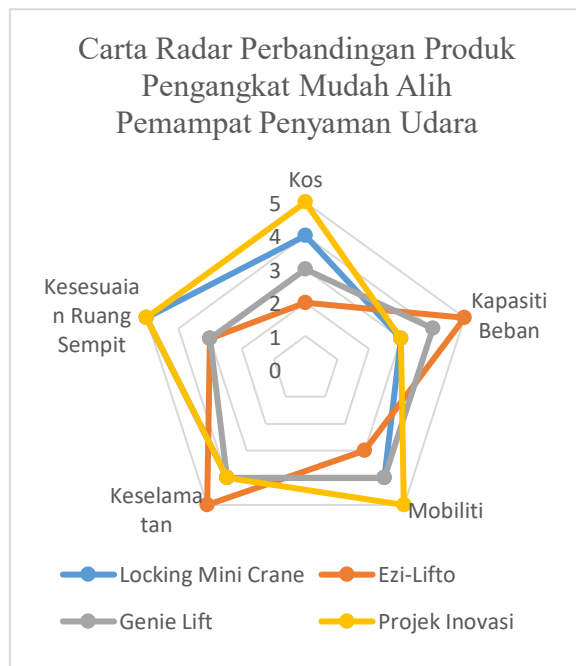
Jadual 9 : Risiko dan Langkah Kawalan Penggunaan

<i>Risiko</i>	<i>Penerangan</i>	<i>Langkah Kawalan</i>
Kerosakan mekanikal pada winch.	Komponen seperti gear, drum, atau bearing boleh haus dan menyebabkan operasi tidak stabil.	Lakukan penyelenggaraan berkala dan gunakan pelincir pada bahagian bergerak.
Kecederaan jari tersepit.	Risiko semasa mengendalikan winch atau semasa beban diangkat/turun.	Jangan letakkan tangan berhampiran tali ketika beroperasi.
Keletihan operator atau kesilapan manusia.	Salah operasi boleh menyebabkan kemalangan atau kerosakan alat.	Latihan kepada operator dan penggunaan prosedur operasi standard (SOP).
Tali winch terputus atau tergelincir dari drum.	Menyebabkan beban jatuh secara tiba-tiba.	Gunakan tali keluli (steel wire rope) yang sesuai dengan kapasiti beban dan pastikan lilitan kemas pada drum.

Kesimpulan Projek

Projek ini di bina untuk menginovasikan alat pengangkat pemampat penyaman udara mudah alih bagi memudahkan juruteknik yang memasang atau membuat servis penyaman udara 1.0hp dan 1.5hp. Masalah utama yang cuba diselesaikan adalah untuk memudahkan pemasangan unit luar kondensor. Objektif pertama, iaitu mereka bentuk alat pengangkat pemampat penyaman udara yang mudah dipasang dan disimpan telah berjaya dicapai, ia boleh dilerai kepada 2 bahagian. Objektif kedua, mengubah alat pemampat yang sudah sedia ada dengan sistem bermotor. dimana sistem motor digunakan sebagai mekanisme utama untuk mengerakkan winch bagi proses mengangkat dan menurunkan pemampat penyaman udara tanpa memerlukan tenaga manual yang tinggi seperti konsep takal. Objektif ketiga, iaitu menilai keberkesanan alat pengangkat bermotor dalam meningkat kecekapan kerja dan mengurangkan risiko kecederaan semasa pemasangan penyaman udara, telah dicapai. Seterusnya, analisis kos menunjukkan bahawa alat ini mampu mengurangkan kos pembuatan lebih tinggi daripada yang sedia ada di pasaran. Projek ini memberi impak positif kepada juruteknik dengan menyediakan alternatif yang pratikal untuk penyelesaian masalah mengangkat pemampat penyaman udara, sekali gus berpotensi untuk dikomersialkan pada masa akan datang. Kejayaan projek ini membuktikan bahawa sistem yang direka dapat memberi manfaat kepada industri.

Carta radar seperti Rajah 6 di bawah menunjukkan bahawa projek inovasi mempunyai prestasi paling seimbang berbanding Locking Mini Crane, Ezi-Lifto dan Genie Lift berdasarkan lima kriteria utama iaitu kos, kapasiti beban, mobiliti, keselamatan dan kesesuaian ruang sempit.



Projek inovasi mencatatkan skor tinggi dari segi kos, mobiliti dan kesesuaian penggunaan di ruang sempit, selaras dengan objektif reka bentuk yang menekankan aspek kepraktisan dan kebolehalihan. Ezi-Lifto pula menunjukkan kelebihan dari segi kapasiti beban dan keselamatan, namun kekangan kos dan fleksibiliti ruang menghadkan penggunaannya. Locking Mini Crane dan Genie Lift memperlihatkan prestasi sederhana dan seimbang tanpa dominasi jelas dalam semua kriteria. Secara keseluruhan, analisis ini membuktikan bahawa projek inovasi merupakan pilihan paling sesuai dan pratikal untuk aplikasi pengangkatan unit pemampat penyaman udara bersaiz kecil hingga sederhana.

Rajah 6 : Carta Radar Perbandingan Produk

Cadangan



Walaupun sistem berfungsi dengan baik, namun terdapat beberapa penambahbaikan yang boleh dilakukan pada masa hadapan, antaranya ialah menambah saiz dan panjang wayer elektrik dari jenis tembaga bersaiz 6mm² bagi memastikan sambungan kuasa dapat mencapai peralatan dengan mudah serta mengurangkan kehilangan voltan dan risiko wayar tertarik atau tidak cukup panjang semasa operasi dijalankan. Selain itu, dengan menambah sistem *pully* dan rangka pemegangnya, ia akan dapat mengelakkan pemampat dari bergesel dengan dinding semasa proses mengangkat atau menurunkan pemampat penyaman udara.

Dengan mengintegrasikan sistem IoT (*Internet of Things*), pengguna boleh memantau status operasi winch seperti beban, suhu motor dan masa operasi melalui aplikasi mudah alih secara masa nyata. Ini membolehkan penyelenggaraan dilakukan dengan lebih efisien dan meningkatkan tahap keselamatan serta kecekapan sistem. Struktur rangka juga boleh ditambah baik dengan konsep ianya mudah dibawa kemana-mana. Sebagai contoh membuat struktur rangka yang boleh dilipat dan menjadi lebih kecil serta mudah dibawa.

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PENGAMALAN ETIKA DALAM KALANGAN PELAJAR POLITEKNIK MUKAH DAN FAKTOR-FAKTOR MEMPENGARUHI

Farah Hanan Abu Bakar¹, Fatin Faqeriah Hamsah², Syifaa' Badri³

¹Jabatan Pengajian Am, Politeknik Mukah (PMU), Sarawak, Malaysia. (farah@pmu.edu.my)

²Jabatan Pengajian Am, Politeknik Kuching Sarawak (PKS), Malaysia. (faqeriah@pks.edu.my)

³Jabatan Pengajian Am, Politeknik Mukah (PMU), Sarawak, Malaysia. (syifaa@pmu.edu.my)

Abstrak: Kajian ini dijalankan untuk meneliti tahap pengamalan etika dan peradaban dalam kalangan pelajar di Politeknik Mukah, Sarawak serta mengenal pasti faktor-faktor utama yang mempengaruhi pengamalan tersebut. Pengamalan etika dan peradaban bukan sahaja penting dalam membentuk keperibadian pelajar, malah menjadi asas kepada pembangunan modal insan yang holistik dan berintegriti tinggi. Justeru, pemahaman dan penghayatan nilai-nilai murni seperti tanggungjawab, hormat-menghormati, amanah, tolak ansur dan adab sopan perlu diperkasa dalam kalangan pelajar institusi pengajian tinggi, khususnya politeknik sebagai institusi pendidikan teknikal. Kajian ini menggunakan pendekatan kuantitatif melalui kaedah tinjauan dengan instrumen soal selidik yang dibina berdasarkan dimensi pengamalan etika dan peradaban. Responden kajian dalam kajian ini terdiri daripada pelajar yang telah mengikuti Kursus Penghayatan Etika dan Peradaban pada sesi II:2024/2025. Data yang dikumpul dianalisis menggunakan perisian SPSS melibatkan statistik deskriptif iaitu min, sisihan piawai serta korelasi untuk menguji hubungan antara pemboleh ubah. Hasil kajian ini menunjukkan bahawa secara keseluruhan, pelajar mempunyai tahap pengamalan etika dan peradaban yang tinggi. Pengaruh keluarga mencapai min yang tertinggi dalam mempengaruhi etika pelajar. Antara faktor utama yang dikenal pasti mempengaruhi amalan etika dan peradaban ialah diri sendiri, pengaruh rakan sebaya dan keluarga. Pengaruh diri sendiri, rakan sebaya dan keluarga mempunyai hubungan yang kuat dalam pengamalan etika pelajar. Dapatan ini memberi implikasi penting kepada pihak pengurusan politeknik untuk merangka program pembangunan sahsiah pelajar yang lebih menyeluruh dan berkesan, termasuk memperkukuh budaya organisasi yang berteraskan nilai etika serta memperkasa kursus etika dan peradaban agar lebih kontekstual dan dekat dengan realiti kehidupan pelajar. Diharap kajian ini dapat membantu pensyarah kursus bagi memperkukuh nilai etika dan peradaban dalam kalangan pelajar politeknik.

Kata Kunci: Pengamalan, Etika dan Peradaban, Pelajar Politeknik Mukah, Faktor-Faktor

Pengenalan

Falsafah Pendidikan Kebangsaan (FPK) berperanan sebagai asas kepada sistem pendidikan di bagi memastikan proses pendidikan mampu melahirkan insan yang seimbang dan holistik dari segi jasmani, emosi, rohani dan intelek bagi menyumbang kepada kesejahteraan negara (Syahirah Rosli et al, 2022). Ini membuktikan bahawa semua dasar dan pelaksanaan sistem pendidikan kita selaras seperti yang telah ditetapkan di dalam FPK (Saad & Rajamanickam, 2021). Dalam pelaksanaan usaha ini, Kementerian Pendidikan Tinggi (KPT) telah



memperkenalkan penawaran Kursus Mata Pelajaran Umum (MPU) di semua Institusi Pengajian Tinggi (IPT) di Malaysia (Sakinatul et al., 2022). Kursus Penghayatan Etika dan Peradaban merupakan kursus wajib dalam Matapelajaran Pengajian Umum (MPU) di semua institusi pengajian tinggi termasuk politeknik dengan tujuan untuk memupuk serta menerapkan etika dan peradaban dalam kalangan pelajar (Ani Raihana et al, 2023). Ini menjelaskan bahawa kursus ini dapat meningkatkan nilai etika dan moral di kalangan pelajar bukan sahaja dalam bidang akademik malah memiliki keperibadian unggul.

Kursus Penghayatan Etika dan Peradaban (PEP) diperkenalkan oleh Jabatan Pendidikan Tinggi (JPT) sebagai satu usaha berterusan dalam membangunkan nilai dan etika yang baik dalam diri mahasiswa (Rosli et al., 2023). Sehubungan itu, kursus ini diperkenalkan di politeknik Malaysia pada semester Jun 2020. Rentetan itu, kursus ini adalah pengganti kepada kursus Pengajian Malaysia yang ada sebelum ini supaya dapat memperkukuh keupayaan pemikiran kritis pelajar dalam menghadapi isu etika dan kepelbagaian peradaban etnik di Malaysia (Kamsani, 2021). Sehubungan dengan itu, kursus ini berperanan membina keperibadian mahasiswa yang seimbang dengan menekankan pengamalan nilai etika, peradaban dan sikap saling menghormati dalam kalangan masyarakat pelbagai kaum di Malaysia. (Esa et al., 2021). Justeru, kursus ini diwujudkan bagi melahirkan pelajar yang berakhlak mulia dengan memberi penekanan kepada aspek kefahaman yang jelas berkaitan pengamalan etika dan peradaban yang menjurus kepada pembinaan peradaban.

Penyataan Masalah

Kajian Ismail et al. (2024) menunjukkan bahawa pelajar TVET menghadapi cabaran dalam mengamalkan etika terutamanya dalam aspek komunikasi berhemah, disiplin serta etika digital. Hal ini disokong oleh Mohamad Zaki et al., (2023) yang mendapati kemerosotan nilai etika akademik dalam kalangan pelajar institusi teknikal akibat pengaruh media sosial dan persekitaran sosial. Berdasarkan pemerhatian pensyarah di Politeknik Mukah, beberapa isu terhadap etika dalam kalangan pelajar seperti lewat datang ke kelas, penggunaan bahasa kurang sopan, kurang rasa hormat kepada pensyarah, ketidakpatuhan terhadap peraturan serta mengambil sikap sambil lewa terhadap tugas yang telah diberikan. Keadaan ini menunjukkan adanya keperluan bagi kajian empirikal untuk mengenal pasti tahap pengamalan etika pelajar serta faktor-faktor yang mempengaruhinya.

Kajian ini memberikan tumpuan kepada tiga faktor utama yang sering dikaitkan dengan pembentukan etika pelajar, iaitu faktor diri sendiri, rakan sebaya dan keluarga. Kajian oleh Rahman dan Jamali (2022) mendapati kawal selia diri dan kesedaran moral menyumbang kepada pengamalan etika seseorang pelajar. Pengaruh rakan sebaya pula merupakan elemen yang kuat kerana pelajar lebih cenderung untuk meniru norma dan tingkah laku kumpulan mereka (Latip & Noor, 2023). Sementara itu, keluarga memainkan peranan awal dalam pembentukan nilai etika melalui gaya keibubapaan dan persekitaran sosialisasi (Samsudin et al., 2021).



Objektif Kajian

- a) Mengenal pasti pengamalan etika dalam kalangan pelajar Politeknik Mukah
- b) Mengenal faktor-faktor yang mempengaruhi pengamalan etika di kalangan di pelajar
- c) Mengkaji hubungan di antara faktor diri sendiri, rakan sebaya dan keluarga dalam mempengaruhi pengamalan etika di kalangan pelajar

Literature Review

Pengamalan Etika dalam kalangan Pelajar Institusi Pengajian Tinggi

Pengamalan etika dalam kalangan pelajar institusi pengajian tinggi merupakan aspek penting dalam membentuk generasi berpengetahuan tinggi yang bukan sahaja cemerlang secara akademik tetapi juga berkeperibadian mulia. Dalam konteks Politeknik Mukah, isu berkaitan etika dan peradaban semakin diberi perhatian memandangkan ia berperanan besar dalam membentuk budaya pembelajaran yang positif serta melahirkan graduan TVET yang berintegriti. Secara umum, etika didefinisikan sebagai asas pertimbangan moral yang memandu tindakan seseorang serta menentukan sama ada sesuatu tingkah laku itu betul atau salah. Pengamalan etika pelajar merangkumi pelbagai aspek seperti penghayatan nilai murni, integriti akademik, adab dalam pergaulan, rasa hormat terhadap pensyarah dan rakan, serta disiplin diri dalam menunaikan tanggungjawab pembelajaran.

Kajian-kajian terdahulu menunjukkan bahawa isu penurunan etika dalam kalangan pelajar institusi pengajian tinggi kini menjadi kebimbangan global. Di Malaysia, beberapa penyelidikan mendapati peningkatan isu plagiarisme, ketidakjujuran akademik, salah guna media sosial, kurang rasa hormat terhadap pensyarah, dan kelemahan disiplin diri. Mohamad Zaki et al. (2023) mendapati pengaruh media sosial dan norma sosial rakan sebaya menyumbang kepada kemerosotan etika akademik dalam kalangan pelajar teknikal. Dapatan ini disokong oleh Ismail et al. (2024) yang menunjukkan bahawa pelajar TVET berdepan cabaran dalam mengurus tingkah laku etika, khususnya dalam aspek etika digital dan komunikasi berhemah. Walaupun kursus Penghayatan Etika dan Peradaban ditawarkan secara wajib, pengamalan etika yang sebenar masih bergantung kepada kesediaan pelajar untuk menghayati nilai yang dipelajari.

Dari sudut teori, pengamalan etika sering dikaitkan dengan Teori Perkembangan Moral Kohlberg yang menjelaskan bahawa pertimbangan moral individu berkembang melalui beberapa peringkat, bermula dengan kepatuhan kepada peraturan sehingga mampu membuat pertimbangan berdasarkan prinsip moral universal. Dalam konteks pendidikan tinggi, teori ini menunjukkan bahawa pelajar yang matang dari segi pemikiran moral cenderung mengamalkan tingkah laku etika yang lebih tinggi. Selain itu, Teori Pembelajaran Sosial Bandura pula menerangkan bahawa tingkah laku individu dipelajari melalui pemerhatian, peniruan dan pengukuhan sosial. Hal ini bermaksud, pelajar lebih mudah meniru tingkah laku rakan sebaya atau pensyarah yang dianggap sebagai model, justeru persekitaran sosial memainkan peranan penting dalam membentuk tingkah laku etika.



Faktor-faktor yang mempengaruhi Pengamalan Etika

Pengaruh rakan sebaya merupakan faktor yang sangat signifikan dalam konteks pelajar politeknik. Latip dan Noor (2023) menyatakan bahawa pelajar cenderung mengikut norma kumpulan rakan untuk mengelakkan tekanan sosial. Jika kumpulan rakan menganggap perbuatan seperti meniru tugas atau melanggar peraturan sebagai perkara biasa, maka kemungkinan besar individu turut terlibat. Dalam konteks pembelajaran berasaskan projek yang merupakan ciri utama TVET, rakan sebaya memainkan peranan besar kerana interaksi yang kerap membentuk budaya kerja tertentu. Justeru, norma rakan sebaya berpotensi mempengaruhi tahap disiplin, kejujuran, dan rasa tanggungjawab pelajar.

Selain itu, faktor keluarga turut dikenal pasti sebagai asas penting kepada pembentukan etika pelajar. Kajian oleh Samsudin et al. (2021) menunjukkan gaya keibubapaan yang mengutamakan komunikasi, sokongan emosi dan nilai moral dapat meningkatkan integriti dan kesedaran etika remaja. Walaupun pelajar politeknik biasanya tinggal berjauhan daripada keluarga, nilai-nilai yang dibentuk sejak awal kehidupan masih berfungsi sebagai panduan tingkah laku. Keluarga yang menekankan nilai kejujuran, amanah dan disiplin lebih berpotensi menghasilkan pelajar yang mempunyai penghayatan etika lebih tinggi.

Di samping faktor individu, rakan sebaya dan keluarga, faktor institusi juga mempengaruhi pengamalan etika dalam kalangan pelajar. Institusi yang memiliki budaya integriti yang kukuh, polisi disiplin yang jelas serta pensyarah yang menunjukkan teladan positif biasanya melahirkan pelajar yang lebih beretika. Rahman dan Jamali (2022) menunjukkan bahawa pengalaman pembelajaran berkualiti serta sokongan pensyarah meningkatkan kesedaran moral dan kecenderungan pelajar untuk mengamalkan etika dalam pembelajaran harian. Dalam konteks Politeknik Mukah, pengamalan etika juga dipengaruhi oleh pelaksanaan kursus etika, pendekatan pengajaran pensyarah, serta keberkesanan peraturan kampus dalam membendung salah laku.

Cabaran era digital turut memberi kesan besar terhadap tingkah laku etika pelajar. Penggunaan media sosial secara berlebihan, pembelajaran dalam talian, serta akses tidak terbatas kepada maklumat menyebabkan berlaku lonjakan masalah plagiarisme, kecurangan peperiksaan serta penyebaran maklumat palsu. Kajian Munir et al. (2023) menunjukkan bahawa pembelajaran atas talian semasa pandemik meningkatkan kecenderungan pelajar untuk melakukan ketidakjujuran akademik. Hal ini menunjukkan bahawa etika digital menjadi komponen penting dalam memahami tingkah laku etika pelajar moden.

Berdasarkan kajian-kajian lepas dapatlah disimpulkan bahawa pengamalan etika pelajar dipengaruhi oleh gabungan pelbagai faktor psikologi, sosial dan institusi. Namun begitu, kajian yang meneliti pengamalan etika secara khusus dalam konteks Politeknik Mukah masih terhad. Oleh itu, kajian ini penting bagi mengenal pasti tahap pengamalan etika pelajar, memahami faktor-faktor yang mempengaruhinya serta merangka cadangan intervensi bagi memperkukuh budaya etika dalam kalangan pelajar politeknik.



Metodologi Kajian Tata Cara Pengumpulan Data

Kajian ini adalah melibatkan kajian kuantitatif yang menggunakan kaedah soal selidik sebagai alat kajian utama. Begitu juga liputan kajian kuantitatif ini hanya melibatkan pelajar di Politeknik Mukah sahaja. Dalam kajian ini akan membincangkan aspek metodologi dan prosedur kajian. Oleh yang demikian, kajian ini membincangkan populasi dan sampel kajian, instrumen kajian dan kajian rintis bagi prosedur pengumpulan data kajian,. Oleh hal yang demikian, metodologi yang digunakan dalam kajian ini adalah untuk menjawab setiap persoalan kajian yang membawa kepada perbincangan lanjut tentang kajian. Justeru, prosedur dalam penyelidikan akan diuraikan dengan jelas untuk menentukan bahawa persoalan kajian tersebut mendapat data yang bermakna untuk menyumbang kepada keseluruhan kajian.

Populasi dan Sampel Kajian

Mohd. Majid Konting (1993) menjelaskan sampel ialah sebahagian individu yang diambil melalui persampelan bagi mewakili sesuatu populasi yang dikaji atau sebahagian dalam populasi. Richard Levin dan David Rubin (2000) menghuraikan sampel sebagai pengumpulan sebahagian tetapi bukan semua unsur populasi yang dikaji dan digunakan untuk menghuraikan populasi. Dalam menjalankan kajian ini pengkaji memilih populasi kajian di seramai 534 pelajar yang mengambil kursus penghayatan Etika dan Peradaban di Politeknik Mukah, Sarawak. Sampel kajian diambil daripada populasi yang melibatkan 232 pelajar yang mengambil kursus tersebut. Berdasarkan jadual penentuan saiz sampel oleh Krejcie dan Morgan (1970) saiz populasi kajian ini berpadanan dengan pengiraan saiz sampel.

Instrumen Kajian

Instrumen adalah alat kajian bagi mendapatkan data dalam sesuatu penyelidikan (Ghazali Darusalam & Sufean, 2021). Dalam menjalankan kajian ini data dikumpul menggunakan soal selidik dan data ini dianalisis secara deskriptif. Tujuan soal selidik mengikut Pratt (1980) digunakan bagi memudahkan pengkaji memungut data terhadap responden yang ada untuk mendapatkan maklumat yang tepat. Bagi mendapatkan data serta membolehkan pengkaji menjawab persoalan dan pelajar diminta menjawab soal selidik berskala likert lima 5 skala Likert, iaitu Sangat tidak setuju (STS), Tidak setuju (TS), Kurang setuju (KS), Setuju (S) dan Sangat setuju (SS). Soal selidik ini terdiri daripada empat bahagian iaitu bahagian A mengenai demografi responden dan Bahagian B berfokuskan kepada pengamalan etika dan peradaban dalam kalangan pelajar Politeknik Mukah manakala bahagian C berkenaan faktor-faktor yang mempengaruhi pengamalan etika dan peradaban di kalangan di Politeknik Mukah.

Kajian Rintis

Kajian rintis telah dilaksanakan melibatkan seramai 20 orang pelajar semester 2 yang telah mengikuti kursus Penghayatan Etika dan Peradaban. Pemilihan responden kajian rintis dibuat berdasarkan persamaan ciri dengan sampel yang akan digunakan dalam kajian sebenar. Kajian



rintis ini bertujuan untuk menilai tahap kebolehppercayaan dan kesahan instrumen soal selidik yang dibangunkan oleh pengkaji.

Sepanjang pelaksanaan kajian rintis, beberapa aspek telah diberi perhatian, antaranya kejelasan arahan soalan, kefahaman terhadap setiap item yang dikemukakan, ketiadaan kekeliruan terhadap maklumat yang disampaikan serta memastikan tiada kesilapan atau kelemahan yang memerlukan penambahbaikan sebelum kajian sebenar dijalankan (Nadhilah Abdul Pisal & Kamarul Shukri Mat Teh, 2019). Di samping itu, kajian rintis turut dijalankan bagi menilai tahap kebolehppercayaan dan ketekalan instrumen soal selidik melalui pengiraan nilai pekali Alfa Cronbach. Nilai alfa yang diperolehi ialah 0.994, yang menunjukkan tahap kebolehppercayaan instrumen berada pada aras yang sangat tinggi.

Analisis Data

Pengkaji menggunakan nilai skor min yang dinyatakan oleh Nik Mohd. Rahimi (2005) bagi menentukan interpretasi skor min. Skor min digunakan untuk pengamalan etika dan peradaban dalam kalangan pelajar Politeknik Mukah dan faktor-faktor yang mempengaruhi pengamalan etika dan peradaban dengan mengkategorikan tiga tahap iaitu rendah, sederhana dan tinggi berdasarkan skor min item seperti yang ditunjukkan dalam Jadual 1.

Jadual 1: Nilai skor min

Nilai Skor Min	Tahap
1.00-2.33	Rendah
2.34-3.67	Sederhana
3.68-5.00	Tinggi

Sumber: Nik Rahimi (2005)

Analisis Statistik Deskriptif

Data statistik deskriptif dianalisis secara kuantitatif bagi memberikan gambaran awal terhadap dapatan kajian. Analisis deskriptif bagi item Bahagian A dijalankan untuk mengenal pasti taburan kekerapan dan peratusan responden. Menurut Creswell (2011), analisis deskriptif merupakan kaedah analisis data yang paling asas dan lazim digunakan, khususnya bagi data berskala nominal seperti maklumat demografi atau profil responden. Kaedah analisis data ini dilaksanakan bagi membantu pengkaji menjawab semua persoalan kajian serta menjadi asas dalam penyediaan laporan kajian secara sistematik dan teratur.

Analisis Statistik Inferensi

Pengkaji menggunakan ujian Pekali Korelasi Pearson bagi menentukan sama ada wujud hubungan yang signifikan antara pembolehubah-pembolehubah yang dikaji. Bagi menilai kekuatan hubungan antara kedua-dua pembolehubah tersebut, pengkaji merujuk kepada tafsiran anggaran kekuatan hubungan yang dicadangkan oleh Cohen (1998) seperti yang dipaparkan dalam Jadual 2.

Jadual 2: Anggaran kekuatan perhubungan antara dua pembolehubah

Pekali Korelasi	Kekuatan Hubungan
0.10 – 0.29	Rendah
0.30 – 0.49	Sederhana
0.50 – 1.0	Tinggi

Kawasan Kajian

Pemilihan lokasi kajian ini melibatkan pelajar yang mengambil kursus penghayatan etika dan peradaban pada sesi II:2024/2025 yang berada di Politeknik Mukah. Dalam kajian ini lokasi yang dipilih ialah di Politeknik Mukah.

Dapatan dan Perbincangan

Taburan Kekerapan Respondan

Seramai 232 orang pelajar yang mengikuti kursus Penghayatan Etika dan Peradaban telah dipilih sebagai responden dalam kajian ini. Responden kajian melibatkan lima jabatan yang terdapat di Politeknik Mukah, Sarawak, iaitu Jabatan Kejuruteraan Awam, Jabatan Kejuruteraan Elektrik, Jabatan Kejuruteraan Mekanikal, Jabatan Perdagangan dan Jabatan Teknologi Maklumat dan Komunikasi. Pemilihan responden daripada kelima-lima jabatan tersebut dilaksanakan menggunakan kaedah persampelan rawak bagi memastikan setiap pelajar mempunyai peluang yang sama untuk dipilih sebagai sampel kajian. Jadual 3 menunjukkan taburan kekerapan responden yang terlibat dalam kajian ini.

Jadual 3: Taburan Kekerapan Responden

Ciri Demografi	Jantina/ Jabatan	N	Peratus%
Jantina	Lelaki	132	56.9
	Perempuan	100	43.1
Bidang Pengajian	Jabatan Kejuruteraan Awam	98	42.2
	Jabatan Kejuruteraan Elektrik	7	3.0
	Jabatan Kejuruteraan Mekanikal	87	37.5
	Jabatan Perdagangan	34	14.7
	Jabatan Teknologi Maklumat dan Komunikasi	6	2.6
Jumlah Keseluruhan		232	100

Hasil daripada jadual di atas menunjukkan kekerapan jantina dan bidang pengajian responden yang dipilih dalam kajian ini. Dalam kajian ini lelaki Responden teramai adalah terdiri daripada Jabatan Kejuruteraan Awam iaitu sebanyak 198 orang (42.2%). Diikuti oleh Jabatan Kejuruteraan Mekanikal iaitu 87 orang (37.5%). Seterusnya Jabatan Perdagangan sebanyak 34 orang (14.7%). Manakala Jabatan Kejuruteraan Elektrik iaitu 7 orang (3.0%). Akhir sekali responden yang paling sedikit adalah daripada Jabatan Teknologi Maklumat dan Komunikasi iaitu 6 orang (2.6%)

Dapatan Kajian

Pengamalan Etika dan Peradaban dalam kalangan pelajar Politeknik Mukah

Jadual 4: Pengamalan Etika Dan Peradaban Dalam Kalangan Pelajar Politeknik Mukah

Bil	Penyataan	Min	SP	Tahap Interpretasi
B1	Saya menjaga adab dan kesopanan ketika berkomunikasi dengan pensyarah dan rakan.	4.54	.799	Tinggi
B2	Saya menjaga ketepatan waktu dalam menghadiri kuliah dan aktiviti-aktiviti lain.	4.35	.796	Tinggi
B3	Saya menyelesaikan tugas yang diberikan oleh pensyarah dengan penuh dedikasi dan kejujuran.	4.40	.777	Tinggi
B4	Saya menggunakan bahasa yang sopan ketika bercakap dengan orang lain.	4.43	.813	Tinggi
B5	Saya mengutamakan kejujuran dan integriti dengan mengelakkan diri daripada meniru semasa peperiksaan atau meniplak hasil kerja orang lain.	4.50	.848	Tinggi
B6	Saya menggunakan kemudahan awam di politeknik dengan berhemah dan bertanggungjawab.	4.54	.783	Tinggi
B7	Saya mengelakkan diri daripada menyebarkan maklumat palsu atau khabar angin di media sosial.	4.57	.819	Tinggi
B8	Saya mematuhi peraturan dan etika berpakaian yang ditetapkan.	4.50	.832	Tinggi
B9	Saya percaya bahawa sikap tanggungjawab membantu saya mengekalkan etika yang baik.	5.31	1.77	Tinggi
B10	Saya sedar bahawa tingkah laku saya mencerminkan nilai etika yang saya pegang.	4.43	.819	Tinggi
	Jumlah	4.56	.753	Tinggi

Jadual 4 menunjukkan bahawa tahap pengamalan etika pelajar berada pada tahap tinggi, dengan min keseluruhan 4.56 dan sisihan piawai 0.753. Item B9 (“Saya percaya bahawa sikap tanggungjawab membantu saya mengekalkan etika yang baik.”) mencatatkan jumlah min tertinggi (5.310), sisihan piawai (1.767). Sikap tanggungjawab merupakan elemen kritikal yang membantu individu mengekalkan etika yang baik secara konsisten. Hal ini disokong oleh Hassan dan Bakar (2024) yang mendapati bahawa tahap tanggungjawab yang tinggi berkait rapat dengan kestabilan amalan etika seseorang. Selain itu, Adnan dan Mohd (2023) turut menegaskan bahawa tanggungjawab sendiri adalah asas kepada pembentukan integriti yang kukuh dalam kalangan pelajar. Item B2 (“Saya menjaga ketepatan waktu dalam menghadiri kuliah dan aktiviti-aktiviti lain”) merupakan item min yang terendah iaitu min (4.35), sisihan

piawai (0.777). Menurut Rahman dan Ismail (2023), ketepatan waktu adalah manifestasi daripada tanggungjawab sendiri yang secara langsung menyumbang kepada pembentukan sahsiah pelajar yang cemerlang."

Faktor-Faktor Yang Mempengaruhi Pengamalan Etika Dan Peradaban Di Kalangan Di Pelajar

Jadual 5 : Faktor diri sendiri

Bil	Penyataan	Min	SP	Tahap Interpretasi
C1	Saya mempunyai kesedaran tinggi terhadap kepentingan etika dalam kehidupan seharian.	4.48	.756	Tinggi
C2	Saya mempunyai matlamat hidup yang jelas untuk menjadi individu beretika.	4.45	.766	Tinggi
C3	Saya berusaha menjadi individu yang beretika untuk mencapai matlamat hidup yang sejahtera.	4.49	.762	Tinggi
C4	Saya percaya amalan etika membantu saya menjadi individu yang lebih baik.	4.56	.754	Tinggi
C5	Saya mengamalkan disiplin diri yang baik dalam mematuhi peraturan.	4.49	.773	Tinggi
C6	Saya berasa puas apabila berjaya mengamalkan etika dalam kehidupan harian.	4.47	.805	Tinggi
C7	Saya sentiasa berusaha untuk bersikap jujur dalam semua tugas akademik.	4.51	.784	Tinggi
C8	Saya mempunyai kesedaran diri yang tinggi tentang pentingnya beretika sebagai pelajar.	4.51	.784	Tinggi
C9	Saya percaya bahawa sikap tanggungjawab membantu saya mengekalkan etika yang baik.	4.51	.778	Tinggi
C10	Saya sedar bahawa tingkah laku saya mencerminkan nilai etika yang saya pegang.	4.54	.794	Tinggi
	Jumlah	4.50	.718	Tinggi

Jadual 5 menunjukkan dapatan kajian bagi pengamalan etika dipengaruhi oleh faktor diri sendiri. berada pada tahap tinggi iaitu dengan min keseluruhan 4.50 dan sisihan piawai 0.718. Item C4 ("Saya percaya amalan etika membantu saya menjadi individu yang lebih baik") mencatatkan min tertinggi (4.55), sisihan piawai (.754). Menurut Fernandez Gonzalez & Akrivou (2024) menunjukkan bahawa etika membantu dalam pembentukan identiti moral yang lebih mantap melalui interaksi aspek emosi, keputusan dan tindakan moral dalam kehidupan

seharian. Ini disokong oleh Sibarani dan Wiharsianti (2024) mendapati bahawa tahap faktor diri sendiri memberikan kesan positif dan signifikan terhadap pematuhan etika. Isu masalah sosial dalam kalangan pelajar tidak boleh dipandang mudah kerana matlamat sebenar proses pendidikan ialah melahirkan pelajar yang beretika bermula daripada dirinya sendiri. Dapatan ini menunjukkan bahawa individu yang mempunyai kesedaran tinggi terhadap nilai dan tingkah laku moral diri sendiri cenderung untuk mengamalkan etika secara konsisten dalam kehidupan seharian, sekali gus membentuk tingkah laku yang lebih bertanggungjawab dan berintegriti.

Jadual 6: Faktor Rakan Sebaya

<i>Bil</i>	<i>Penyataan</i>	<i>Min</i>	<i>SP</i>	<i>Tahap Interpretasi</i>
D1	Rakan saya menasihati saya agar mematuhi peraturan yang ditetapkan.	4.34	.867	Tinggi
D2	Rakan saya menyokong usaha saya untuk menjadi individu beretika.	4.42	.839	Tinggi
D3	Rakan-rakan saya sentiasa menunjukkan sikap yang sopan.	4.28	.856	Tinggi
D4	Saya cenderung meniru tingkah laku positif rakan-rakan saya.	4.32	.885	Tinggi
D5	Saya mengamalkan etika yang baik untuk menjaga hubungan dengan rakan.	4.49	.778	Tinggi
D6	Saya menerima teguran daripada rakan untuk memperbaiki kesalahan saya.	4.46	.799	Tinggi
D7	Rakan-rakan saya menyokong usaha saya untuk menjadi individu beretika.	4.42	.786	Tinggi
D8	Saya dan rakan-rakan sering berbincang tentang nilai-nilai murni dalam kehidupan..	4.28	.899	Tinggi
D9	Saya mengelakkan diri daripada terlibat dalam tingkah laku negatif kerana pengaruh rakan.	4.51	.789	Tinggi
D10	Pengaruh positif rakan sebaya memotivasikan saya untuk menjadi individu yang lebih baik.	4.51	.773	Tinggi
	Jumlah	4.40	.728	Tinggi

Jadual 6 menunjukkan dapatan kajian bagi pengamalan etika disebabkan oleh faktor rakan sebaya. Secara keseluruhannya, dapatan kajian menunjukkan bahawa pengaruh rakan sebaya terhadap responden berada pada tahap yang Tinggi. Nilai min keseluruhan adalah 4.40 dengan Sisihan Piawai sebanyak 0.728. Ini menunjukkan bahawa majoriti responden bersetuju bahawa rakan sebaya memainkan peranan positif dalam membentuk sahsiah dan etika mereka. Item D9 ("Saya mengelakkan diri daripada terlibat dalam tingkah laku negatif kerana pengaruh rakan")

dan D10 ("Pengaruh positif rakan sebaya memotivasikan saya untuk menjadi individu yang lebih baik") mencapai min yang tertinggi iaitu sebanyak 4.51. Kajian Mohammad Izzulhilm Ghazali et al (2023) elemen persekitaran pendidikan di sekolah mendapati bahawa rakan sebaya memberi pengaruh sosialisasi yang kuat kepada pelajar termasuk aspek tingkah laku dan norma sosial dalam konteks pembelajaran dan hubungan sosial. Dapatan mengatakan bahawa hubungan rakan sebaya boleh mempengaruhi individu untuk memilih tingkah laku yang positif atau menghindari yang bersifat negatif dalam kehidupan harian mereka. Ini disokong dalam kajian Nor hasimah et al., (2022) pengaruh rakan sebaya, memberi kesan yang ketara terhadap pembentukan akhlak dan etika remaja menunjukkan bahawa persekitaran sosial yang positif boleh mengurangkan kecenderungan terlibat dalam tingkah laku negatif. Luo Tongbin dan Aini Azeqa Ma'rof (2024) mengatakan bahawa sokongan rakan sebaya mempunyai korelasi positif dan signifikan dengan pengamalan etika. Ini menunjukkan bahawa pengaruh rakan sebaya mempengaruhi pengamalan etika di kalangan pelajar.

Jadual 7: Faktor keluarga

Bil	Penyataan	Min	SP	Tahap Interpretasi
E1	Keluarga saya menekankan kepentingan etika dalam kehidupan seharian.	4.58	.758	Tinggi
E2	Saya mengikut nilai-nilai etika yang diajarkan oleh ahli keluarga saya.	4.59	.739	Tinggi
E3	Saya menjaga tingkah laku untuk menghormati maruah keluarga.	4.66	.734	Tinggi
E4	Ahli keluarga saya menjadi contoh dalam mengamalkan etika yang baik..	4.57	.769	Tinggi
E5	Keluarga saya sentiasa mengingatkan saya tentang kepentingan menjaga tingkah laku.	4.65	.724	Tinggi
E6	Saya berasa bertanggungjawab menjaga nama baik keluarga melalui amalan etika.	4.63	.739	Tinggi
E7	Saya belajar tentang etika melalui pengalaman yang dikongsi oleh keluarga saya.	4.58	.746	Tinggi
E8	Sokongan keluarga membantu saya mematuhi nilai-nilai murni.	4.60	.750	Tinggi
E9	Keluarga saya membantu saya mengenal pasti tingkah laku yang baik dan buruk.	4.57	.758	Tinggi
E10	Saya sering mendapat nasihat daripada keluarga tentang cara bertindak secara beretika.	4.60	.749	Tinggi
	Jumlah	4.60	.703	Tinggi

Berdasarkan jadual 7 menunjukkan bahawa tahap amalan etika dan pengaruh keluarga dalam kalangan responden berada pada tahap Tinggi berbanding faktor diri sendiri dan faktor rakan

sebay. Secara keseluruhannya, min keseluruhan adalah 4.60 dengan sisihan piawai (0.703). Nilai min yang tinggi ini (melebihi 4.00) menunjukkan bahawa institusi keluarga memainkan peranan yang sangat dominan dalam membentuk etika individu. Item E3 mencapai min paling tertinggi iaitu 4.66 dengan sisihan piawai (0.734). Kajian oleh Chaudhary et al., (2025) bahawa agama dan nilai keluarga mempengaruhi tingkah laku etika seseorang individu dalam kehidupan. Ini disokong oleh Siti Shamsiah (2025) yang menegaskan bahawa keluarga merupakan agen pertama dalam pembentukan sahsiah di kalangan individu. Hal ini selaras dengan kajian oleh Norazmah dan Faudzi (2022) yang menyatakan bahawa individu dalam masyarakat kolektif cenderung menjaga tingkah laku demi mengekalkan nama baik keluarga. Responden bersetuju bahawa mereka menjaga tingkah laku demi menghormati maruah keluarga. Ini menunjukkan elemen faktor keluarga menjadi motivasi utama individu untuk bertindak secara beretika.

Hubungan amalan etika dengan faktor diri sendiri, faktor rakan sebaya dan rakan keluarga

Jadual 8: Hubungan amalan etika dengan faktor diri sendiri, faktor rakan sebaya dan rakan keluarga

Hubungan	Korelasi	Pengamalan etika	Faktor diri sendiri	Faktor rakan sebaya	Faktor keluarga
Pengamalan etika	Korelasi Person	1	.853***	.825***	.796***
	Sig. (2-tailed)		< .001	< .001	< .001
	N		232	232	232
Faktor diri sendiri	Korelasi Person	.853***	1	.933***	.902***
	Sig. (2-tailed)	< .001		< .001	< .001
	N	232		232	232
Faktor rakan sebaya	Korelasi Person	.825***	.933***	1	.885***
	Sig. (2-tailed)	< .001	< .001		< .001
	N	232	232		232
Faktor keluarga	Korelasi Person	.796***	.902***	.885***	1
	Sig. (2-tailed)	< .001	< .001	< .001	
	N	232	232	232	

** Signifikan pada aras keyakinan 0.01 (2-tailed).

Secara keseluruhannya, terdapat hubungan yang positif dan sangat kuat antara ketiga-tiga faktor (diri sendiri, rakan sebaya, dan keluarga) dengan pengamalan etika. Nilai signifikansi bagi kesemua hubungan adalah $p < 0.001$. Hal ini menyokong hujah Ahmad dan Roslan (2023) bahawa kesedaran sendiri bertindak sebagai faktor yang membimbing individu untuk bertindak secara beretika walaupun tanpa pengawasan luaran. Selain itu, Lim dan Tan (2022) menekankan bahawa efikasi sendiri yang tinggi membolehkan seseorang mengekalkan prinsip moral mereka walaupun berhadapan dengan tekanan persekitaran. Kekuatan korelasi yang sangat tinggi ini juga selari dengan kajian Dewi dan Pratama (2024) yang mendapati nilai peribadi merupakan faktor utama kepada pembentukan sahsiah individu moden. Luo Tongbin & Aini Azeqa Ma'rof (2025) mendapati bahawa tingkah laku dalam kalangan belia mencerminkan peranan rakan sebaya dalam pembentukan nilai etika. Selain itu, sokongan



keluarga yang positif dapat membantu perkembangan nilai moral dan tingkah laku beretika dalam kalangan generasi muda (Pititanun dan Supparekchaisakul (2025). Ini membuktikan bahawa pengaruh diri sendiri, rakan sebaya dan keluarga mempeunyai pengaruh yang kuat dalam pembentukan dan pengamalan etika pelajar.

Kesimpulan

Secara keseluruhannya, kajian ini menunjukkan bahawa pelajar Politeknik Mukah mempunyai tahap pengamalan etika dan peradaban yang tinggi. Hasil kajian mendapati bahawa faktor keluarga memainkan peranan yang paling dominan dalam membentuk tingkah laku pelajar, di mana mereka cenderung menjaga perlakuan demi menghormati maruah dan nama baik keluarga. Selain itu, faktor diri sendiri dan pengaruh rakan sebaya juga berada pada tahap yang tinggi, dengan kesedaran sendiri dikesan mempunyai hubungan korelasi yang paling kuat terhadap pengamalan etika secara konsisten. Dapatan ini memberi implikasi penting kepada pihak pengurusan politeknik untuk terus merangka program pembangunan sahsiah yang lebih menyeluruh serta memperkukuh budaya organisasi yang berteraskan nilai etika. Keberkesanan Kursus Penghayatan Etika dan Peradaban terbukti penting dalam melahirkan modal insan yang seimbang dari segi jasmani, emosi, rohani, dan intelek selaras dengan Falsafah Pendidikan Kebangsaan. Justeru, usaha berterusan perlu dilakukan bagi memastikan pelajar bukan sahaja cemerlang dalam bidang akademik, malah memiliki keperibadian unggul untuk menyumbang kepada kesejahteraan negara.

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KEFAHAMAN DAN PENGAMALAN NILAI-NILAI MURNI DALAM KALANGAN PELAJAR KURSUS NILAI MASYARAKAT MALAYSIA DAN PENDIDIKAN MORAL DI POLITEKNIK MUKAH

Fatin Faqeriah Hamsah¹, Farah Hanan Abu Bakar², Fadhlina Mohamad Ahmad³

¹Jabatan Pengajian Am, Politeknik Kuching Sarawak (PKS), Malaysia, (faqeriah@poliku.edu.my)

²Jabatan Pengajian Am, Politeknik Mukah (PMU), Malaysia, (farah@pmu.edu.my)

³Jabatan Pengajian Am, Politeknik Kuching Sarawak (PKS), Malaysia, (fadhlina@poliku.edu.my)

Abstrak: Penghayatan nilai-nilai murni memainkan peranan yang besar dalam membentuk sahsiah serta keperibadian pelajar. Nilai seperti hormat, tanggungjawab dan toleransi perlu difahami dan diamalkan dalam kehidupan seharian. Namun, terdapat kebimbangan terhadap kurangnya pembudayaan nilai-nilai terpuji dalam diri pelajar meskipun pendedahan telah diberikan melalui pembelajaran formal. Kajian ini dilaksanakan dengan tujuan mengenal pasti tahap kefahaman dan tahap pengamalan nilai-nilai murni pelajar. Penyelidikan ini turut meneliti perhubungan antara tahap kefahaman dengan tahap pengalaman nilai-nilai murni pelajar yang terlibat. Kajian ini melibatkan kumpulan responden dalam kalangan pelajar semester dua yang mengikuti kursus Nilai Masyarakat Malaysia serta Pendidikan Moral sesi II: 2024/2025 di Politeknik Mukah. Soal selidik mengandungi 33 item dibangunkan melalui google form. Hasil kajian rintis menunjukkan nilai kebolehpercayaan Cronbach's Alpha adalah 0.975. Analisis data deskriptif dijalankan menggunakan perisian "Statistical Package for Social Science version 26" bagi memperoleh jumlah kekerapan, kadar peratusan dan nilai min. Analisis data inferensi dijalankan menggunakan kaedah korelasi "Pearson" bagi meneliti sejauh mana hubungan antara tahap kefahaman dengan tahap pengamalan nilai-nilai murni dalam kalangan pelajar kursus Nilai Masyarakat Malaysia serta Pendidikan Moral. Dapatan menunjukkan tahap pemahaman pelajar terhadap nilai-nilai murni berada pada paras tinggi dengan nilai min 4.86. Bagi tahap pengamalan nilai-nilai murni pelajar, nilai min yang diperolehi juga adalah tinggi iaitu 4.75. Hasil kajian menunjukkan wujudnya hubungan signifikan yang sangat kuat antara tahap kefahaman dengan tahap pengamalan nilai-nilai murni pelajar iaitu $r=.762^{**}$. Justeru itu, kajian mencadangkan agar pendekatan pengajaran yang lebih interaktif dan berfokuskan pembelajaran kontekstual dilaksanakan secara berterusan bagi mengukuhkan pembudayaan nilai terpuji dalam kalangan pelajar. Diharap penyelidikan ini dapat menjadi asas kepada usaha peningkatan pendidikan nilai murni secara menyeluruh pada masa hadapan.

Kata Kunci: Kefahaman, pengamalan, nilai-nilai murni.

Pengenalan

Pendidikan nilai merupakan elemen penting dalam sistem pendidikan Malaysia kerana ia berperanan membentuk sahsiah dan tingkah laku positif dalam diri generasi muda. Keperluan untuk memperkukuhkan pendidikan nilai telah mendorong institusi pengajian tinggi menekankan penguasaan nilai murni melalui kursus yang dirancang untuk membimbing pelajar



memahami prinsip moral serta mengamalkannya dalam kehidupan seharian. Selaras dengan itu, Syahirah Rosli et al. (2022), menyatakan bahawa Falsafah Pendidikan Kebangsaan (FPK) dibentuk sebagai teras sistem pendidikan di Malaysia dalam usaha membentuk insan secara menyeluruh dan bersepadu. Falsafah ini menekankan matlamat pembentukan insan yang holistik, meliputi aspek fizikal, mental, spiritual dan intelektual dengan berasaskan kepercayaan serta akhlak masyarakat Malaysia. Bagi merealisasikan matlamat tersebut, kursus seperti Nilai Masyarakat Malaysia dan Pendidikan Moral diperkenalkan untuk memupuk nilai-nilai murni, yang bukan sahaja difahami secara kognitif, tetapi juga diterapkan dan diamalkan dalam kehidupan harian pelajar.

Walaupun usaha pendidikan nilai terus diperkasa, isu kemerosotan akhlak serta peningkatan gejala sosial yang melibatkan pelajar kini masih membimbangkan dan terus meningkat. Permasalahan akhlak dalam kalangan remaja merupakan fenomena yang memberi implikasi negatif dan memerlukan perhatian serius daripada semua pihak. Kajian oleh Mohd Saiful Akmal A. Karim et al. (2021), menunjukkan bahawa isu seperti jenayah juvana, buli, keganasan, pergaulan bebas, dan penyalahgunaan dadah mencerminkan pegangan nilai moral yang semakin longgar dalam masyarakat. Seiring dengan dapatan tersebut, kajian oleh Abdul Hamid Busthami Nur et al. (2023), mendapati bahawa buli wujud dalam empat bentuk yang meluas, iaitu fizikal, lisan, antisosial, dan siber, di mana buli fizikal merupakan bentuk dominan yang paling kerap berlaku. Menambahkan lagi kebimbangan, menurut kajian Siaw Hun Liew et al. (2023), daripada 27,497 pelajar sekolah menengah di seluruh Malaysia, seramai 16.2% melaporkan pernah dibuli sekurang-kurangnya sekali dalam tempoh 30 hari dan pelajar yang mengalami buli ini mempunyai risiko hampir lima kali ganda untuk mencuba membunuh diri berbanding mereka yang tidak dibuli. Situasi ini menjadi lebih membimbangkan apabila berlaku kes seperti yang dilaporkan oleh Berita Harian Online (2025), di mana seorang murid perempuan Tingkatan Tiga maut ditikam oleh murid lelaki Tingkatan Dua daripada sebuah sekolah menengah di Bandar Utama, memperlihatkan tahap salah laku remaja yang serius sehingga sanggup melakukan tindakan ekstrem yang mengancam nyawa orang lain. Selaras dengan itu, Vikneswaran Sabramani et al. (2021), menekankan bahawa kerosakan nilai moral ini sering kali berkait dengan peningkatan kecenderungan agresif di kalangan pelajar. Keadaan ini turut diperkuatkan oleh penemuan Nor Anisa Musa et al. (2022), bahawa peningkatan kadar jenayah dan masalah sosial yang melibatkan golongan remaja telah menjejaskan kesejahteraan sosial dan merosakkan nilai moral.

Memandangkan situasi semasa menunjukkan peningkatan pelbagai bentuk isu berkaitan masalah sosial serta salah laku dalam kalangan remaja, wujud kepentingan untuk menilai kembali sejauh mana pendidikan nilai yang diterapkan dalam institusi pengajian tinggi benar-benar berkesan dalam membina sahsiah pelajar. Persoalan yang timbul ialah sejauh mana pelajar benar-benar menghayati serta mempraktikkan nilai murni yang diterapkan melalui kursus yang ditawarkan. Keperluan menilai isu ini semakin jelas apabila kajian Dg Norizah Ag Kiflee@Dzulkifli et al. (2020), menunjukkan bahawa penghayatan nilai terhadap pendidikan abad ke-21, membuktikan wujudnya hubungan positif yang signifikan terhadap pembinaan sahsiah pelajar. Selain itu, menurut kajian Jawiah Dakir et al. (2021), walaupun subjek nilai moral atau pendidikan akhlak diajar secara formal, pelajar masih menunjukkan tahap penghayatan dan pembudayaan nilai murni yang rendah, menandakan wujudnya jurang yang



jelas antara apa yang dipelajari dan apa yang diamalkan dalam kehidupan harian. Oleh itu, wujud keperluan untuk menjalankan penyelidikan ini dalam konteks kursus Nilai Masyarakat Malaysia dan Pendidikan Moral di Politeknik Mukah bagi menilai tahap kefahaman serta tahap pengamalan nilai-nilai murni dalam kalangan pelajar, di samping melihat hubungan antara kedua-dua pemboleh ubah tersebut. Justeru, kajian ini dilaksanakan bagi mencapai objektif berikut:

1. Menenal pasti tahap kefahaman nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral di Politeknik Mukah.
2. Menenal pasti tahap pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral di Politeknik Mukah.
3. Melihat hubungan antara tahap kefahaman dengan tahap pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral di Politeknik Mukah.

Tinjauan Literatur

Kefahaman

Kefahaman merujuk kepada hal atau keadaan faham akan sesuatu, iaitu keupayaan individu untuk memahami sesuatu konsep, maklumat atau isi yang dipelajari. Dalam konteks pendidikan nilai, kefahaman pelajar mencerminkan sejauh mana mereka memahami nilai, prinsip dan ajaran yang diajar sebelum ia diterjemahkan kepada pengamalan dalam kehidupan seharian. Menurut Kamus Dewan melalui Portal Rasmi Pusat Rujukan Persuratan Melayu (PRPM) (Dewan Bahasa dan Pustaka, n.d.), kefahaman ditakrifkan sebagai keupayaan atau tingkat pemahaman seseorang terhadap sesuatu, menekankan bahawa kefahaman yang baik menjadi asas kepada pengamalan nilai secara berkesan.

Pengamalan

Pengamalan merujuk kepada perihal atau perbuatan mengamalkan sesuatu, iaitu proses melaksanakan nilai, prinsip atau ajaran dalam bentuk tindakan yang nyata. Dalam konteks pendidikan nilai, pengamalan menggambarkan bagaimana individu menerjemahkan kefahaman mereka kepada perlakuan, sikap dan keputusan moral dalam kehidupan seharian. Menurut Kamus Dewan melalui Portal Rasmi Pusat Rujukan Persuratan Melayu (PRPM) (Dewan Bahasa dan Pustaka, n.d.), pengamalan ditakrifkan sebagai perlaksanaan atau pelaksanaan terhadap sesuatu amalan, menunjukkan bahawa sesuatu nilai dikira benar-benar berfungsi hanya apabila ia dizahirkan melalui tindakan.

Nilai-Nilai Murni

Istilah nilai murni ditakrifkan sebagai prinsip dan amalan positif yang menjadi panduan dalam pembentukan akhlak serta tingkah laku individu. Nilai ini merangkumi prinsip etika, moral dan akhlak yang dianggap positif serta suci dalam masyarakat dan pendidikan. Dalam konteks pendidikan nilai, penekanan terhadap nilai-nilai murni bertujuan membimbing pelajar untuk mengamalkan sikap, tingkah laku dan keputusan yang berlandaskan prinsip moral yang baik.



Menurut Kamus Dewan melalui Portal Rasmi Pusat Rujukan Persuratan Melayu (PRPM) (Dewan Bahasa dan Pustaka, n.d.), nilai murni ditakrifkan sebagai prinsip atau standard yang bersih dan tulen, yang menjadi asas kepada pembentukan sahsiah dan pengamalan etika dalam kehidupan seharian.

Hubungan antara Kefahaman dan Pengamalan dari Kajian-Kajian Lepas

Pelbagai kajian menunjukkan bahawa kefahaman terhadap nilai-nilai murni atau etika mempunyai hubungan dengan pengamalan nilai dalam kalangan pelajar. Kajian Norcikeyonn Samuni et al. (2025) mengenai kursus integriti dan antirasuah menunjukkan bahawa kefahaman terhadap konsep integriti meningkatkan kesedaran moral, walaupun pengamalan nilai memerlukan sokongan tambahan seperti bimbingan praktikal dan budaya sekolah. Menurut Nur 'Aisyah Asyikin Adnan et al. (2023), dalam konteks sekolah menengah, pengaplikasian nilai moral berasaskan kefahaman yang jelas terhadap nilai tersebut didapati memberikan pengaruh positif terhadap akademik serta disiplin pelajar. Kajian tersebut mengesahkan bahawa penghayatan nilai mempunyai peranan yang besar dalam membentuk corak kelakuan pelajar. Menurut Akmal Khairani dan Naysha Aulia (2025), dalam ulasan sistematik terhadap beberapa kajian mendapati bahawa penguasaan nilai dan etika memberi sumbangan signifikan kepada pembentukan sahsiah dan karakter moral pelajar. Mereka menunjukkan bahawa sekolah yang melaksanakan pendidikan nilai secara konsisten dan menyeluruh dapat meningkatkan kesedaran moral serta pengamalan nilai di kalangan pelajar. Menurut kajian Ani Raihana Rosli et al. (2023), mahasiswa Politeknik Mersing yang terlibat dalam kursus Penghayatan Etika dan Peradaban (PEP) menunjukkan tahap kefahaman dan pengamalan nilai-nilai murni yang tinggi, membuktikan bahawa pemahaman konsep nilai merupakan asas kepada pengamalan nilai dalam kehidupan seharian.

Metodologi Kajian

Populasi dan Kaedah Persampelan

Populasi yang terlibat dalam penyelidikan ini merangkumi semua pelajar semester dua yang mengikuti kursus Nilai Masyarakat Malaysia dan Pendidikan Moral bagi Sesi II 2024/2025 di Politeknik Mukah. Selaras dengan takrifan populasi oleh Mohamad Najib (1999) yang merujuk kepada keseluruhan elemen dalam sesuatu kelompok, persampelan kajian ini melibatkan keseluruhan populasi. Jumlah responden kajian ini adalah seramai 167 orang. Kursus ini ditawarkan kepada lima jabatan pada Sesi II 2024/2025. Walau bagaimanapun, hanya pelajar dari tiga jabatan sahaja iaitu Jabatan Kejuruteraan Elektrik, Jabatan Teknologi, Maklumat dan Komunikasi, serta Jabatan Perdagangan yang membuat pendaftaran kursus. Dua lagi jabatan, iaitu Jabatan Kejuruteraan Awam dan Jabatan Kejuruteraan Mekanikal, tiada pelajar yang mendaftar.

Instrumen Kajian

Pendekatan kuantitatif digunakan dalam kajian ini melalui pembangunan dan pengedaran set soal selidik yang dibangunkan menggunakan *google form*. Instrumen tersebut merangkumi tiga bahagian utama iaitu bahagian A berkaitan maklumat latar belakang responden, bahagian B



tentang tahap kefahaman nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral, manakala bahagian C adalah tahap pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral. Analisis bagi bahagian B dan C menggunakan Skala Likert 5 yang terdiri daripada Sangat Tidak Setuju, Tidak Setuju, Kurang Setuju, Setuju dan Sangat Setuju. Berdasarkan pandangan Lukman Hakim (2014), soal selidik boleh diadaptasi daripada instrumen kajian terdahulu yang dibangunkan oleh pengkaji lain. Soalan dibangunkan dengan mengadaptasi instrumen soal selidik yang digunakan dalam kajian Asma'Mohamad Adib dan Jaffary Awang (2024) dan Tedi Supriyadi et al. (2025) dengan beberapa pengubahsuaian mengikut kesesuaian objektif kajian.

Kajian Rintis

Responden kajian rintis dipilih secara rawak yang melibatkan 23 orang pelajar. Sampel ini mempunyai ciri yang serupa dengan sampel sebenar. Nilai *Cronbach's Alpha* adalah 0.967, menunjukkan bahawa kebolehpercayaan item soal selidik kajian ini adalah tinggi dan boleh diterima.

Analisis Data

Analisis data adalah secara deskriptif dan inferensi. Kadangkala pengkaji boleh menggunakan pelbagai teori dan formula sendiri bagi menghasilkan satu indeks tersendiri berdasarkan objektif kajian (Mohamad Najib Abdul Ghafar, 2003). Oleh itu, hasil analisa dalam bahagian B, C, D, E dan F dianalisis berdasarkan kepada nilai skor min kepada tiga tahap iaitu:

Jadual 1: Nilai skor min

Nilai Skor Min	Tahap
1.00 – 2.33	Rendah
2.34 – 3.67	Sederhana
3.68 – 5.00	Tinggi

Sumber: Mohamad Najib Abdul Ghafar (2003)

Jadual 1 adalah nilai skor min dikelaskan kepada 3 tahap iaitu tahap rendah nilai min 1.00 – 2.33, tahap sederhana nilai min 2.34 – 3.67 dan tahap tinggi nilai min 3.68 – 5.00. Bagi analisis inferensi pula, pengkaji menggunakan kaedah *Pearson Coefficient Of Correlation*. Analisis korelasi dihasilkan adalah untuk mengetahui hubung kait antara dua pemboleh ubah (Mohamad Najib Abdul Ghafar, 1999). Pengkaji menggunakan cadangan Davis (1971) dalam menentukan tahap kekuatan korelasi.

Jadual 2: Klasifikasi kekuatan korelasi

Julat (+ atau -)	Kekuatan
0.01 hingga 0.09	Diabaikan
0.10 hingga 0.29	Rendah
0.30 hingga 0.49	Sederhana kuat
0.50 hingga 0.69	Kuat



0.70 atau lebih

Sangat kuat

Sumber: Davis (1971)

Jadual 2 adalah klasifikasi kekuatan korelasi mengikut tahap kekuatan. Julat 0.01 – 0.09 tahap kekuatan diabaikan, 0.10 – 0.29 tahap rendah, 0.30 – 0.49 tahap sederhana kuat, 0.50 – 0.69 tahap kuat dan 0.70 atau lebih tahap sangat kuat.

Dapatan dan Perbincangan

Maklumat Latar Belakang Responden

Jantina

Jadual 3: Jantina

Jantina	Kekerapan	Peratus
Lelaki	46	27.5
Perempuan	121	72.5

N = 167

Seperti yang ditunjukkan dalam jadual 3 iaitu jantina, daripada jumlah responden, 46 orang (27.5%) adalah pelajar lelaki dan 121 orang (72.5%) merupakan pelajar perempuan yang menjawab soal selidik kajian ini.

Jabatan

Jadual 4: Jabatan

Jabatan	Kekerapan	Peratus
Jabatan Kejuruteraan Elektrik	3	1.8
Jabatan Teknologi, Maklumat dan Komunikasi	26	15.6
Jabatan Perdagangan	138	82.6

N = 167

Jadual 4 merujuk responden mengikut jabatan. Jabatan Perdagangan adalah responden terbanyak terdiri daripada 138 orang (82.6%), manakala selebihnya diikuti Jabatan Teknologi, Maklumat dan Komunikasi iaitu 26 orang (15.6%) manakala Jabatan Kejuruteraan Elektrik 3 orang (1.8%).

Bangsa

Jadual 5: Bangsa

Bangsa	Kekerapan	Peratus
Iban	94	56.3
Melanau	16	9.6
Cina	12	7.2
Bidayuh	8	4.8



India	5	3.0
Lain-lain	32	19.2

$N = 167$

Jadual 5 menunjukkan responden mengikut bangsa. Responden berbangsa Iban merupakan responden paling ramai iaitu seramai 94 orang (56.3%). Diikuti bangsa lain-lain seramai 32 orang (19.2%). Kemudian bangsa Melanau 16 orang (9.6%) manakala bangsa Cina 12 orang (7.2%). Seterusnya bangsa Bidayuh 8 orang (4.8%) dan bangsa India 5 orang (3.0%).

Tahap kefahaman nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral

Jadual 6: Tahap Kefahaman Nilai-Nilai Murni dalam Kalangan Pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral

No. Item	Item	Min	Sisihan Piawai	Tahap Interpretasi
B1	Menghormati budaya dan adat resam orang lain adalah penting dalam kehidupan bermasyarakat.	4.92	.380	Tinggi
B2	Menghormati kepercayaan agama lain adalah penting untuk mencapai keharmonian dan kesejahteraan.	4.92	.380	Tinggi
B3	Nilai toleransi dapat membantu mengurangkan salah faham dalam pergaulan seharian.	4.85	.499	Tinggi
B4	Sikap bertolak ansur adalah sebahagian dalam nilai toleransi dan sangat penting semasa menyelesaikan sesuatu konflik.	4.87	.442	Tinggi
B5	Sikap bekerjasama dalam menyelesaikan sesuatu tugas dapat meningkatkan keberkesanan sesuatu hasil yang berkualiti.	4.86	.451	Tinggi
B6	Nilai kerjasama memerlukan setiap individu memainkan peranan masing-masing.	4.84	.452	Tinggi
B7	Sikap berkasih sayang dapat membantu membina hubungan yang baik dengan orang lain.	4.83	.465	Tinggi
B8	Sikap berkasih sayang dapat ditunjukkan melalui keprihatinan dan empati terhadap orang lain.	4.76	.583	Tinggi
B9	Penggunaan bahasa yang sopan melambangkan nilai budi bahasa.	4.87	.428	Tinggi
B10	Budi bahasa mencerminkan keperibadian dan imej seseorang dalam masyarakat.	4.87	.433	Tinggi

$N = 167$

Jadual 6 menunjukkan dapatan bagi tahap kefahaman nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral. Bahagian ini merangkumi 10 item. Item 1 “Menghormati budaya dan adat resam orang lain adalah penting dalam kehidupan bermasyarakat.” dan item 2 “Menghormati kepercayaan agama lain adalah penting untuk mencapai keharmonian dan kesejahteraan.” merupakan skor min tertinggi iaitu masing-masing dengan min 4.92 dan sisihan piawai .380, menunjukkan tahap yang tinggi. Dapatan ini selaras dengan kenyataan Ayu Nor Azilah Mohamad dan Wayu Nor Asikin Mohamad (2025), yang menekankan kepentingan kepelbagaian agama dan budaya di Malaysia menuntut tahap pemahaman toleransi yang tinggi dalam kalangan masyarakat. Mereka menyatakan bahawa usaha menghargai perbezaan budaya dan kepercayaan bukan sahaja mengukuhkan hubungan antara komuniti, tetapi juga menjadi asas penting dalam mewujudkan keharmonian sosial dan kestabilan negara. Kajian tersebut turut menekankan bahawa interaksi positif antara masyarakat berbilang agama dan budaya mampu mengurangkan prasangka serta meningkatkan perpaduan nasional. Dapatan ini juga selari dengan kajian Tan Yoong Yee dan Zainudin Hassan (2024), bahawa menghormati budaya dan agama di institusi pendidikan adalah penting dalam mewujudkan hubungan yang harmonis antara pelajar serta menyumbang keharmonian sosial. Kajian tersebut turut membuktikan bahawa apabila budaya hormat menghormati dipupuk sejak di bangku sekolah sehingga ke institusi pengajian tinggi, ia dapat mengurangkan konflik dan meningkatkan persefahaman. Dapatan ini juga disokong oleh kajian Muhammad Daniel Mohd Sahid et al. (2025), menyatakan bahawa sikap prejudis terhadap kaum lain, perbuatan menghina agama serta mengeksploitasi isu agama secara sengaja boleh mengancam keharmonian masyarakat. majmuk di Malaysia. Beliau menegaskan bahawa saling menghormati antara agama serta kaum adalah penting untuk memelihara kesejahteraan sosial dan hubungan harmoni antara komuniti. Secara keseluruhannya min untuk tahap kefahaman pelajar terhadap nilai-nilai murni dalam Kursus Nilai Masyarakat Malaysia serta Pendidikan Moral adalah 4.86 dengan sisihan piawai .383, menunjukkan tahap pemahaman yang tinggi.

Tahap pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral

Jadual 7: Tahap Pengamalan Nilai-Nilai Murni dalam Kalangan Pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral

No. Item	Item	Min	Sisihan Piawai	Tahap Interpretasi
C1	Saya sentiasa menghormati pandangan orang lain walaupun berbeza dengan pendapat saya.	4.61	.610	Tinggi
C2	Saya memberi penghormatan kepada guru dan orang yang lebih tua dalam setiap situasi	4.83	.478	Tinggi
C3	Saya bersikap bertoleransi terhadap perbezaan budaya dan adat resam dalam kalangan rakan-rakan saya.	4.85	.448	Tinggi
C4	Saya berusaha bertolak ansur apabila berlaku konflik dalam perbincangan.	4.69	.557	Tinggi

C5	Saya sentiasa memberikan kerjasama sepenuhnya semasa melaksanakan tugas berkumpulan.	4.77	.499	Tinggi
C6	Saya memberikan kerjasama dalam menyelesaikan masalah tanpa mengharapkan balasan.	4.74	.559	Tinggi
C7	Saya prihatin terhadap rakan-rakan yang memerlukan bantuan atau sokongan.	4.81	.478	Tinggi
C8	Saya berusaha menunjukkan sikap empati terhadap perasaan orang lain.	4.73	.531	Tinggi
C9	Saya menggunakan bahasa yang sopan semasa bercakap dengan sesiapa sahaja.	4.70	.576	Tinggi
C10	Saya menjaga tingkah laku dan pertuturan supaya tidak menyinggung perasaan orang lain.	4.77	.511	Tinggi

N = 167

Jadual 7 merujuk dapatan bagi tahap pengamalan pelajar terhadap nilai-nilai murni dalam Kursus Nilai Masyarakat Malaysia serta Pendidikan Moral. Daripada 10 item pada bahagian ini, item 3 “Saya bersikap bertoleransi terhadap perbezaan budaya dan adat resam dalam kalangan rakan-rakan saya” menunjukkan skor min paling tinggi dengan purata 4.85 manakala sisihan piawai .448, menandakan tahap yang tinggi. Dapatan ini sejajar dengan hasil kajian Dziauddin Sharif et al. (2022), bahawa, latar belakang etnik responden mempengaruhi tahap toleransi dalam masyarakat majmuk di Malaysia. Kajian tersebut mendapati bahawa komuniti di Borneo menunjukkan skor toleransi yang lebih tinggi berbanding etnik lain, menunjukkan wujudnya sikap toleransi dan penerimaan terhadap kepelbagaian etnik dalam kalangan responden. Kajian ini juga seiring dengan dapatan Mashitah Sabdin dan Mohd Ikhwan Izzat Zulkefli (2023), yang menunjukkan bahawa pendidikan nilai dan pengetahuan agama dapat memupuk penghayatan terhadap kepelbagaian budaya. Penghayatan ini seterusnya menyumbang kepada terbentuknya sikap toleransi dalam interaksi sosial, khususnya dalam kalangan rakan-rakan yang berbeza latar budaya. Dapatan ini turut disokong oleh Wan Zulkifli Wan Hassan (2021), pelaksanaan nilai melalui interaksi antara kaum memainkan peranan yang penting dalam membina keharmonian sosial, kerana ia mendorong sikap toleransi dalam hubungan antara individu berlainan etnik dan budaya. Min keseluruhan pada bahagian ini adalah 4.75 sisihan piawai .432 menandakan tahap yang tinggi.

Hubungan antara tahap kefahaman dengan tahap pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral

Jadual 8: Hubungan antara Tahap Kefahaman dengan Tahap Pengamalan Nilai-Nilai Murni dalam Kalangan Pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral

	Kekerapan	Peratus
Korelasi Person	1	.762**
Sig. (1 tailed)	32	.000



*** Signifikan pada aras keyakinan 0.01 (1-tailed)*

Jadual 8 menunjukkan hubungan antara tahap kefahaman dengan tahap pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral. Dapatan menunjukkan terdapat hubungan signifikan yang sangat kuat antara pemboleh ubah tahap kefahaman dengan tahap pengamalan nilai-nilai murni iaitu ($r=.762^{**}$, $p<0.05$). Hasil dapatan kajian ini memperlihatkan bahawa kefahaman yang kukuh terhadap nilai-nilai murni bukan sahaja meningkatkan kesedaran pelajar mengenai kepentingannya, malah turut mempengaruhi tahap pengamalan nilai-nilai tersebut dalam kehidupan seharian. Hubungan positif ini selaras dengan penemuan kajian kuantitatif Hairol Anuar Mak Din et al. (2021), bahawa pelajar universiti di Malaysia mengamalkan tingkah laku berasaskan nilai dengan baik kerana mereka didedahkan kepada program pendidikan nilai serta menerima bimbingan berterusan di kampus, sekali gus membuktikan bahawa penerapan nilai positif berlaku dalam kehidupan harian mereka. Dapatan tersebut juga seiring dengan kajian yang telah dijalankan oleh Hasnah Haron et al. (2022), analisis terhadap penerapan nilai di universiti Islam di Malaysia menunjukkan bahawa kefahaman terhadap nilai dari perspektif Islam dan Barat menjadi asas penting dalam membentuk serta mengamalkan nilai-nilai murni mahasiswa. Hasil kajian ini turut sejajar dengan kajian Ahmad Rosli Mohd Nor et al. (2021), bahawa integrasi nilai kerohanian Islam dalam perancangan kerjaya pelajar TVET membolehkan mereka memahami dan menghayati nilai dalam konteks kerjaya serta merancang masa depan dengan lebih beretika.

Rumusan dan Cadangan

Kajian ini meneliti tahap kefahaman dan pengamalan nilai-nilai murni dalam kalangan pelajar Kursus Nilai Masyarakat Malaysia dan Pendidikan Moral di Politeknik Mukah. Analisis mendapati bahawa kedua-dua aspek menunjukkan tahap yang tinggi, menggambarkan bahawa pelajar bukan sahaja menguasai konsep nilai dengan mendalam malah juga mengaplikasikannya secara konsisten dalam rutin harian mereka. Analisis juga memperlihatkan hubungan yang sangat kuat antara kefahaman dan pengamalan. Ini membuktikan peningkatan pengetahuan tentang nilai turut mendorong peningkatan dalam cara pelajar mempraktikkannya. Secara keseluruhannya, hasil kajian menggambarkan bahawa kursus ini berperanan penting sebagai medium pembentukan sahsiah, kerana pendedahan sistematik terhadap nilai-nilai murni berjaya memberi kesan positif terhadap perkembangan moral, sikap bertanggungjawab, dan keupayaan pelajar mengaplikasikan nilai dalam konteks akademik serta sosial mereka.

Cadangan untuk kajian akan datang agar penyelidikan lanjutan dijalankan dengan bilangan responden yang lebih besar kepada pelbagai institusi bagi mendapatkan gambaran yang lebih menyeluruh tentang tahap kefahaman serta pengamalan nilai murni pelajar. Di samping itu, kajian lanjutan juga boleh menilai keberkesanan pelbagai pendekatan pengajaran yang berbeza bagi meningkatkan penghayatan nilai dalam kalangan pelajar. Selain itu, faktor seperti sokongan pensyarah, persekitaran pembelajaran dan rakan sebaya turut dicadangkan untuk dikaji bagi melihat pengaruhnya terhadap tahap pengamalan nilai pelajar.



Penyelidikan ini mempunyai kepentingan pada pelbagai peringkat. Pada peringkat keluarga, ianya dapat membantu ibu bapa memahami keperluan pembentukan nilai murni dalam kehidupan anak-anak, seterusnya mengukuhkan hubungan kekeluargaan melalui amalan hormat dan tanggungjawab. Pada peringkat masyarakat, penerapan nilai murni melalui pendidikan nilai berpotensi melahirkan generasi yang beretika dan mampu mewujudkan suasana sosial yang lebih harmoni. Dari sudut institusi, kajian ini memberi asas kepada pihak pentadbiran dan pensyarah untuk menambah baik pendekatan pengajaran serta merancang strategi yang lebih berkesan dalam memperkukuhkan pembangunan sahsiah pelajar. Pada peringkat negara, kajian ini penting dalam menyumbang kepada pembinaan modal insan yang berkualiti dan berakhlak, secara langsung menyokong perpaduan dan pembangunan negara secara menyeluruh.

Justeru, kajian ini menyediakan asas yang kukuh untuk mempertingkatkan pendidikan nilai murni secara lebih menyeluruh pada masa hadapan. Dapatan kajian memberi sumbangan penting dalam menambahbaik strategi pengajaran serta memperkukuhkan pembentukan sahsiah pelajar melalui pendekatan yang lebih sistematik dan berkesan. Hasil kajian turut menyediakan panduan berguna kepada pendidik, pembuat dasar dan institusi pendidikan dalam merangka intervensi yang lebih berimpak bagi memperkasa penghayatan nilai dalam kalangan generasi muda.

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MEMAHAMI PENGGUNAAN KECERDASAN BUATAN (AI) DALAM PENULISAN ARTIKEL PENDIDIKAN SARJANA

Siti Zalbiha Amzah¹, Hafizhah Zulkifli²

¹Fakulti Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (p144908@siswa.ukm.edu.my)

²Fakulti Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (hafizhah_zulkifli@ukm.edu.my)

Abstrak: Perkembangan pesat kecerdasan buatan (Artificial Intelligence, AI), khususnya AI generatif, telah mempengaruhi amalan penulisan akademik dalam pendidikan tinggi, termasuk di peringkat pengajian sarjana. Dalam konteks ini, AI semakin digunakan sebagai alat sokongan bagi penjanaan idea, penstrukturkan hujah dan penambahbaikan bahasa dalam penulisan ilmiah. Walaupun potensi AI dalam meningkatkan kecekapan penulisan diakui, penggunaannya turut menimbulkan kebimbangan berkaitan integriti akademik, keaslian idea dan kebergantungan kognitif pelajar. Artikel ini bertujuan untuk mensintesis kajian-kajian lepas berkaitan penggunaan AI dalam penulisan artikel pendidikan di peringkat sarjana melalui pendekatan kajian kepustakaan konseptual. Perbincangan memfokuskan kepada corak penggunaan AI oleh pelajar sarjana, persepsi terhadap keberkesanan teknologi tersebut, dilema etika yang dikenal pasti dalam literatur, serta ketidaksejajaran antara dasar institusi dan amalan sebenar pelajar. Sintesis literatur menunjukkan bahawa penggunaan AI dalam penulisan akademik bersifat situasional dan bergantung kepada konteks tugas, tahap literasi AI serta kefahaman pelajar terhadap batasan teknologi tersebut. Artikel ini menolak pendekatan dikotomi yang melihat AI sama ada sebagai ancaman mutlak atau penyelesaian menyeluruh kepada cabaran penulisan akademik, sebaliknya menegaskan bahawa nilai sebenar AI terletak pada cara penggunaannya yang beretika dan berinformasi. Sebagai sumbangan utama, artikel ini membangunkan satu sintesis konseptual yang memposisikan AI sebagai alat sokongan penulisan, dengan literasi AI dan pertimbangan etika sebagai faktor pengantara penting, di samping menyoroti implikasi terhadap pendidikan sarjana dan keperluan pembangunan dasar institusi yang jelas dan kontekstual.

Kata Kunci: Integriti akademik, kecerdasan buatan, literasi AI, pelajar sarjana, penulisan akademik.

Pengenalan

Kecerdasan Buatan atau Artificial Intelligence (AI) kini menjadi antara teknologi paling berpengaruh dalam landskap pendidikan global. Perkembangannya bukan sahaja mengubah cara maklumat diproses dan disampaikan, malah turut mempengaruhi amalan pembelajaran, penilaian akademik, serta penghasilan penulisan ilmiah dalam pendidikan tinggi. Perbincangan semasa menunjukkan bahawa AI semakin diterima sebagai alat sokongan pembelajaran, namun pada masa yang sama menimbulkan kebimbangan berkaitan keaslian akademik, etika penggunaan, dan peranan sebenar pemikiran manusia dalam proses akademik.



Dalam konteks pengajian sarjana, penggunaan AI generatif seperti ChatGPT semakin meluas sebagai sokongan dalam penulisan akademik, termasuk bagi tujuan menjana idea awal, menyusun struktur hujah, dan memperbaiki kejelasan bahasa. Menurut data Turnitin (2024) terhadap lebih 200 juta kertas kerja yang telah disemak sejak pelancaran ciri pengesanan AI, sekitar 11% daripada penulisan pelajar mengandungi sekurang-kurangnya 20% kandungan yang dipercayai dijana oleh AI. Statistik ini menunjukkan bahawa walaupun majoriti tugas masih dihasilkan oleh pelajar sendiri, penggunaan AI dalam penulisan akademik adalah signifikan dan perlu diberi perhatian dalam konteks integriti akademik. Trend ini mendorong institusi pendidikan tinggi untuk menilai semula dasar akademik dan garis panduan integriti, khususnya berkaitan penggunaan teknologi AI dalam penulisan ilmiah (Hui Wang et al., 2024). Walaupun AI berpotensi meningkatkan kecekapan dan kualiti penulisan, penggunaannya secara tidak terkawal boleh mengaburkan matlamat pembelajaran sebenar di peringkat pascasiswazah.

Sorotan kajian lepas menunjukkan bahawa perbincangan mengenai AI dalam pendidikan tinggi banyak tertumpu kepada aspek keberkesanan teknologi (Adamakis & Rachiotis, 2025), implikasi terhadap integriti akademik (Ncube et al., 2025), serta keperluan membangunkan literasi AI dalam kalangan pelajar (Becirovic et al., 2025). UNESCO (2023) menekankan kepentingan keseimbangan antara inovasi teknologi dan prinsip etika, manakala kajian-kajian terkini menyoroti kebimbangan terhadap kebergantungan berlebihan pelajar terhadap AI dalam penulisan akademik (Sonia et al., 2025). Pendekatan ini, walaupun penting, sering kurang memberi perhatian kepada analisis konseptual yang menghimpunkan dapatan kajian lepas untuk memahami secara lebih mendalam bagaimana peranan AI dalam penulisan akademik di peringkat sarjana dapat ditafsirkan secara bernuansa. Sehubungan itu, artikel ini bertujuan untuk mensintesis kajian-kajian lepas bagi menghuraikan corak penggunaan AI dalam penulisan artikel pendidikan oleh pelajar sarjana, serta membincangkan implikasi konseptual dan pedagogi terhadap penggunaan AI yang beretika dan bertanggungjawab dalam pendidikan tinggi.

Berdasarkan jurang tersebut, artikel ini memberi tumpuan kepada penerokaan konseptual terhadap penggunaan kecerdasan buatan (AI) dalam penulisan artikel pendidikan di peringkat sarjana melalui analisis dan sintesis kajian-kajian lepas yang berkaitan. Artikel ini bertujuan untuk memahami corak penggunaan AI dalam penulisan akademik, persepsi terhadap keberkesanannya, serta cabaran dan batasan yang dikenal pasti dalam literatur, khususnya berkaitan usaha memastikan penulisan akademik yang beretika dan bermakna. Melalui pendekatan kajian kepustakaan, artikel ini berhasrat menyumbang kepada pemahaman yang lebih bernuansa tentang peranan AI sebagai alat sokongan penulisan dalam konteks pendidikan pascasiswazah. (TNR, 12, single spacing, justify)

Kajian Kepustakaan

Sorotan literatur ini disusun kepada lapan bahagian utama yang membincangkan berkaitan penggunaan Kecerdasan Buatan (AI) dalam penulisan artikel pendidikan peringkat sarjana.



Teori Literasi AI

Perbincangan mengenai penggunaan kecerdasan buatan (AI) dalam penulisan akademik tidak dapat dipisahkan daripada konsep literasi AI. Literasi AI merujuk kepada keupayaan individu untuk memahami asas bagaimana sistem AI berfungsi, menilai kebolehpercayaan dan keterbatasan output yang dijana, serta menggunakan teknologi tersebut secara beretika dan bertanggungjawab dalam konteks pembelajaran dan akademik. Long dan Magerko (2020) menegaskan bahawa literasi AI melangkaui kemahiran teknikal semata-mata, sebaliknya merangkumi dimensi kognitif, kritikal dan etika yang membolehkan pengguna membuat pertimbangan bermakna terhadap penggunaan AI.

Dalam konteks pendidikan tinggi, literasi AI menjadi elemen penting bagi memastikan AI dimanfaatkan sebagai alat sokongan pembelajaran, bukan sebagai pengganti kepada usaha intelektual pelajar. Kajian oleh Ng et al. (2023) menunjukkan bahawa tanpa literasi AI yang mencukupi, pelajar cenderung menerima hasil janaan AI secara pasif, sekali gus berisiko mengabaikan proses penaakulan, analisis dan pembinaan hujah yang merupakan teras kepada penulisan akademik. Oleh itu, tahap literasi AI pelajar mempengaruhi cara, tujuan dan tahap kebergantungan mereka terhadap teknologi ini dalam menghasilkan penulisan ilmiah.

Perkembangan Penyelidikan AI dalam Pendidikan

Penyelidikan berkaitan kecerdasan buatan (AI) dalam pendidikan telah berkembang dengan ketara sejak sedekad lalu, seiring dengan kemajuan teknologi digital. Pada peringkat awal, kajian AI dalam pendidikan banyak menumpukan kepada aspek teknikal, khususnya pembangunan sistem tutor pintar, automasi penilaian, dan analisis pembelajaran bagi meningkatkan kecekapan pengajaran dan pemantauan prestasi pelajar (Olaf et al., 2019). Dalam kerangka ini, AI dilihat terutamanya sebagai alat sokongan untuk mengoptimumkan proses pengajaran melalui personalisasi dan maklum balas berasaskan data.

Namun demikian, literatur menunjukkan bahawa fokus penyelidikan AI dalam pendidikan telah mengalami peralihan yang signifikan daripada pendekatan teknikal kepada pendekatan pedagogi dan sosio-teknikal. AI tidak lagi dikaji semata-mata dari sudut keberkesanan sistem, tetapi sebagai sebahagian daripada ekosistem pembelajaran yang mempengaruhi interaksi antara pelajar, pendidik dan institusi (Khoza & Walt, 2025). Melalui analisis sistematik terhadap kajian AI pendidikan, impak sebenar AI hanya dapat difahami apabila teknologi ini dianalisis bersama faktor manusia dan konteks institusi, termasuk peranan pendidik dan amalan pedagogi sedia ada.

Seiring perkembangan teknologi, penyelidikan AI dalam pendidikan tidak lagi terhad kepada fungsi teknikal seperti personalisasi pembelajaran atau automasi penilaian, tetapi semakin menekankan nilai pedagogi dan implikasi terhadap amalan pendidikan secara lebih luas. Kajian sistematik terbaru menunjukkan bahawa AI kini dilihat bukan sekadar alat pemberi maklum balas, tetapi juga sebagai elemen yang mempengaruhi strategi pengajaran, keterlibatan pelajar dan reka bentuk pembelajaran yang adaptif (Zakaria et al., 2025). Peralihan ini mencerminkan pemahaman bahawa AI perlu diintegrasikan melalui pendekatan pendidikan yang lebih



holistik, yang mengambil kira dimensi etika, kesediaan pendidik, dan konteks institusi, seterusnya membawa kepada transformasi dalam pedagogi abad ke-21. Contohnya, penekanan terhadap literasi AI dan kesedaran kritikal dalam kalangan pendidik dan pelajar telah muncul sebagai fokus utama dalam literatur, menunjukkan bahawa penyelidikan kini menilai AI sebagai sebahagian daripada learning ecosystem dan bukan sekadar teknologi sokongan.

Kemunculan AI generatif, khususnya model bahasa besar seperti ChatGPT, telah memperkukuh lagi peralihan fokus penyelidikan ini. Kajian terkini menunjukkan bahawa AI generatif berpotensi berfungsi sebagai rakan kognitif yang menyokong penjanaan idea, penstrukturan hujah dan penghalusan bahasa dalam penulisan akademik. Namun, pada masa yang sama, penyelidik memberi amaran tentang risiko kebergantungan berlebihan dan penghakisan pemikiran kritis sekiranya penggunaan AI tidak disertai dengan literasi AI yang mencukupi (Kasneci, 2023). Secara keseluruhannya, literatur mencadangkan bahawa nilai AI dalam pendidikan tidak terletak pada kecanggihan teknologi semata-mata, tetapi pada keupayaan pengguna memahami batasan, implikasi etika dan peranan AI sebagai alat sokongan dalam pembelajaran.

Selain itu, penyelidikan menunjukkan bahawa tahap literasi AI dalam kalangan pelajar pendidikan tinggi adalah tidak seiring dengan tahap penggunaan teknologi tersebut. Walaupun pelajar mahir menggunakan AI dari sudut praktikal, ramai yang kurang memahami cara sistem AI berfungsi, termasuk isu ketepatan maklumat, bias algoritma dan had keupayaan model bahasa. Kekurangan literasi ini boleh menjejaskan keupayaan pelajar untuk menilai kandungan yang dijana secara kritis serta menggunakan AI secara bertanggungjawab dalam penulisan akademik (Kasneci, 2023). Secara keseluruhannya, literatur mencadangkan bahawa penggunaan AI dalam pendidikan tinggi perlu disertai dengan pembangunan literasi AI dan bimbingan institusi agar teknologi ini berfungsi sebagai alat sokongan pembelajaran, bukannya pengganti proses kognitif dan penaakulan akademik pelajar.

Seiring dengan peralihan fokus penyelidikan AI dalam pendidikan daripada pendekatan teknikal kepada pendekatan pedagogi dan sosio-teknikal, perhatian terhadap amalan penulisan akademik dalam pendidikan tinggi menjadi semakin relevan. Penulisan akademik, khususnya di peringkat sarjana, merupakan aktiviti kognitif yang kompleks dan menuntut keupayaan penaakulan, sintesis idea serta pertimbangan etika yang tinggi. Justeru, penggunaan AI generatif dalam penulisan akademik tidak boleh difahami semata-mata sebagai isu teknologi, tetapi perlu dianalisis dalam kerangka pedagogi, literasi AI dan integriti akademik. Berdasarkan perkembangan penyelidikan AI dalam pendidikan yang dibincangkan, bahagian seterusnya memberi tumpuan khusus kepada peranan dan implikasi penggunaan AI dalam penulisan akademik pascasiswazah.

AI dalam Penulisan Akademik Pascasiswazah

Penggunaan kecerdasan buatan (AI) dalam penulisan akademik semakin ketara dalam kalangan pelajar pascasiswazah, khususnya apabila teknologi ini mula digunakan sebagai sokongan dalam proses penghasilan artikel ilmiah. Kajian kepustakaan menunjukkan bahawa pelajar sarjana lazimnya menggunakan AI untuk membantu penjanaan idea awal, penyusunan struktur



penulisan, serta penambahbaikan aspek bahasa seperti kejelasan ayat dan ketepatan tatabahasa. Dalam satu sorotan sistematik terhadap penggunaan AI dalam penulisan akademik, Mohamed dan Mona (2024) mendapati bahawa fungsi utama AI dalam konteks akademik tertumpu kepada sokongan awal proses penulisan, khususnya dalam membantu pelajar merangka idea dan menyusun kandungan secara lebih sistematik. Dapatan ini menunjukkan bahawa AI berperanan sebagai alat sokongan awal, bukannya pengganti kepada proses intelektual utama pelajar.

Dalam konteks pengajian pascasiswazah, penggunaan AI dalam penulisan akademik mempunyai ciri yang berbeza berbanding penggunaan oleh pelajar prasiswazah. Kajian menunjukkan bahawa pelajar sarjana cenderung menggunakan AI secara lebih selektif dan berfokus, iaitu sebagai alat untuk memperkemas hujah, memperbaiki bahasa, dan menyemak struktur penulisan, berbanding menghasilkan kandungan akademik secara menyeluruh. Mohamed et al. (2025) melaporkan bahawa penggunaan AI oleh pelajar pascasiswazah menyumbang kepada peningkatan keyakinan terhadap kemahiran penulisan akademik dan kefahaman terhadap struktur penulisan ilmiah, khususnya dalam penulisan artikel dan laporan penyelidikan. Walau bagaimanapun, kajian tersebut turut menegaskan bahawa keberkesanan penggunaan AI bergantung kepada keupayaan pelajar menilai dan menyesuaikan cadangan yang dijana dengan konteks akademik masing-masing.

Dari sudut peranan kognitif, literatur terkini mencadangkan bahawa AI lebih sesuai difahami sebagai alat sokongan kognitif yang membantu pelajar mengembangkan idea dan menstrukturkan penulisan, bukan sebagai penjana kandungan akademik sepenuhnya. Analisis rentas jurnal oleh Xu (2025) menunjukkan bahawa AI paling kerap digunakan untuk tujuan penambahbaikan kebolehbacaan, penyusunan perenggan, dan semakan bahasa, manakala penggunaan AI untuk menghasilkan hujah akademik yang kompleks adalah terhad. Dapatan ini mengukuhkan pandangan bahawa AI berfungsi sebagai alat sokongan yang membantu pelajar mengurus proses penulisan dengan lebih cekap, namun tetap memerlukan penglibatan aktif pelajar dalam membuat keputusan akademik dan intelektual.

Walaupun demikian, beberapa kajian turut menimbulkan kebimbangan terhadap risiko kebergantungan berlebihan terhadap AI dalam penulisan akademik. Deep dan Chen (2025) menegaskan bahawa penggunaan AI tanpa kefahaman literasi AI yang mencukupi berpotensi melemahkan keupayaan pemikiran kritis dan kemahiran menulis secara mendalam dalam kalangan pelajar pascasiswazah. Apabila pelajar menerima cadangan AI secara pasif tanpa proses penilaian kritikal, penulisan yang dihasilkan berisiko menjadi bersifat mekanikal dan kurang mencerminkan kefahaman sebenar terhadap kandungan akademik. Situasi ini amat membimbangkan dalam konteks pengajian sarjana yang menekankan kebolehan menganalisis, mensintesis dan membina hujah berasaskan literatur secara kritis.

Selain itu, kajian kepustakaan menunjukkan bahawa perbezaan ketara antara pelajar prasiswazah dan pascasiswazah terletak pada tahap kerumitan tugas akademik dan jangkaan intelektual. Hannifa dan Agus (2025) mendapati bahawa pelajar lebih cenderung menggunakan AI untuk tujuan penjanaan idea dan pembetulan bahasa, namun kurang menggunakannya untuk sintesis literatur dan penghasilan hujah kritikal yang mendalam. Dapatan ini menunjukkan



bahawa walaupun AI dapat menyokong aspek teknikal penulisan, tanggungjawab untuk membina makna, membuat interpretasi dan menilai literatur kekal terletak pada pelajar itu sendiri.

Secara keseluruhannya, kajian kepustakaan mencadangkan bahawa penggunaan AI dalam penulisan akademik pascasiswazah perlu difahami sebagai satu bentuk sokongan pembelajaran yang bersifat terhad dan kontekstual. AI berpotensi membantu pelajar dalam fasa awal penulisan dan penambahbaikan bahasa, namun keberkesanannya bergantung kepada tahap literasi AI, kesedaran etika, dan keupayaan refleksi sendiri pelajar. Oleh itu, AI tidak seharusnya dilihat sebagai pengganti kepada pemikiran akademik, sebaliknya sebagai alat sokongan yang memperkaya proses penulisan sekiranya digunakan secara beretika dan bertanggungjawab.

Isu Etika dan Integriti Akademik dalam Penggunaan AI

Walaupun kecerdasan buatan (AI) menawarkan sokongan teknikal dan pedagogi dalam proses penulisan akademik, implikasi etika dan integriti akademik terus menjadi cabaran utama dalam pendidikan tinggi. Dalam konteks ini, salah satu isu paling ketara ialah ketelusan dalam penggunaan AI. Literatur menekankan bahawa pelajar perlu jelas dan bertanggungjawab apabila menggunakan AI untuk mendapatkan idea, menyusun konsep atau memperbaiki teks. Kegagalan untuk melaporkan penggunaan AI boleh menimbulkan persoalan tentang keaslian dan kredibiliti hasil akademik. Kajian sistematik oleh Bittle dan El-Gayar (2025) menunjukkan bahawa kekurangan penjelasan mengenai penggunaan AI merupakan salah satu faktor yang menyumbang kepada cabaran integriti akademik dalam masyarakat pendidikan tinggi hari ini. Justeru, penekanan kepada ketelusan dan tanggungjawab pengguna AI dalam tugas akademik amatlah diperlukan.

Isu seterusnya ialah keaslian idea dibandingkan dengan bantuan teknologi. Dalam penyelidikan yang bertumpu pada AI dan plagiarisme, Rahma et al. (2025) mendapati bahawa penggunaan AI boleh mengaburkan sempadan antara idea pelajar dengan output yang dijana sistem, khususnya apabila pelajar tidak mengkaji semula atau memodifikasi hasil AI secara kritikal sebelum dimasukkan dalam tugas mereka. Ketidaktegasan ini menjurus kepada risiko plagiarisme berbentuk baharu, di mana kandungan yang kelihatan asli sebenarnya merupakan hasil generatif AI yang tidak dinyatakan penggunaannya.

Isu kebergantungan kognitif juga menjadi cabaran etika yang semakin mendapat perhatian. Walaupun AI mampu membantu pelajar dalam menyelesaikan tugas tertentu, keberergantungan yang berlebihan terhadap teknologi ini boleh mengurangkan peluang pelajar melatih kemahiran pengolahan maklumat, analisis dan penaakulan kritikal sendiri. Ramai penyelidik menekankan bahawa penggunaan AI tanpa kefahaman yang mendalam boleh menyebabkan “ketidakcekapan yang disamarkan” (illusion of competence), di mana pelajar merasakan mereka berjaya kerana tugas lengkap, tetapi kurang memahami kandungan yang terhasil atau proses intelektual di sebaliknya. Hal ini bukan sahaja mempengaruhi hasil penulisan, tetapi juga pembelajaran jangka panjang yang merupakan tujuan utama pendidikan pascasiswazah.



Tambahan pula, terdapat ketidaksejajaran antara dasar institusi dan amalan sebenar pelajar dalam penggunaan AI. Walaupun banyak institusi pendidikan tinggi kini mula menggubal garis panduan untuk penggunaan AI, pelaksanaan dan pemantauan dasar tersebut sering tidak konsisten, sehingga pelajar sendiri kekurangan panduan jelas tentang cara yang beretika menggunakan alat AI. Hal ini memberi peluang kepada amalan yang berbeza-beza antara pelajar dan program pengajian, yang akhirnya menimbulkan kebimbangan tentang standard integriti akademik yang seragam di peringkat institusi.

Secara keseluruhannya, isu etika dan integriti akademik dalam konteks penggunaan AI merangkumi pelbagai dimensi, dari ketelusan dan keaslian idea, kepada kebergantungan kognitif dan ketidakselarasan dasar institusi. Oleh itu, perbincangan akademik mengenai AI dalam pendidikan tinggi tidak boleh terhad kepada aspek teknikal sahaja, tetapi juga mesti mengambil kira prinsip etika, kefahaman kritikal dan pembentukan dasar pendidikan yang menyokong penggunaan teknologi secara bertanggungjawab.

Pengalaman dan Persepsi Pelajar Sarjana terhadap AI

Kajian kepustakaan menunjukkan bahawa pengalaman dan persepsi pelajar sarjana terhadap penggunaan kecerdasan buatan (AI) dalam penulisan akademik adalah bersifat kompleks dan tidak seragam. Secara umum, pelajar tidak menilai AI secara mutlak sebagai alat yang sama ada sepenuhnya membantu atau sepenuhnya berisiko, sebaliknya mempamerkan sikap yang ambivalen terhadap penggunaannya. Kasneci et al. (2023), dalam analisis menyeluruh mengenai AI generatif dalam pendidikan tinggi, mendapati bahawa pelajar mengiktiraf potensi AI dalam menyokong pembelajaran dan penulisan, namun pada masa yang sama menyuarakan kebimbangan terhadap kesan teknologi tersebut terhadap pemikiran kritis, keaslian idea dan kebergantungan berlebihan. Dapatan ini menunjukkan bahawa penerimaan AI dalam kalangan pelajar sarjana sering disertai dengan pertimbangan kritikal dan keraguan yang berasas.

Dari sudut persepsi keberkesanan, pelajar sarjana lazimnya melihat AI sebagai alat yang berguna untuk tugas tertentu, khususnya dalam fasa awal penulisan seperti penjanaan idea, pemahaman struktur artikel akademik dan penambahbaikan bahasa. Kajian oleh Lund et al. (2023) yang meneliti persepsi pelajar terhadap penggunaan ChatGPT mendapati bahawa kebanyakan pelajar menganggap AI membantu meningkatkan kejelasan penulisan dan menjimatkan masa, tetapi tidak sesuai digunakan untuk membina hujah akademik yang kompleks atau membuat interpretasi literatur secara mendalam. Persepsi ini mencerminkan pemahaman pelajar bahawa AI mempunyai nilai instrumental, namun tetap mempunyai batasan yang jelas dalam konteks penulisan ilmiah pascasiswazah.

Walau bagaimanapun, literatur turut melaporkan kebimbangan pelajar berkaitan implikasi etika dan akademik penggunaan AI. Antara kebimbangan utama ialah risiko melanggar integriti akademik, kekeliruan tentang tahap penggunaan yang dibenarkan, serta ketakutan terhadap implikasi penilaian sekiranya penggunaan AI dikesan. Debby et al. (2023) mendapati bahawa pelajar sering berada dalam keadaan dilema, di mana mereka mengakui kegunaan AI tetapi tidak pasti sama ada penggunaannya selari dengan jangkaan pensyarah dan dasar



institusi. Keadaan ini mewujudkan ketegangan antara keinginan untuk memanfaatkan teknologi dan keperluan mematuhi norma akademik tradisional.

Dilema etika ini mendorong pelajar sarjana mengamalkan penggunaan AI secara selektif dan berhati-hati, bergantung kepada jenis tugas dan tahap risiko akademik yang dirasakan. Literatur menunjukkan bahawa pelajar lebih cenderung menggunakan AI untuk tugas berisiko rendah, seperti draf awal, penyuntingan bahasa atau pemahaman umum terhadap topik, berbanding tugas berisiko tinggi seperti penulisan artikel untuk penerbitan atau tugas yang menilai keaslian hujah secara langsung. Chevalere et al. (2023) melaporkan bahawa pelajar secara sadar mengehadkan penggunaan AI apabila tugas memerlukan analisis kritikal dan sumbangan intelektual yang jelas, sekali gus menunjukkan bahawa penggunaan AI adalah bergantung kepada konteks dan bukan amalan automatik.

Secara konseptual, dapatan kajian-kajian ini memperlihatkan pola penggunaan AI yang bersifat situasional, di mana keputusan untuk menggunakan atau tidak menggunakan AI dipengaruhi oleh pertimbangan etika, jangkaan akademik, dan persepsi terhadap tujuan pembelajaran. Pelajar sarjana tidak semata-mata menerima atau menolak AI, sebaliknya menilai kesesuaian teknologi tersebut berdasarkan konteks tugas dan keperluan akademik. Pola ini menyokong hujah bahawa penggunaan AI dalam penulisan akademik tidak wajar difahami secara dikotomi sebagai sama ada berfaedah atau berbahaya, tetapi sebagai satu amalan akademik yang dinamik dan dipengaruhi oleh pelbagai faktor situasional.

Kesimpulannya, kajian kepustakaan menunjukkan bahawa pengalaman dan persepsi pelajar sarjana terhadap AI dicirikan oleh sikap ambivalen, penggunaan yang selektif, serta kebergantungan kepada konteks tugas. Kefahaman ini penting kerana ia menegaskan bahawa peranan AI dalam penulisan akademik perlu dinilai dalam kerangka pedagogi dan etika yang lebih bernuansa, selari dengan matlamat pembelajaran di peringkat pascasiswazah yang menekankan pemikiran kritis, refleksi dan keaslian intelektual.

Sintesis Konseptual: Memposisikan AI sebagai Alat Sokongan Penulisan Akademik

Berdasarkan perbincangan literatur terdahulu, dapat disimpulkan bahawa penggunaan kecerdasan buatan (AI) dalam penulisan akademik pelajar sarjana tidak boleh difahami secara reduktif sebagai sama ada amalan yang wajar atau sebaliknya. Sebaliknya, dapatan kajian menunjukkan keperluan untuk satu kerangka konseptual yang memposisikan AI sebagai alat sokongan penulisan yang berfungsi dalam ekosistem akademik yang kompleks, dipengaruhi oleh tahap literasi AI, peringkat pengajian, serta pertimbangan etika.

Secara konseptual, literasi AI muncul sebagai faktor asas yang menentukan corak dan kualiti penggunaan AI dalam penulisan akademik. Literasi AI tidak terhad kepada keupayaan teknikal menggunakan alat, tetapi merangkumi kefahaman tentang had, risiko epistemik, serta implikasi etika penggunaan teknologi tersebut. Pelajar sarjana yang memiliki literasi AI yang lebih tinggi cenderung menggunakan AI secara reflektif dan terkawal, iaitu sebagai alat sokongan untuk menjana idea awal, memperkemas bahasa, dan menstruktur penulisan, tanpa menyerahkan sepenuhnya proses pembinaan makna kepada teknologi. Dapatan ini sejajar dengan hujah



bahawa AI berfungsi sebagai cognitive scaffold yang menyokong, bukannya menggantikan, proses kognitif penulis (Kasneci et al., 2023).

Tahap pengajian turut memainkan peranan penting dalam membezakan corak penggunaan AI. Pelajar sarjana, berbanding pelajar prasiswazah, beroperasi dalam landskap akademik yang menuntut tahap autonomi intelektual, keaslian hujah dan kebertanggungjawaban epistemik yang lebih tinggi. Oleh itu, penggunaan AI dalam kalangan pelajar sarjana lazimnya lebih selektif dan berstrategi, khususnya apabila tugas melibatkan analisis kritikal, sintesis literatur dan sumbangan konseptual. Dalam konteks ini, AI tidak dilihat sebagai penjana kandungan utama, tetapi sebagai alat sokongan yang memudahkan proses penulisan tanpa menjejaskan identiti kepengarangan akademik (Lund et al., 2023).

Pertimbangan etika pula bertindak sebagai mekanisme pengawal yang membentuk keputusan pelajar sama ada untuk menggunakan atau mengehadkan penggunaan AI. Isu seperti keaslian idea, ketelusan penggunaan dan risiko plagiarisme tidak disengajakan mendorong pelajar untuk menilai kesesuaian AI berdasarkan konteks tugas dan jangkaan institusi. Seperti yang dibincangkan sebelum ini, ketidaksejajaran antara dasar institusi dan amalan sebenar pelajar sering mewujudkan ruang kelabu etika, yang akhirnya mendorong penggunaan AI secara berhati-hati dan bersyarat (Debby et al., 2023). Dalam kerangka konseptual ini, pertimbangan etika bukan sekadar faktor luaran, tetapi sebahagian daripada proses metakognitif pelajar dalam mengawal penggunaan teknologi.

Interaksi antara literasi AI, tahap pengajian dan pertimbangan etika seterusnya membentuk corak penggunaan AI yang bersifat situasional. Corak ini dicirikan oleh penggunaan yang fleksibel, bergantung kepada tujuan tugas, tahap risiko akademik dan nilai pembelajaran yang ingin dicapai. AI digunakan secara lebih terbuka dalam tugas berorientasikan sokongan bahasa dan struktur, tetapi dikawal dengan ketat dalam tugas yang menilai keaslian pemikiran dan hujah akademik. Pola ini mengukuhkan hujah bahawa penggunaan AI dalam penulisan akademik tidak bersifat dikotomi, sebaliknya berada pada satu spektrum yang dinamik dan kontekstual (Chevalere et al., 2023).

Secara keseluruhan, sintesis konseptual ini memposisikan AI sebagai alat sokongan penulisan akademik yang berfungsi dalam rangka pedagogi yang beretika dan reflektif. Peranan AI bukan sebagai pengganti penulis, tetapi sebagai perantara kognitif yang membantu pelajar mengurus beban kognitif penulisan tanpa menjejaskan keaslian intelektual. Kerangka ini memberi implikasi penting kepada institusi pengajian tinggi, khususnya dalam merangka dasar penggunaan AI yang realistik, berperingkat dan sejajar dengan tahap pengajian, serta dalam memupuk literasi AI sebagai sebahagian daripada kompetensi akademik pelajar sarjana.

Implikasi kepada Pendidikan Sarjana dan Dasar Institusi

Sintesis konseptual yang memposisikan kecerdasan buatan (AI) sebagai alat sokongan penulisan mempunyai implikasi langsung terhadap amalan pendidikan sarjana dan perumusan dasar institusi pengajian tinggi. Memandangkan penggunaan AI dalam penulisan akademik semakin menjadi sebahagian daripada realiti pembelajaran, institusi tidak lagi boleh



bergantung kepada pendekatan larangan menyeluruh atau dasar yang bersifat umum dan tidak berperingkat. Sebaliknya, keperluan mendesak wujud untuk membangunkan garis panduan penggunaan AI yang jelas, kontekstual dan sejajar dengan matlamat pembelajaran di peringkat sarjana.

Pertama, kejelasan garis panduan penggunaan AI merupakan asas kepada pemeliharaan integriti akademik. Literatur menunjukkan bahawa kekaburan dasar institusi sering mewujudkan ketidaksejajaran antara jangkaan rasmi dan amalan sebenar pelajar, sekali gus mendorong penggunaan AI secara tersembunyi atau tidak konsisten. Oleh itu, institusi perlu merangka garis panduan yang bukan sahaja menyatakan apa yang dibenarkan dan dilarang, tetapi turut menjelaskan rasional pedagogi di sebalik ketetapan tersebut. Pendekatan ini dapat membantu pelajar memahami bahawa penggunaan AI bukan isu moral yang bersifat mutlak, tetapi berkait rapat dengan tujuan pembelajaran, keaslian sumbangan intelektual dan tahap pengajian (Debby et al., 2023).

Kedua, peranan pensyarah adalah kritikal dalam membentuk amalan penggunaan AI yang beretika dan reflektif dalam kalangan pelajar sarjana. Pensyarah tidak lagi berfungsi semata-mata sebagai penilai hasil akhir penulisan, tetapi sebagai pembimbing yang membantu pelajar menilai kesesuaian penggunaan AI dalam proses penulisan akademik. Melalui dialog terbuka, penjelasan jangkaan tugas dan contoh amalan baik, pensyarah boleh membimbing pelajar membezakan antara bantuan teknologi yang sah dan kebergantungan yang menjejaskan perkembangan kognitif. Pendekatan bimbingan ini sejajar dengan pandangan bahawa AI seharusnya berfungsi sebagai cognitive scaffold, bukan pengganti proses pemikiran kritis pelajar (Kasneci et al., 2023).

Selain itu, pensyarah juga berperanan dalam membina kesedaran metakognitif pelajar terhadap risiko seperti kebergantungan kognitif dan “illusion of competence”, di mana pelajar mungkin merasakan mereka telah menguasai kemahiran penulisan atau kefahaman konsep sedangkan hasil tersebut sebenarnya banyak bergantung kepada AI. Dengan menstruktur tugas yang menekankan justifikasi, refleksi proses dan tanggungjawab intelektual, pensyarah dapat mengurangkan risiko tersebut serta mengekalkan nilai pembelajaran penulisan akademik di peringkat sarjana.

Ketiga, dapatan kajian menyokong keperluan mengintegrasikan literasi AI secara formal dalam kurikulum sarjana. Literasi AI perlu difahami sebagai sebahagian daripada kompetensi akademik, bukan kemahiran tambahan yang bersifat opsyenal. Integrasi ini boleh dilaksanakan melalui kursus metodologi penyelidikan, penulisan akademik atau modul kemahiran siswazah yang menekankan kefahaman tentang fungsi, batasan dan implikasi etika AI. Pendekatan ini membolehkan pelajar membangunkan keupayaan membuat keputusan yang berinformasi dan bertanggungjawab dalam penggunaan AI, selari dengan tuntutan akademik dan profesional masa hadapan (Lund et al., 2023).

Secara keseluruhan, implikasi terhadap pendidikan sarjana dan dasar institusi menuntut peralihan daripada pendekatan kawalan semata-mata kepada pendekatan pembangunan kapasiti. Dengan menyediakan garis panduan yang jelas, memperkasa peranan pensyarah



sebagai pembimbing etika, serta mengintegrasikan literasi AI dalam kurikulum, institusi pengajian tinggi dapat memastikan bahawa penggunaan AI menyokong, bukannya menjejaskan matlamat pendidikan sarjana. Pendekatan ini juga mengukuhkan kedudukan AI sebagai alat sokongan penulisan yang selari dengan prinsip integriti akademik dan pembangunan intelektual pelajar.

Cadangan Penyelidikan Masa Hadapan

Berdasarkan sintesis literatur yang dibincangkan, beberapa hala tuju penyelidikan masa hadapan dapat dikenal pasti bagi memperkukuh pemahaman tentang penggunaan kecerdasan buatan (AI) dalam penulisan akademik di peringkat sarjana. Pertama, terdapat keperluan untuk kajian empirikal kualitatif yang meneliti pengalaman sebenar pelajar sarjana dalam menggunakan AI sepanjang proses penulisan ilmiah. Pendekatan seperti temu bual mendalam atau kajian kes dapat memberikan gambaran yang lebih bernuansa tentang pertimbangan etika, strategi penggunaan dan refleksi sendiri pelajar yang tidak dapat ditangkap sepenuhnya melalui kajian kuantitatif berskala besar.

Kedua, penyelidikan merentas disiplin wajar dijalankan bagi mengenal pasti variasi corak penggunaan AI mengikut bidang pengajian. Keperluan penulisan akademik dalam bidang pendidikan, sains sosial, sains gunaan atau bidang profesional adalah berbeza. Justeru, peranan dan batasan AI juga berpotensi berbeza mengikut konteks disiplin. Kajian perbandingan sedemikian dapat menyumbang kepada pembangunan garis panduan penggunaan AI yang lebih kontekstual dan berperingkat, selari dengan keperluan akademik setiap bidang.

Ketiga, literatur semasa menunjukkan keperluan mendesak untuk pembangunan dan pengesahan instrumen literasi AI yang khusus untuk konteks pendidikan tinggi. Instrumen yang sah dan boleh dipercayai diperlukan bagi menilai tahap kefahaman pelajar terhadap fungsi, batasan dan implikasi etika AI, serta hubungannya dengan corak penggunaan dalam penulisan akademik. Pembangunan instrumen sedemikian bukan sahaja menyokong penyelidikan empirikal yang lebih sistematik, malah boleh dimanfaatkan oleh institusi dalam merancang intervensi kurikulum dan latihan literasi AI.

Secara keseluruhannya, cadangan penyelidikan masa hadapan ini menekankan keperluan untuk bergerak melangkaui perbincangan normatif tentang AI kepada pemahaman empirikal dan kontekstual. Pendekatan ini penting bagi memastikan penggunaan AI dalam penulisan akademik sarjana terus menyokong pembangunan intelektual, pemikiran kritis dan integriti akademik dalam pendidikan tinggi.

Rumusan

Artikel ini telah membincangkan penggunaan kecerdasan buatan (AI) dalam penulisan akademik di peringkat sarjana melalui analisis dan sintesis kajian-kajian lepas yang relevan. Perbincangan menunjukkan bahawa AI semakin menjadi sebahagian daripada ekosistem penulisan ilmiah dalam pendidikan tinggi, khususnya sebagai alat sokongan dalam penjanaan idea awal, penstrukturan hujah dan penambahbaikan aspek bahasa. Walau bagaimanapun,



penggunaan AI tidak berlaku secara homogen atau seragam, sebaliknya dipengaruhi oleh tahap literasi AI, keperluan tugas akademik, pertimbangan etika serta konteks institusi.

Hujah utama artikel ini menegaskan bahawa penggunaan AI dalam penulisan akademik sarjana tidak wajar difahami melalui kerangka dikotomi yang melihat teknologi ini sama ada sebagai ancaman mutlak terhadap integriti akademik atau sebagai penyelesaian menyeluruh kepada cabaran penulisan ilmiah. Sebaliknya, literatur menunjukkan bahawa AI berfungsi sebagai alat sokongan yang nilainya bergantung kepada cara, tujuan dan tahap penggunaannya. Apabila digunakan secara selektif dan berinformasi, AI berpotensi menyokong proses kognitif pelajar tanpa menggantikan peranan pemikiran kritis, analisis dan penaakulan yang menjadi teras penulisan akademik di peringkat sarjana.

Artikel ini juga menekankan bahawa risiko seperti kebergantungan kognitif, kekaburan keaslian idea dan fenomena “illusion of competence” bukan berpunca daripada teknologi AI itu sendiri, tetapi daripada penggunaan yang tidak disertai kefahaman yang mencukupi tentang batasan dan implikasi etika teknologi tersebut. Oleh itu, literasi AI muncul sebagai faktor pengantara yang kritikal dalam menentukan sama ada penggunaan AI menyokong atau menjejaskan matlamat pembelajaran akademik. Pelajar yang memiliki literasi AI yang baik cenderung menggunakan AI sebagai rangsangan pemikiran dan sokongan teknikal, manakala pelajar dengan literasi yang rendah berisiko menerima output AI secara pasif tanpa penilaian kritis.

Selain itu, sintesis konseptual yang dibangunkan dalam artikel ini memperlihatkan bahawa penggunaan AI dalam penulisan akademik bersifat situasional dan bergantung kepada konteks. Corak penggunaan AI berbeza mengikut tahap pengajian, jenis tugas dan jangkaan pensyarah, sekali gus menyokong pandangan bahawa dasar dan amalan institusi perlu bersifat fleksibel dan berperingkat. Pendekatan yang terlalu berfokus kepada kawalan atau larangan berpotensi mengabaikan realiti amalan pelajar serta peluang pedagogi yang boleh dimanfaatkan melalui penggunaan AI secara beretika.

Secara keseluruhan, artikel ini menyumbang kepada perbincangan akademik dengan memposisikan AI sebagai alat sokongan penulisan yang memerlukan kefahaman kritikal dan kerangka etika yang jelas, bukannya sebagai pengganti kepada usaha intelektual pelajar. Dengan menekankan kepentingan literasi AI, bimbingan pensyarah dan dasar institusi yang selari dengan matlamat pendidikan sarjana, artikel ini menegaskan bahawa masa depan penulisan akademik bukan terletak pada penolakan atau penerimaan mutlak teknologi AI, tetapi pada keupayaan komuniti akademik untuk mengintegrasikannya secara bertanggungjawab, bermakna dan berteraskan nilai keilmuan.

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KESAN PENGGUNAAN PERSONA MAYA TERHADAP PEMBENTUKAN IDENTITI REMAJA

Zuraida Manaam¹, Shawal Amran²

¹Fakulti Pendidikan, Universiti Kebangsaan Malaysia (UKM), Malaysia, (P144367@Siswa.Ukm.Edu.My)

Abstrak: Kajian ini dijalankan untuk meneliti kesan penggunaan persona maya terhadap pembentukan identiti remaja dalam era digital yang serba kompleks dan pantas berubah. Dalam landskap teknologi semasa, remaja bukan sahaja menjadi pengguna aktif media sosial, tetapi juga pencipta identiti digital melalui avatar, nama samaran dan profil dalam talian. Kajian ini menggunakan pendekatan Systematic Literature Review (SLR) berlandaskan model PRISMA dengan menganalisis 19 artikel ilmiah terpilih dari dalam dan luar negara yang diterbitkan antara tahun 2008 hingga 2024. Tiga dimensi utama yang dikenal pasti sebagai kerangka kajian ialah konsep sendiri, interaksi sosial dan kesejahteraan mental, yang dimana saling berkait dalam membentuk struktur identiti digital remaja. Dapatan menunjukkan bahawa penggunaan persona maya membolehkan remaja menjalani proses eksplorasi identiti dengan lebih fleksibel, selamat dan terkawal. Ia turut memberi ruang untuk mereka menampilkan versi diri yang lebih ideal, meningkatkan keyakinan diri dan meluaskan keupayaan komunikasi sosial. Namun begitu, dapatan juga mendedahkan kewujudan risiko seperti kekeliruan identiti, tekanan untuk menyesuaikan diri dengan norma sosial digital, serta ancaman kepada kestabilan emosi dan mental. Kajian ini turut menyoroti jurang ketara antara dapatan kajian luar negara dan tempatan, di mana konteks budaya tempatan seperti nilai agama dan norma masyarakat masih kurang diberi perhatian dalam kajian identiti digital. Secara keseluruhannya, kajian ini menegaskan bahawa persona maya memainkan peranan signifikan dalam proses pembentukan identiti remaja dan memberi implikasi besar terhadap kesejahteraan psikososial mereka. Kajian ini menyarankan agar sokongan strategik daripada ibu bapa, pendidik, pembuat dasar dan pembangun teknologi diberi penekanan dalam usaha membimbing remaja membina identiti digital yang sihat, autentik dan berdaya tahan. Seterusnya, penyelidikan kontekstual yang lebih mendalam diperlukan dalam kalangan masyarakat tempatan untuk memastikan dasar dan intervensi yang digubal adalah relevan dan berkesan.

Kata Kunci: Persona Maya, Identiti Remaja, Avatar, Media Sosial, Kesejahteraan Mental, Interaksi Sosial, SLR

Abstract: This study investigates the impact of virtual persona usage on adolescent identity formation in an increasingly complex and digitally-driven world. In today's technological landscape, adolescents are not only active users of social media but also creators of digital identities through avatars, pseudonyms, and online profiles. Using a Systematic Literature Review (SLR) guided by the PRISMA model, the study analyzes 19 selected scholarly articles published between 2008 and 2024, drawn from both local and international sources. The research is structured around three key dimensions: self-concept, social interaction, and



mental well-being, which collectively form a multidimensional framework for understanding identity construction in digital spaces. Findings reveal that virtual personas provide adolescents with a flexible and relatively safe environment for identity exploration. These digital representations often serve as idealized versions of the self, enhancing self-confidence, social connectedness, and communication skills. However, the study also uncovers associated risks, including identity confusion, pressure to conform to online social norms, and threats to emotional and psychological stability. Notably, the analysis highlights a significant gap between global and local studies, with limited research addressing cultural and societal values specific to the Malaysian context. Overall, the study emphasizes the influential role of virtual personas in shaping adolescent identity and underscores the psychosocial implications of their usage. It advocates for strategic support from parents, educators, policymakers, and digital platform developers to guide adolescents in developing authentic, resilient, and healthy digital identities. Moreover, future research rooted in local contexts is crucial to ensure that policies and interventions are both relevant and effective in addressing the realities of Malaysian youth.

Keywords: *Virtual Persona, Adolescent Identity, Avatar, Social media, Mental Well-Being, Social Interaction, SLR*

Pengenalan

Dalam era digital yang serba pantas, persona maya bukan sekadar identiti sementara, tetapi medium penting bagi remaja untuk mengekspresikan diri, mencuba pelbagai identiti dan mendapatkan penerimaan sosial secara dalam talian. Persona maya merangkumi avatar, nama samaran, imej profil, kandungan dikongsi, serta gaya komunikasi digital yang dipilih remaja, kadangkala lebih berani atau “sempurna” berbanding identiti sebenar (Avci, Baams & Kretschmer, 2024; Boyd, 2014). Fenomena ini memberi ruang penerokaan identiti alternatif, namun jurang antara persona maya dan identiti sebenar boleh menimbulkan tekanan psikologi, kebimbangan sosial dan konflik identiti (Michikyan et al., 2014; Marwick & Boyd, 2011).

Pembentukan persona maya berkait rapat dengan teori Erikson mengenai krisis identiti remaja dan Teori Pendekatan Marcia, di mana remaja melalui fasa eksplorasi (“moratorium”) sebelum mencapai identiti mantap. Faktor luaran seperti norma komuniti digital, tekanan rakan sebaya dan algoritma media sosial turut mempengaruhi pembentukan identiti digital mereka (Soh, 2023; Avci et al., 2024). Platform seperti Instagram, TikTok dan dunia metaverse menjadi medium ekspresi sendiri, tetapi tekanan untuk mengekalkan imej “sempurna” boleh menjejaskan kesejahteraan mental dan kestabilan emosi (Riva et al., 2016; Sinar Harian, 2023). Justeru, pemahaman terhadap persona maya amat penting kerana ia mempengaruhi konsep sendiri, interaksi sosial dan kesejahteraan mental remaja. Kajian ini menggunakan pendekatan Systematic Literature Review (SLR) berdasarkan model PRISMA untuk menganalisis artikel terkini, mengenal pasti pola, cabaran dan implikasi psikososial dalam penggunaan persona maya. Dapatan kajian diharapkan dapat membantu ibu bapa, pendidik dan pembuat dasar menyokong remaja membina identiti yang sihat, seimbang dan sesuai dengan realiti digital semasa.



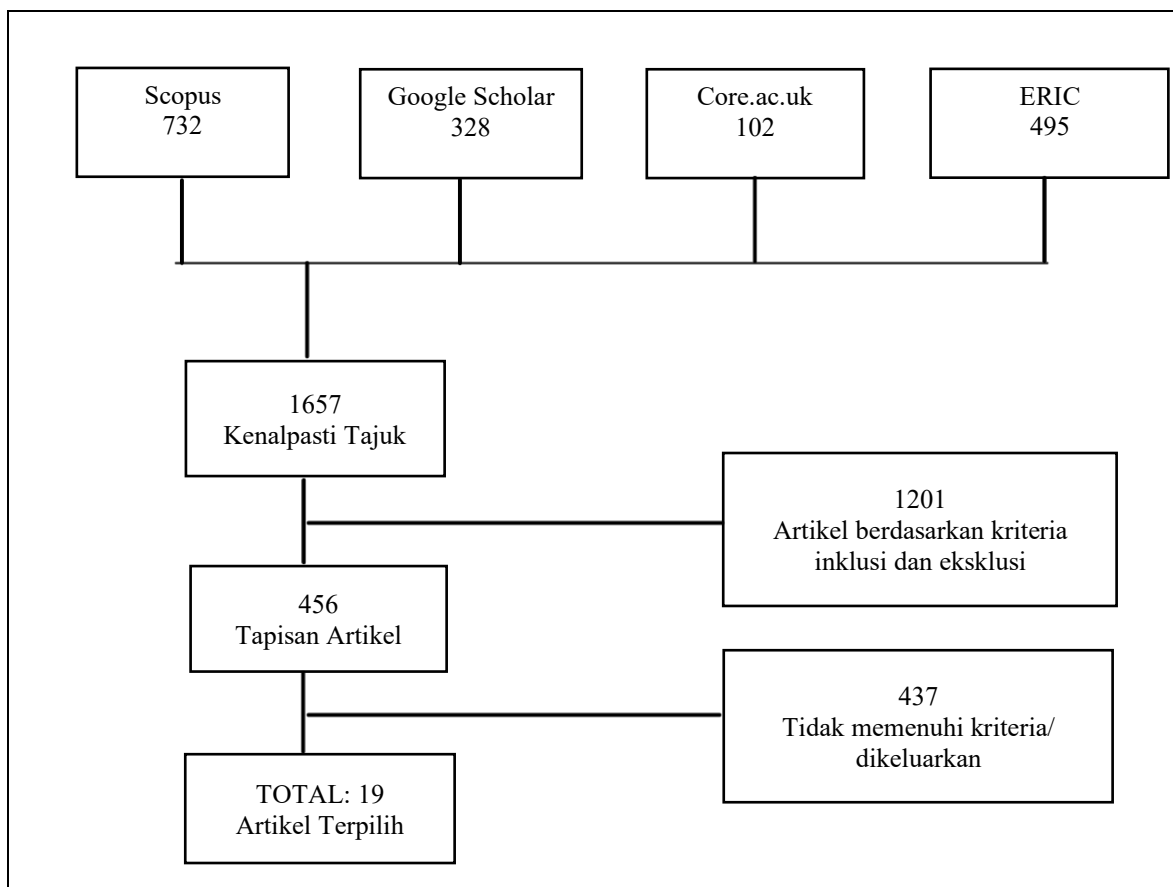
Sorotan Kajian

Sorotan kajian menunjukkan bahawa dunia digital kini bukan sekadar medium interaksi, tetapi turut memonopoli pembentukan identiti remaja. Remaja bukan pengguna pasif, sebaliknya aktif mencipta dan mengekspresikan identiti melalui persona maya seperti avatar, nama samaran dan profil media sosial (Avci et al., 2024). Persona maya membolehkan remaja meneroka pelbagai “versi diri” sebelum mencapai komitmen identiti yang stabil, selari dengan fasa eksplorasi dalam Teori Marcia (1966). Konsep “digital social mirror” memperlihatkan bagaimana maklum balas dalam talian mempengaruhi persepsi sendiri remaja, mempercepatkan penerokaan identiti tetapi juga meningkatkan tekanan sosial (Soh, 2023; 2024). Kajian terhadap ciptaan avatar dan ekspresi identiti gender menekankan persona maya sebagai medium untuk menzahirkan “ideal self” dan aspirasi peribadi (Kim, 2023; Dr. Jane Smith, 2012). Dalam konteks Malaysia, remaja menggunakan media sosial dan platform seperti Second Life untuk membina identiti ideal dan ruang eskapisme, walaupun tekanan untuk mengekalkan persona maya konsisten boleh menjejaskan kestabilan emosi (Siti Ezaleila & Azizah, 2014; Norhayati et al., 2021; MyMHI’23, 2023). Faktor individu seperti gaya identiti dan umur/jantina mempengaruhi cara remaja membina persona maya dan avatar mereka (Paleczna, 2023; Perini et al., 2016; Bassi et al., 2016; Taylor & Smith, 2024). Statistik digital tempatan menunjukkan kebergantungan tinggi terhadap media sosial, di mana 92.7% remaja pra-universiti adalah pengguna aktif, menjadikan platform digital sebahagian penting proses pembentukan identiti mereka (DataReportal, 2024; CommissionFactory, 2024). Persona maya bukan sekadar representasi sendiri, tetapi terbentuk melalui interaksi sosial dan pengaruh rakan digital (Yusof & Ariffin, 2023). Keseluruhannya, penggunaan persona maya adalah fenomena kompleks yang melibatkan dimensi psikologi, sosial dan budaya. Ia menawarkan ruang penerokaan identiti yang dinamik tetapi turut menimbulkan cabaran terhadap kestabilan emosi dan harga diri. Pemahaman mendalam terhadap fenomena ini penting untuk menyokong remaja membina identiti positif, produktif dan seimbang dalam dunia digital semasa.

Metodologi

Kajian ini menggunakan pendekatan Systematic Literature Review (SLR) berstruktur berdasarkan model PRISMA untuk memastikan pemilihan artikel dilakukan secara telus, sistematik dan berfokus kepada objektif kajian. Kaedah ini membolehkan penyelidik menilai, mensintesis dan mengenal pasti tema daripada kajian lepas berkaitan persona maya dan pembentukan identiti remaja. Pencarian literatur dijalankan dalam empat pangkalan data utama iaitu Scopus, Google Scholar, CORE.ac.uk dan ERIC, menggunakan kata kunci seperti “persona maya”, “identiti remaja”, “digital identity”, “social media”, “avatar” dan “identity formation” dengan logik Boolean “AND” dan “OR” bagi meningkatkan ketepatan hasil. Daripada 1657 artikel yang dikenalpasti, 1201 artikel dikeluarkan pada saringan awal kerana tidak relevan. Saringan seterusnya melalui tajuk, abstrak dan kandungan ringkas menyingkirkan 437 artikel, akhirnya 19 artikel terpilih untuk analisis akhir. Artikel dipilih berdasarkan kriteria inklusi: melibatkan remaja, membincangkan persona maya dan pembentukan identiti, diterbitkan antara 2008–2024, serta dalam jurnal diiktiraf atau akses terbuka. Setiap artikel dianalisis dari segi pengarang, tahun, lokasi kajian, metodologi, fokus

dan kesimpulan, kemudian dianalisis secara tematik kepada tiga dimensi utama: konsep sendiri, interaksi sosial, dan kesejahteraan mental. Pendekatan SLR ini menyediakan peta literatur yang komprehensif, mengenal pasti jurang penyelidikan, perbezaan konteks budaya, serta trend terkini, sekaligus menjadi rujukan kukuh untuk kajian masa hadapan.



Carian Artikel

Nama Pengarang, Tahun & Tajuk Artikel	Lokasi Kajian, Topik Umum & Metodologi	Kaitan Kajian, Fokus Kajian	Kesimpulan
Avci, H., Baams, L., & Kretschmer, T. (2024) <i>A Systematic Review of Social Media Use and Adolescent Identity Development</i>	Luar Negara Tinjauan sistematik media sosial dan identiti remaja. Kajian sistematik literatur.	Memberi gambaran menyeluruh tentang pengaruh media sosial dalam pembentukan identiti digital remaja. Menenalpasti kesan pelbagai jenis penggunaan media sosial terhadap identiti remaja.	Penggunaan aktif media sosial berkait rapat dengan fasa eksplorasi dan komitmen identiti; kesan berbeza mengikut jenis penggunaan.
Bassi, M., Delle Fave, A., Bartolucci, M., & LaFortuna, C. (2016)	Luar Negara	Menyokong kajian tentang bagaimana remaja membentuk identiti	Remaja menggunakan avatar untuk mengekspresikan identiti diri; perbezaan



<i>Exploration of Virtual Body-Representation in Adolescence: The Role of Age and Sex in Avatar Customization</i>	Representasi tubuh maya dalam kalangan remaja. Kajian kuantitatif, soal selidik dan analisis statistik.	melalui persona atau avatar maya. Meneliti pengaruh umur dan jantina terhadap penyesuaian avatar dalam kalangan remaja.	umur dan jantina memainkan peranan dalam pembentukan identiti maya.
Baysden, M.F., et al. (2021) <i>Teen Reactions to a Self-Representational Avatar: A Qualitative Study</i>	Luar Negara Reaksi remaja terhadap avatar yang mewakili diri sendiri. Kajian kualitatif; temu bual separa berstruktur dengan remaja.	Memberi perspektif mendalam tentang bagaimana remaja menanggapi penggunaan avatar sebagai cerminan identiti diri mereka. Persepsi dan emosi remaja terhadap avatar yang menyerupai mereka sendiri.	Remaja menunjukkan pelbagai reaksi seperti keterujaan, kekeliruan identiti dan keinginan untuk mengawal representasi diri melalui avatar.
Bittner, M.T. (2019) <i>The Use of Video Game Avatars to Explore Identity in Gifted Adolescents</i>	Luar Negara Eksplorasi identiti melalui avatar dalam permainan video. Kajian kualitatif; analisis tematik terhadap naratif remaja berbakat menggunakan avatar.	Menyokong kajian anda mengenai bagaimana remaja menggunakan avatar sebagai alat penerokaan dan pembentukan identiti. Penerokaan identiti dalam kalangan remaja berbakat melalui penglibatan dalam dunia maya dan avatar.	Remaja berbakat menggunakan avatar untuk mencuba peranan sosial, mencerminkan nilai diri dan memahami pelbagai aspek identiti mereka dalam persekitaran maya.
Blinka, L. (2008) <i>The Relationship Between Players and Their Avatars in MMORPGs: Differences Between Adolescents, Emerging Adults and Adults</i>	Luar Negara Hubungan antara pemain dan avatar. Kuantitatif - soal selidik ke atas pemain MMORPG	Memberi perspektif bagaimana remaja membentuk identiti digital berbanding golongan dewasa. Menilai perbezaan keterikatan avatar antara golongan umur.	Remaja menunjukkan keterikatan emosi yang lebih tinggi terhadap avatar berbanding dewasa.
Dr. Jane Smith (2012) <i>Exploring the Idealised Self: Avatars as a Vessel for Adolescent Identity Exploration</i>	Luar Negara Persona maya sebagai medium ideal self. Kualitatif - analisis naratif dan pemerhatian etnografi digital.	Relevan dengan pembentukan persona maya sebagai representasi identiti aspirasi. Menjelaskan bagaimana remaja membentuk avatar berdasarkan gambaran sendiri ideal.	Remaja sering menggunakan avatar untuk mencipta versi "lebih baik" diri mereka, mempengaruhi proses eksplorasi identiti.



Jennifer L. Cross. (2019) <i>The Use of Video Game Avatars to Explore Identity in Gifted Adolescents</i>	Luar Negara Eksplorasi identiti melalui avatar dalam permainan video. Kajian kualitatif; temubual dan analisis naratif terhadap remaja berbakat.	Memberi pandangan mendalam bagaimana remaja berbakat menggunakan avatar sebagai cara untuk membentuk dan meneroka identiti diri. Cara avatar digunakan sebagai alat eksperimen identiti oleh remaja berbakat.	Avatar menjadi ruang selamat bagi remaja berbakat untuk menguji nilai, peranan sosial dan aspek identiti tanpa risiko sosial dunia sebenar.
Kim, J. (2023) <i>Adolescent Female Users' Avatar Creation in Social Virtual Worlds</i>	Luar Negara Ciptaan avatar dalam kalangan remaja Perempuan. Kajian kualitatif - analisis temubual dan pemerhatian.	Menunjukkan bagaimana ekspresi diri dalam bentuk avatar berkait langsung dengan perkembangan identiti. Mengkaji motif dan proses remaja perempuan mencipta avatar dalam dunia sosial maya.	Avatar sering menggambarkan aspirasi dan perasaan sebenar; unsur tekanan sosial turut dikesan.
Nesi, J. et al. (2023) <i>A Systematic Review of Social Media Use and Adolescent Identity Development</i>	Luar Negara Media sosial dan perkembangan identiti remaja. Kajian sistematik literatur.	Memberi gambaran menyeluruh bagaimana media sosial pengaruhi fasa eksplorasi identiti. Rumusan dapatan empirikal berkaitan kesan media sosial terhadap identiti remaja.	Terdapat hubungan dua hala antara penggunaan media sosial dan pembentukan identiti.
Norhayati Mohd Yusof et al. (2021) <i>The Worldview of Malay Youths in the Virtual World of Second Life: The Real-World Escapism</i>	Dalam Negara Pelarian dari realiti dalam dunia maya. Kajian kualitatif - temu bual dengan belia Melayu.	Relevan dalam memahami motivasi remaja menggunakan persona maya untuk melarikan diri daripada realiti. Eksplorasi penggunaan Second Life sebagai ruang alternatif untuk ekspresi diri.	Penggunaan dunia maya sebagai cara untuk melepaskan tekanan dunia sebenar dan membina identiti baru.
Paleczna, M. (2023) <i>Adolescent Identity Styles and Avatar Perception: Examining the Link Between Identity Formation and Virtual Representation</i>	Luar Negara Hubungan antara gaya identiti remaja dan persepsi avatar. Kajian kuantitatif; soal selidik gaya identiti dan persepsi	Menyokong kajian tentang kaitan antara pembentukan identiti remaja dan cara mereka menyesuaikan diri dengan persona maya. Hubungan antara gaya identiti (informational, normative, diffuse-	Gaya identiti berpengaruh terhadap bagaimana remaja menilai dan menyesuaikan avatar mereka; remaja dengan gaya informational lebih reflektif dalam reka bentuk avatar.



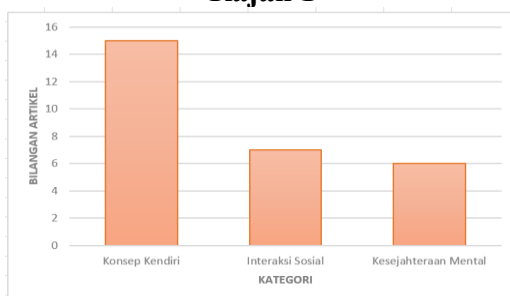
	avatar; analisis korelasi.	avoidant) dan persepsi terhadap avatar.	
Perini et al. (2016) <i>Exploration of Virtual Body-Representation in Adolescence: The Role of Age and Sex in Avatar Customization</i>	Luar Negara Persona maya dan perwakilan diri dalam kalangan remaja. Kuantitatif - soal selidik dan analisis statistik terhadap pilihan avatar dalam permainan.	Memberi pemahaman tentang bagaimana remaja menggunakan persona maya (avatar) untuk mewakili diri mereka dan kaitannya dengan pembentukan identiti. Meneliti pengaruh umur dan jantina terhadap penyesuaian avatar (virtual body representation) dalam kalangan remaja.	Remaja menyesuaikan avatar berdasarkan ideal diri dan jangkaan sosial. Selain itu, terdapat perbezaan berdasarkan umur dan jantina.
Siti Ezaleila & Azizah Hamzah (2014) <i>Constructing Online Identity Via Picture Sharing: Malaysian Youths' Experience with Social Networking Sites</i>	Dalam Negara Identiti dalam media sosial - konteks Malaysia. Kajian kualitatif - temubual dan analisis kandungan.	Memberi konteks tempatan terhadap pembentukan identiti dalam platform digital. Bagaimana remaja Malaysia membina identiti melalui perkongsian gambar.	Remaja menggunakan gambar untuk mewakili "ideal self" yang diinginkan dalam talian.
Soh, P. (2023) <i>A Digital Social Mirror for Identity Development During Adolescence</i>	Luar Negara Cerminan sosial digital dalam pembangunan identiti. Kajian konseptual dan meta-analisis.	Menyokong teori bahawa interaksi digital mempengaruhi pembentukan sendiri remaja. Konsep "digital mirror" sebagai sumber maklum balas identiti.	Identiti remaja terbentuk melalui maklum balas sosial di media digital yang bertindak sebagai "cermin".
Soh, P. (2024) <i>Identity Development in the Digital Context</i>	Luar Negara Perkembangan identiti dalam konteks digital. Kajian literatur dan analisis konseptual.	Memperkuatkan konsep bahawa perkembangan identiti remaja semakin dipengaruhi oleh interaksi dan ekspresi digital. Mengkaji proses perkembangan identiti dalam ruang digital dengan fokus pada cabaran dan peluang.	Perkembangan identiti digital adalah proses kompleks yang dipengaruhi oleh media sosial, persona maya dan interaksi dalam talian.
Taylor & Smith (2024) <i>Gender Exploration and Expression in Avatar</i>	Luar Negara Eksplorasi jantina dan ekspresi melalui	Membantu memahami peranan persona maya sebagai medium ekspresi	Pemain cenderung menggunakan avatar untuk bereksperimen dengan ekspresi

<i>Customization: A Study of Player Choices in Video Games</i>	penyesuaian avatar dalam permainan video. Kuantitatif - analisis data pilihan avatar oleh pemain dalam permainan video.	identiti jantina dalam kalangan remaja. Mengkaji bagaimana pemain mengekspresikan jantina dan identiti melalui pilihan avatar dalam permainan video.	jantina; variasi pilihan berkait dengan norma sosial dan identiti peribadi.
Vasalou, A. et al. (2022) <i>Self-Representation Through Avatars in Digital Environments</i>	Luar Negara Representasi sendiri melalui avatar. Gabungan kuantitatif & kualitatif.	Memberi kefahaman bagaimana avatar menjadi bentuk ekspresi diri maya. Kajian reka bentuk avatar sebagai cerminan identiti.	Avatar mencerminkan identiti sebenar atau ideal. Ia digunakan untuk bereksperimen dengan imej diri.
Villani, D. et al. (2012) <i>Am I My Avatar? A Tool to Investigate Virtual Body Image Representation in Adolescence</i>	Luar Negara Perwakilan imej tubuh maya dalam kalangan remaja. Kajian eksperimen.	Relevan dengan isu pembentukan identiti tubuh dalam kalangan pengguna remaja. Menilai kaitan antara imej tubuh dalam avatar dan imej tubuh sebenar.	Terdapat korelasi kuat antara imej avatar dan tahap kepuasan tubuh remaja.
Yusof & Ariffin (2023) <i>From Avatars to E-Personalities: Understanding the Social Dynamics and Identity Exploration in Virtual World Platforms among University Students</i>	Dalam Negara Dinamik sosial dan pembentukan identiti di platform dunia maya. Kajian kualitatif - temu bual separa berstruktur dengan pelajar universiti yang aktif di platform maya.	Membantu memahami aspek sosial dalam pembentukan persona maya yang relevan dengan remaja dalam konteks sosial digital. Mengetahui pasti bagaimana interaksi sosial dalam dunia maya mempengaruhi pembentukan identiti maya.	Persona maya bukan sahaja cerminan diri, tetapi juga dibentuk melalui interaksi sosial; peranan platform maya sangat penting.

Dapatan Kajian

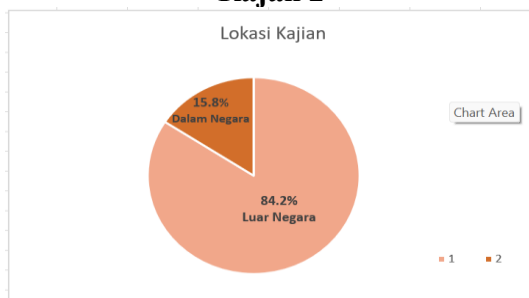
Dapatan gambar rajah dibawah akan menjelaskan kajian dengan lebih terperinci dan jelas. Gambar rajah 1 menjelaskan tiga komponen utama dalam kajian iaitu konsep sendiri, interaksi sosial dan kesejahteraan mental. Manakala gambar rajah 2 menerangkan dapatan kajian lokasi kajian yang diperolehi dan dianalisis daripada luar negara dan dalam negara. Seterusnya gambar rajah 3 iaitu tahun kajian akan merumuskan trend peningkatan perhatian terhadap isu persona maya dan identiti remaja sejak tahun 2021 hingga 2024.

Rajah 1



Dapatan menunjukkan bahawa konsep sendiri merupakan kategori paling banyak dikaji dengan 15 artikel, diikuti oleh interaksi sosial (8 artikel) dan kesejahteraan mental (7 artikel). Dapatan ini menunjukkan bahawa aspek pembentukan sendiri remaja mendapat perhatian paling besar dalam kalangan penyelidik, manakala aspek sosial dan kesejahteraan mental pula turut dikaji tetapi pada kadar yang lebih rendah. Ini mencerminkan keutamaan terhadap isu identiti remaja dalam era penggunaan persona maya.

Rajah 2



Daripada keseluruhan 19 artikel yang dianalisis dalam kajian ini, sebanyak 84.2% (16 artikel) merupakan kajian luar negara, manakala hanya 15.8% (3 artikel) berasal dari dalam negara. Perbezaan yang ketara ini menunjukkan bahawa isu berkaitan penggunaan persona maya dalam pembentukan identiti remaja lebih banyak diberi perhatian dalam konteks penyelidikan antarabangsa berbanding di Malaysia. Analisis ini memberikan beberapa implikasi yang penting untuk difahami dari aspek dan praktikal dan teknikal.

Rajah 3



Analisis terhadap tahun penerbitan 19 artikel yang dikaji dalam kajian ini menunjukkan bahawa terdapat trend peningkatan terhadap isu persona maya dan identiti remaja sejak tahun 2021 hingga 2024, dengan kemuncak tertinggi pada tahun 2023 yang mencatatkan 5 artikel. Pembahagian artikel adalah seperti berikut: 2008 (1), 2012 (2), 2014 (1), 2016 (2), 2019 (2), 2021 (2), 2022 (1), 2023 (5) dan 2024 (3). Analisis ini memberikan gambaran tentang perkembangan semasa isu ini serta tahap keaktifan penyelidikan dalam bidang berkaitan.

Perbincangan

Bahagian perbincangan menumpukan kepada kesan penggunaan persona maya terhadap pembentukan identiti remaja berdasarkan tiga dimensi utama iaitu konsep sendiri, interaksi sosial dan kesejahteraan mental. Persona maya menjadi medium utama bagi remaja mengekspresikan diri, berinteraksi dan menyesuaikan identiti dalam persekitaran digital yang fleksibel, kreatif dan selamat. Platform seperti media sosial, permainan dalam talian, avatar dan metaverse memberi ruang untuk eksplorasi identiti, termasuk identiti gender dan “ideal self”, sambil mempengaruhi cara remaja menangani tekanan emosi dan norma sosial maya (Avci et al., 2024; Soh, 2024; Taylor & Smith, 2024). Dalam dimensi konsep sendiri, penggunaan avatar membolehkan remaja meneroka aspek fizikal dan psikologi diri, dengan perbezaan mengikut umur dan jantina (Bassi et al., 2016; Paleczna, 2023). Ia membantu pemahaman sendiri dan fasa pencarian identiti, walaupun kajian masih tertumpu pada permainan video dan kurang merangkumi aplikasi sosial moden seperti TikTok atau Instagram. Bagi interaksi sosial, komunikasi maya melalui mesej, komen, perkongsian gambar dan avatar membentuk hubungan dan persepsi sosial, sejajar dengan Teori Perbandingan Sosial (Blinka, 2008; Kim, 2023; Siti Ezaleila & Azizah, 2014; Nesi et al., 2023). Ia membolehkan penerokaan identiti secara kolektif, tetapi terdapat cabaran membezakan hubungan membina dan toksik. Dimensi kesejahteraan mental menunjukkan bahawa tekanan mengekalkan persona maya ideal boleh menimbulkan kebimbangan, keresahan dan konflik antara “real self” dan “ideal self” (Baysden et al., 2021; Dr. Jane Smith, 2012; Avci et al., 2024; MyMHI’23, 2023). Kajian tempatan menekankan peranan budaya, nilai keluarga dan komuniti dalam pembentukan identiti digital remaja Malaysia (Siti Ezaleila & Azizah, 2014; Wan Sallha Yusoff et al., 2010; Norhayati et al., 2021). Analisis trend menunjukkan perkembangan pesat kajian selepas 2020, mengambil kira perubahan budaya digital pasca COVID-19, integrasi teori psikososial, interaksi maya dan kesejahteraan mental dengan platform terkini seperti TikTok, Roblox dan Instagram Reels (Avci et al., 2024; Soh, 2023 & 2024; Kim, 2023). Kajian awal sebelum 2014 lebih terhad kepada platform lama dan sampel kecil, dengan kurang fokus pada kesejahteraan mental, menjadikan kajian semasa lebih relevan dan komprehensif (Blinka, 2008; Michikyan



et al., 2014). Kesimpulannya, persona maya membentuk identiti remaja secara dinamik, kompleks dan pelbagai dimensi, di mana pengalaman digital mempengaruhi konsep sendiri, interaksi sosial dan kesejahteraan mental. Kajian ini memberi pemahaman yang lebih mendalam mengenai cabaran dan peluang dalam pembentukan identiti remaja dalam dunia digital semasa.

Cadangan

Berdasarkan dapatan kajian terdahulu, cadangan masa depan memberi tumpuan kepada tiga dimensi utama: konsep sendiri, interaksi sosial, dan kesejahteraan mental. Dalam dimensi konsep sendiri, remaja menggunakan persona maya untuk mengekspresikan “ideal self” melalui avatar dan identiti digital, tetapi jurang antara identiti maya dan sebenar boleh menimbulkan konflik dalaman (Bassi et al., 2016; Paleczna, 2023). Penyelidikan masa depan disarankan bersifat longitudinal untuk menilai kesan jangka panjang serta dimensi konflik identiti yang berkait dengan nilai budaya dan peribadi. Dalam interaksi sosial, persona maya membolehkan pembentukan hubungan maya dan penerokaan identiti melalui komunikasi dalam talian (Blinka, 2008; Nesi et al., 2023). Kajian masa depan wajar menilai kualiti hubungan sosial, keterikatan emosi dan empati, terutamanya bagi remaja berisiko tinggi, dengan menggunakan pendekatan gabungan (mixed method). Bagi kesejahteraan mental, penggunaan persona maya boleh meningkatkan keyakinan diri, namun tekanan untuk mengekalkan imej ideal boleh menyebabkan kebimbangan, keresahan dan gangguan emosi (Dr. Jane Smith, 2012; Baysden et al., 2021; Avci et al., 2024). Penyelidikan masa depan disarankan menilai aspek psikologi secara kuantitatif, termasuk kemurungan, tekanan sosial dan harga diri menggunakan instrumen seperti DASS-21 atau Skala Harga Diri Rosenberg. Dari segi lokasi kajian, ketidakseimbangan antara kajian luar negara (84.2%) dan tempatan (15.8%) menunjukkan keperluan kajian empirik dan kontekstual di Malaysia, melibatkan pelbagai etnik, latar geografi dan nilai budaya tempatan (Siti Ezaleila & Azizah, 2014; Norhayati et al., 2021). Dari perspektif tahun kajian, penyelidikan terkini (2021–2024) lebih responsif terhadap fenomena semasa seperti TikTok, avatar AI dan metaverse, justeru gabungan teori klasik (Erikson, Marcia) dengan konsep kontemporari (“digital mirror”, e-personality) serta penggunaan big data dan analitik digital wajar diterokai (Soh, 2023; Yusof & Ariffin, 2023). Kesimpulannya, kajian masa depan perlu holistik, kontekstual dan berasaskan realiti semasa, melibatkan pelbagai pihak dan metodologi tepat, untuk membantu remaja membina identiti yang positif, seimbang dan berdaya tahan dalam dunia digital.

Kesimpulan

Secara keseluruhannya, kajian ini menunjukkan bahawa penggunaan persona maya memainkan peranan penting dalam pembentukan identiti remaja masa kini, terutamanya melalui tiga dimensi utama: konsep sendiri, interaksi sosial, dan kesejahteraan mental. Persona maya membolehkan remaja mengeksplorasi “ideal self”, membina hubungan sosial dalam talian, dan mencari sokongan emosi, tetapi jurang antara identiti sebenar dan digital serta tekanan untuk menyesuaikan diri dengan norma maya boleh menimbulkan konflik dalaman, kebimbangan, dan keresahan (Bassi et al., 2016; Blinka, 2008; Avci et al., 2024). Analisis menunjukkan ketidakseimbangan lokasi kajian, dengan majoriti daripada luar negara,



menekankan keperluan penyelidikan tempatan yang mengambil kira budaya, agama dan nilai sosial Malaysia (Siti Ezaleila & Azizah, 2014; Norhayati et al., 2021). Kajian terkini (2021–2024) lebih responsif terhadap platform digital moden seperti TikTok, metaverse dan avatar AI, memberikan gambaran yang lebih relevan terhadap kehidupan remaja digital hari ini. Oleh itu, fenomena persona maya perlu difahami dengan serius oleh ibu bapa, pendidik, pembuat dasar dan pembangun teknologi bagi memastikan remaja dapat membina identiti yang seimbang, sihat dan berdaya tahan dalam dunia digital yang semakin kompleks.

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