



4th IVCoSEI 2025

2025

PROCEEDING

**4th International Virtual Conference on Social
Sciences, Education and Innovation 2025**



PROCEEDING

4TH INTERNATIONAL VIRTUAL CONFERENCE ON SOCIAL
SCIENCES, EDUCATION AND INNOVATION 2025



GLOBAL ACADEMIC EXCELLENCE (M) SDN BHD
2025

PROCEEDING

4TH INTERNATIONAL VIRTUAL CONFERENCE ON SOCIAL
SCIENCES, EDUCATION AND INNOVATION 2025



Copyright 2025

Global Academic Excellence (M) Sdn Bhd

No part of this publication may be reproduced in any form or by any means, whether electronically and/or mechanically including photocopying, recording or any means of storage of information and retrieval system, without the written consent of Global Academic Excellence (M) Sdn Bhd / Author.

e ISBN 978-967-2426-58-5



Published By:



GLOBAL ACADEMIC EXCELLENCE (M) SDN BHD - 201701043406 (1257579-U)
LOT 2-11 ARKED MARA KOTA BHARU, JALAN DATO' PATI, 15000 KOTA BHARU,
KELANTAN, MALAYSIA
Website: www.egax.org
Email: admin@egax.org

PREFACE

It is our great pleasure to present the proceedings of the 4th International Virtual Conference on Social Sciences, Education and Innovation 2025 (4th IVCoSEI 2025). This conference serves as a platform for scholars, researchers, educators, and innovators from across the globe to share their knowledge, ideas, and cutting-edge research in the intersecting fields of social sciences, education, and innovation.

The 2025 edition of the conference continues our commitment to fostering dialogue and collaboration in an increasingly digital world, where global challenges require interdisciplinary approaches and innovative solutions. The world is at a critical juncture, where education, technology, and social sciences are playing pivotal roles in shaping the future of societies. From addressing educational disparities and advancing new teaching methodologies, to exploring the socio-economic impact of technological innovations, the 4th IVCoSEI 2025 brings together an array of diverse perspectives aimed at pushing the boundaries of traditional disciplines. It is in this spirit of collaboration and interdisciplinary exchange that we invite participants to engage in discussions that are as intellectually enriching as they are practically relevant.

The proceedings of this conference reflect the diversity of thought and innovation that define our times. The range of papers and presentations cover topics that are not only of academic interest but also crucial to addressing the pressing issues facing education systems, social policies, and technological advancements today. We hope that these contributions inspire further inquiry, spark dialogue, and encourage the development of ideas that will make a meaningful impact in the years to come.

On behalf of the organizing committee, we would like to extend our heartfelt gratitude to the participants, reviewers, and everyone involved in making the 4th IVCoSEI 2025 a success. Lastly, we hope you find the proceedings informative, thought-provoking, and inspiring.

Sincerely,

Log. Dr. Ezanee Mohamed Elias

Conference Chair,

4th International Virtual Conference on Social Sciences, Education and Innovation 2025 (4th IVCoSEI 2025)

CONFERENCE COMMITTEE

Chairman	Log. Dr. Ezanee Mohamed Elias Universiti Utara Malaysia
Treasurer	Nurul Syazni Muhamad Global Academic Excellence, Malaysia
Technical Committee	Norhaslinda Mohd Kamil Global Academic Excellence, Malaysia
Technical Reviewer	Assoc. Prof. Dr. Azizi Abu Bakar Universiti Utara Malaysia Ts. Dr. Wan Azani Wan Mustafa Universiti Malaysia Perlis Dr. Norlila Mahidin Universiti Utara Malaysia Dr. Ani Asmaa Asli Universiti Teknologi MARA
Liaison Officer	Muhamad Firdaus Abdull Razab Global Academic Excellence, Malaysia



TABLE OF CONTENTS

1. A STUDY ON THE TEACHING AND LEARNING OF PROCUREMENT IN LOGISTICS USING INNOVATIVE E BOOK DPL50174.....	1
<i>Hazlin Jamari</i>	
2. GAME-BASED READING ACTIVITIES: IMPROVING STUDENTS' PHONEMIC AWARENESS THROUGH LETTER LADDER SLIDE, DOT-A-DOT, AND FLOWER COLLAGE.....	6
<i>Yuvimin Lumidao, Peter Paul Canuto, Paloma Pallaya, Jennifer Mario, Victory Waclin, Aloja Simpoda, Marites Choycawen, Deborah Lumecio</i>	
3. VOICE-ACCESSIBLE IOT HYDROPONIC MONITORING FOR THE VISUALLY IMPAIRED INDIVIDUAL	21
<i>Anding Nyuak, Nurzawani Mohamad Zani, Johari Ahmad Ghazali, Nazrina Bakar, Mohamad Sharin L Bari, Wu Jia Wang</i>	
4. INTEGRATION OF GARBOLOGY AND BIOMORPHIC: REPRESENTATION OF PLASTIC WASTE THROUGH NATURE-INSPIRED CREATIVITY IN VISUAL ARTS.....	36
<i>Abdullah Ehlid Al Walid Luli</i>	
5. COMPARATIVE LEGAL APPROACHES TO THE RIGHT TO DISCONNECT	44
<i>Harlida Abdul Wahab, Rohana Abdul Rahman, Siti Zubaidah Othman</i>	
6. CRITICAL SUCCESS FACTORS OF DIGITAL BUSINESS PERFORMANCE: THE MEDIATING ROLE OF DIGITAL COMPETENCIES	51
<i>Nurul Hidayana Mohd Noor, Amirah Mohamad Fuzi</i>	
7. E-WASTE RECYCLING BEHAVIOUR IN MALAYSIA: AN INTEGRATION OF THEORY OF PLANNED BEHAVIOUR	67
<i>Nur Batrisyia Nordin, Nurul Hidayana Mohd Noor, Mahazril 'Aini Yaacob</i>	
8. INNOVATING THE LEGAL AID SERVICES IN MALAYSIA USING AI-ENABLED SOLUTION	78
<i>Ani Munirah Mohamad, Mohd Amir Adeeb Abdul Rahim</i>	
9. CHATGPT-4o VS. DEEPSEEK-V3: A PROMPT-ENGINEERED COMPARATIVE ANALYSIS OF AI PERFORMANCE IN INTEGRATED MARKETING COMMUNICATION (IMC)	88
<i>Fahri Ahmed, Hasrina Mustafa</i>	
10. A COMPARATIVE REVIEW OF IONIC FRAMEWORK AS PROGRESSIVE WEB APPLICATION (PWA) FOR MOBILE APPLICATION DEVELOPMENT IN TVET	94
<i>Nuraiman Abd Rahman, Nuzul Ardzan Mokhtar, Muhammad Shafiq Abd Rahman</i>	
11. KAJIAN LEPAS BERKAITAN FILEM <i>BUYA HAMKA</i> BERDASARKAN TEORI TAKMILAH	102
<i>Wan Amirah Najihah Wan Amir Nudin, Mohd Adi Amzar Muhammad Nawawi</i>	
12. AUTHOR INDEX	112



A STUDY ON THE TEACHING AND LEARNING OF PROCUREMENT IN LOGISTICS USING INNOVATIVE E BOOK DPL50174

Hazlin Jamari¹

¹Jabatan Akademik, Politeknik METrO Johor Bahru (PMJB), Malaysia, (hazlin.jamari@pmjb.edu.my)

Abstract: *This paper aims to study the teaching and learning Procurement in Logistics for Diploma in Logistics and Supply Chain students using innovative e book. The researcher carried out action research in producing valid data and valuable insights for this study. This research paper presents a new method called e book DPL50174 that helps Diploma students to understand how the concept of procurement and supply chain in logistics works. This e book uses the course structure of MOHE syllabus DPL50174 Procurement in Logistics which covers seven theoretical topics of this course. The e book uses heyzine online flipbook. This e book was tested by a group of 63 Diploma in Logistics and Supply Chain students at Polytechnic Metro Johor Bahru who took the DPL50174 Procurement in Logistics course for the 2024/2025 session I. For the findings, it achieves more than 40% exceeding the target of the Academic Department, PMJB which is 40% passing marks. In addition, most students have a positive view of the e book.*

Keywords: *E Book DPL50174, Procurement, Innovative Teaching and Learning, Action Research*

Introduction

Teaching and learning process, as of today, is increasingly challenging. The implementation is now emphasis on easy to access and paperless teaching aids. It is becoming gaining attention. According to Chen, 2002, books are considered the most important tool used to transfer knowledge and access information and academic educational program since the invention of the printing machine. With the development of the means of electronic publishing, globalized information, and easy access via internet, e-book became the more advanced tool used to transfer knowledge.

Zucker, Moody and McKenna, 2009 in their study reported at the level of applied practice, e-books proved that they are attractive tools for many learners, because it can be easily integrated within educational programs, for literacy, which required lecturers to have a bit of procedural knowledge and practical skill to use computer.

According to Anuradha, K.T and Usha, 2006, e-book defined as “the container that has been transformed to digital form, and readable via personal computer or via a compacted disc or portable device designed to achieve this purpose, and usually it can be exchanged and set available on the internet and through its services”; e book is featured than printed media by adding multiple new specific features such as hypertext links, cross-references function and multimedia elements.



The Procurement in Logistics course is a field course for semester 5 students of the Diploma in Logistics and Supply Chain Management (DLS) at METrO Johor Bahru Polytechnic and requires students to achieve three course learning outcomes (CLO) namely:-

CLO 1P: Explain the logistics procurement process and procedures implemented by the organization

CLO 2P: Recognize the pricing determination and managing quality of procurement in logistics activities

CLO 3A: Respond on ethics and social responsibility toward procurement issues.

To achieve the three learning outcomes of this course, an innovative e book DPL50174 at METrO Johor Bahru Polytechnic was introduced titled Procurement in Logistics and Supply Chain.

E Book DPL50174

A. Background

This book entirely based on the Polytechnic MOHE syllabus for WBL Diploma in Logistics and Supply Chain. Procurement in Logistics provides knowledge and skills to meet the challenges of the procurement process. The objective of this book to provide source of information and knowledge especially for students who enrolled for DPL50174 Procurement in Logistics And Supply Chain who may require information for any topic relevant to them. Procurement strategic process consist activities on researching, negotiation and planning, this includes identifying a specific product or service requirement and the steps on how a business finds new or existing suppliers, builds supplier relationships and arranging payment, measures cost savings, minimizes risk and is pre-dominantly focused on value and return on investment. Through this book, lecturers can get the way students answer with the knowledge and skills they have to survive in the industry as well as know the understanding of the students answering the Procurement in Logistics and Supply Chain Management syllabus questions.

Therefore, this study was conducted to see the extent of the achievement of teaching and learning Procurement in Logistics by using the innovative e book that is e book DPL50174 at METrO Johor Bahru Polytechnic.

Literature Review

Teaching and learning methods for Procurement in Logistics courses are now showing a development. Several studies have been performed to examine the effectiveness of different types of e-learning and usage computer in education in acquisition and enhance student's skills and increase the effectiveness of their achievement capabilities. One of the methods is using e books in teaching and learning. Many studies proved that the effectiveness of using e books in learning process. Amari, MS. Shabl, ES. (2012), confirmed in their study that the effectiveness of using e books will increase the achievement of first-grade students of secondary school in theoretical course. Abdul Karim, SK. (2011), also confirmed the effectiveness of individual self-learning simulated by computer and e books in the development of creative thinking for science students at the Faculty of Education in Oman. Whereas Alzaq, ES. (2008), reported the effectiveness of diversity of interface e book interaction on academic achievement and skill performance for educational technology master students and their attitudes towards it.



In addition to Mubarez (2008) study that showed the effectiveness of e books in developing the skills of producing multimedia presentations for KG teachers. These results confirmed by Luo (2001) reported that positive effect of e books in the education field.

Research Methodology

The analysis of this study uses the PMJB ismp examination system. Evaluation data includes all evaluation requirements enshrined in the Procurement in Logistics course syllabus. Data were analyzed for the course implementation period which is from 14 August 2024 to 16 November 2024 using the PMJB ismp examination system. The number of respondents is a class for the 2024/2025 study session I, namely DLS Semester 5, PMJB's Diploma in Logistics and Supply Chain Management program, totaling 63 people.

Research Objective

The objective of this study was to see what the achievements were students to;

CLO 1: Explain the logistics procurement process and procedures implemented by the organization

CLO 2: Recognize the pricing determination and managing quality of procurement in logistics activities

CLO 3: Respond on ethics and social responsibility toward procurement issues. after using the practical e book DPL50174.

To achieve the three learning outcomes of this course, an innovative e book DPL50174 at METrO Johor Bahru Polytechnic was introduced titled Procurement in Logistics and Supply Chain.

Research Methodology

The analysis of this study uses the PMJB ismp examination system. Evaluation data includes all evaluation requirements enshrined in the Procurement in Logistics course syllabus. Data were analyzed for the course implementation period which is from 14 August 2024 to 16 November 2024 using the PMJB ismp examination system. The number of respondents is a class for the 2024/2025 study session I, namely DLS Semester 5, PMJB's Diploma in Logistics and Supply Chain Management program, totaling 63 people.

Findings and Conclusion

The results of the study found that the average achievement of CLO learning outcomes 1, 2, and 3 courses is more than 40%. The achievement of CLO 1 is 71%. CLO 2 is 89.5% and CLO 3 is 45%. The highest achievement is CLO 2 which is 89.5%. Students' skills to recognize the pricing determination and managing quality of procurement in logistics activities.

Table 1: The Achievement of Course Learning Outcome (CLO)

CLO		Group Attainment (%)	Passing Marks (%)
1	Explain the logistics procurement process and procedures implemented by the organization	77	40
2	Recognize the pricing determination and managing quality of procurement in logistics activities	89.5	40
3	Respond on ethics and social responsibility toward procurement issues.	45	40

Source: CQI Report WBL Procurement in Logistics Course, DLS, 2025

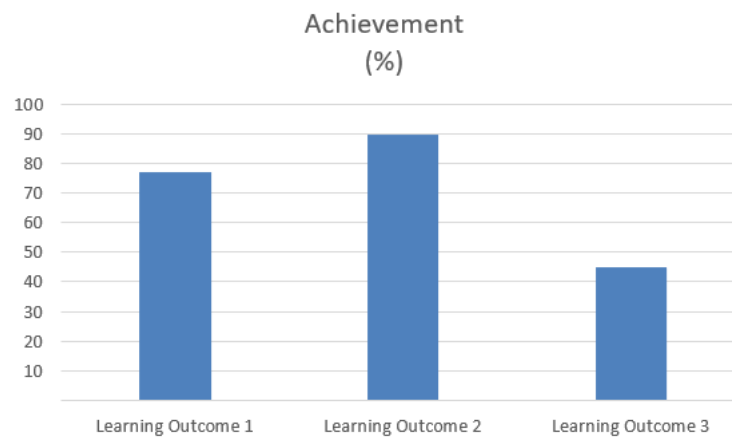


Figure 1: CLO Achievement for WBL Procurement in Logistics

Teaching and learning based on creative and effective teaching methods and techniques through the use of learning aids, innovative able to stimulate students to learn. Lecturers who are positive will accept change as a challenge in their profession. Lecturers are dynamic, efficient and always strive to advance teaching and learning in the classroom by designing teaching techniques and producing interesting teaching aids. Teaching methods should be varied according to the needs of students who have different levels of knowledge to facilitate students to understand the teaching. After the survey is conducted, this innovative e book or teaching and learning help students who have learning difficulties, it can also be used as a strengthening and enrichment activity for students who have mastered a certain knowledge. It also helps students 'skills in group activities, injects student motivation and lecturer -student interaction.

Acknowledgement

High appreciation to the Management of PMJB, Curriculum Division of the Department of Polytechnic Education and Community College Malaysia for the strong support given to complete the survey on the curriculum at PMJB.

References

- Abdul Karim, SK. (2011) "The effectiveness of individual self-learning computer simulated and electronic book in the development of innovative thinking among Science students in second year, Faculty of Education, Sultanate of Oman (experimental study)", *Journal of the Faculty of Education, University of Assiut*, 27(2).
- Almekhlafi, A. G. (2021). The effect of e-books on preservice student teachers' achievement and perceptions in the united arab emirates. *Educ. Inf. Technol.* 26, 1001–1021. doi: 10.1007/s10639-020-10298-x
- Alzaq, ES. (2008) "the effect of differing interaction interface in the e book on cognitive achievement and skills performance among students of educational technology master and attitudes towards it", *Journal of psychiatric and educational research faculty of Education, Menoufia University – Egypt*, 23(2), 104-141.
- Amari, MS. Shabl, ES. (2012) "the effectiveness of using e book in the reading course on academic achievement among students in the secondary first grade", *Reading and knowledge Magazine, Egypt*, 133, 42-88.
- Anuradha, K.T. & Usha, H.S. (2006) "Use of e-books in an academic and research environment: A case study from the Indian institute of science program, *Electronic Library and Information Systems* 40(1):48-62.
- Chen, Y. (2002) "Application and development of electronic books in an e -Gutenberg Age", *Online Information Review* 27, 1-16.
- Erkayhan, S., and Ulke, Y. B. (2017). Digitalization of the book publishing industry. A study on the e-book publishing in Turkey. *Online Commun. Media Technol.* 7, 61–78. doi: 10.29333/ojcm/2610
- Gardiner, Eileen and Ronald G. Musto. "The Electronic Book." In Suarez, Michael Felix, and H. R. Woudhuysen. *The Oxford Companion to the Book*. Archived September 12, 2019, at the Wayback Machine Oxford: Oxford University Press, 2010, p. 164.
- Karakoç Öztürk, B. (2021). *Digital Reading and the Concept of Ebook: Metaphorical Analysis of Preservice Teachers' Perceptions Regarding the Concept of Ebook*. Adana: Sage Open.
- Luo Y-Z, Xiao Y-M, Ma Y-Y and Li C (2021) Discussion of Students' E-book Reading Intention with the Integration of Theory of Planned Behavior and Technology Acceptance Model. *Front. Psychol.* 12:752188. doi: 10.3389/fpsyg.2021.752188
- Mubarez, MA. (2008) "The effectiveness of an e book in the development of the production of multimedia presentations skills for kindergarten teachers", *Egypt, Education Technology Conference and the Arab child's education* 370-402.
- Susantini, E., Puspitawati, R.P., and Suaidah, H. L. (2021). e-book of metacognitive learning strategies: design and implementation to activate student's self-regulation. *Res. Prac. Technol. Enhanced Learn* 16:13 doi: 10.1186/s41039-021-00161-z
- Zucker, T.A., Moody, A.K., & McKenna, M.C. (2009) "The effects of electronic books on pre-kindergarteno-grade 5 students' literacy and language outcomes: A research synthesis: *Journal of Educational Computing Research* 40(1), 47-87.

GAME-BASED READING ACTIVITIES: IMPROVING STUDENTS' PHONEMIC AWARENESS THROUGH LETTER LADDER SLIDE, DOT-A-DOT, AND FLOWER COLLAGE

Yuvimin Lumidao¹
Peter Paul Canuto²
Paloma Pallaya³
Jennifer Mario⁴
Victory Waclin⁵
Aloja Simpoda⁶
Marites Choycawen⁷
Deborah Lumecio⁸

¹College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsuyuvimin@gmail.com)

²College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsupeterpaul@gmail.com)

³College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsupaloma@gmail.com)

⁴College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsujennifer@gmail.com)

⁵College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsuvictory@gmail.com)

⁶College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsualoja@gmail.com)

⁷College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsumentor2018@gmail.com)

⁸College of Education, Ifugao State University - Tinoc Campus, Philippines, (ifsudebbie1025@gmail.com)

Abstract: *Effective reading activities at the elementary level enhance students' reading skills. In relation, strong phonemic awareness leads to better reading literacy, fostering a solid framework for long-term academic success in reading. Relative to game-based learning (GBL), this study assessed the effectiveness of the proposed and implemented educational games as reading interventions, specifically, game-based reading activities (GBRAs) developed by the authors. Three GBRAs, namely, Letter Ladder Slide, Dot-a-Dot, and Flower Collage, were designed, developed, and implemented to enhance students' phonemic awareness and reading performances. It also aimed to determine students' reading performance levels and the significant differences before and after the implementation of the GBRAs. The study involved 14 Grade 3 students of Impugong Elementary School (IES), Tinoc, Ifugao, Philippines. They were initially assessed to have reading frustration levels using the Philippine Informal Reading Inventory (Phil-IRI) for English. The study used action research employing the three GBRAs as innovative interventions. Pre-and post-test evaluation data were used to analyze the results quantitatively. Results indicated that students' phonemic awareness and reading performances improved after consecutively implementing the GBRAs. Most students advanced to independent and instructional reading levels. There was a significant difference between students' reading performance levels before and after implementing the GBRAs. It highly suggests that these educational reading game activities effectively enhanced students' phonemic awareness and addressed their reading frustration levels. These results underscore the significance of targeted reading activities and interventions, demonstrating their pivotal role in enhancing students' academic growth and reading literacy.*

Keywords: *Game-Based Reading Activity (GBRA), Game-Based Learning (GBL), Phonemic Awareness, Reading Activity, Reading Intervention, Action Research, Ifugao, Philippines*



Introduction

Reading is a vital skill for learning and throughout life. It is essential for success as it is used from the start of attending formal education and continues throughout a lifetime (Erdem, 2015), making it the backbone of most learning experiences. Reading skills are significant as they facilitate students' learning in various areas. It is one of a child's most essential skills to develop and nurture at school (Schwanenflugel et al., 2006) and at home (Sonnenschein & Munsterman, 2002). It is one of the critical skills a student should familiarize themselves with, as it contributes to everyone's academic success, making it a prerequisite in all learning areas. The more individuals read, the more things they will learn; the more individuals learn, the more places they will visit. Indeed, the importance of reading skills cannot be stressed enough; reading helps people develop intellectually, socially, and emotionally, cultivating a deeper understanding of their environment.

Phonemic awareness is one of the factors affecting students' reading development. It involves recognizing and manipulating individual sounds, or phonemes, in spoken words (Windingstad, 2011). It involves understanding that words are made up of smaller sound units and being able to isolate, blend, segment, and substitute these sounds. It is a critical skill in early reading development as it helps children connect sounds with letters and understand how sounds form words (Carruth & Bustos, 2019), thus a powerful tool in reading. Phonological awareness instruction aims to build children's capacity to hear and manipulate sounds in spoken words. Students who can manipulate phonemes in words are more likely to be successful at decoding and spelling, as phonemic awareness predicts later reading success (Rice et al., 2022; Rice et al., 2024). Hence, phonological skills are strongly related to early reading and writing development.

In the rapidly evolving educational landscape, academic interventions supporting student learning are crucial to address diverse academic needs and ensure students' success. Competent teachers should provide relevant interventions (Canuto, Choycawen et al., 2024), adapt teaching methods, employ differentiated instruction, and continuously monitor progress to ensure effective and responsive interventions (Libiado & Canuto, 2023). Clearly, appropriate reading interventions are crucial to support students who struggle with literacy, as these provide targeted strategies to improve foundational reading skills (Donegan & Wanzek, 2021; Wanzek et al., 2010). Early and effective reading interventions help prevent long-term academic difficulties by addressing gaps in knowledge before these widen. Reading interventions ensure that students achieve grade-level reading and language proficiency by offering additional practice, explicit instruction, and feedback.

The present technological revolution era is an intensely stimulating period where students are besieged with information from various platforms (Canuto, 2023). With this, teachers look for ways to motivate students to engage in reading activities and enrich their experiences while developing skills essential to thrive in the modern age (Capodieci et al., 2020). Teachers incessantly adopt relevant reading interventions to provide targeted support to students struggling with reading. This creates an inclusive learning environment where all students can succeed regardless of their reading starting point. One pedagogical technique that piqued the interest of many educators is the use of games in learning, commonly called game-based learning or GBL (Ketelhut & Schifter, 2011; Plass et al., 2015).



Integrating educational games in the classroom has become easier and more meaningful through GBL. It offers a more engaging and motivating alternative to the traditional learning environment (Klimova, 2015). Reading teachers can use these affordances to develop specific reading skills. GBL can help develop students' phonemic awareness, vocabulary, reading interest, and, eventually, reading skills. The engaging nature of educational games improves students' participation and reading interests (Klimova, 2015; Liu et al., 2021).

Proposal and Implementation of Game-based Reading Activity

Most teachers worldwide adopt technology-related approaches to teaching reading, but some prefer conventional, physical, innovative, and authentic pedagogies to cater to their students' reading needs. Some teachers use self-developed, written, and physical reading materials due to a lack of technological infrastructure. Others continue to use non-digital materials to teach reading since they value the slower, more deliberate pace that paper-based materials encourage, which can be essential for literacy and critical thinking. Non-digital tools also allow for more personalized and interactive teaching, such as one-on-one reading sessions, which can be challenging to replicate with digital devices. It must also be noted that not all students have access to digital devices or the internet, making physical materials a reliable and inclusive option for ensuring equitable learning experiences (Canuto, Pagdawan et al., 2024; Choycawen et al., 2024; Fabillar et al., 2024). Further, physical reading materials help foster a tactile, hands-on approach that strengthens cognitive processes.

For these reasons, the authors proposed the development of a *game-based reading activity* or *GBRA*. The authors describe GBRA as “an interactive learning strategy that uses games to engage students in practicing essential reading skills and development.” These activities may incorporate modeling, collaboration, problem-solving, and healthy competition, motivating students to participate while actively reinforcing their reading development. The construct of GBRA is based on the characteristics of GBL, although the former is more focused on reading. The authors do not intend to deviate or change GBL's characteristics; instead, they simply want to propose GBRA to directly pertain to using relevant educational games to support and contribute to students' reading skills development.

Due to the lack of digital infrastructure in the locality, the authors self-developed GBRA that used non-digital, physical reading materials. The GBRA proposed and implemented in the study include *Letter Ladder Slide*, *Dot-a-Dot*, and *Flower Collage*, serving as reading interventions. These reading interventions were targeted to help build students' confidence, enhance reading skills, develop critical thinking skills, prevent frustration, and promote independence in reading.

Research Aims and Questions

The study aimed to determine the effectiveness of the three proposed, developed, and implemented GBRA, Letter Ladder Slide, Dot-a-Dot, and Flower Collage, as reading interventions in improving the English reading performance of elementary students with reading frustration levels. The study also aimed to determine the significant differences in students' reading performance before and after the GBRA interventions. The specific research questions include:



1. What are the students' academic reading performances before and after the GBRA interventions are implemented?
2. Is there a significant difference in students' academic reading performance before and after the GBRA interventions are implemented?
3. Do the proposed and implemented Letter Ladder Slide, Dot-a-Dot, and Flower Collage GBRA effectively enhance students' reading performances?

Literature Review

Educational Theories Supporting Game-based Reading Activity

Modeling is a crucial instructional strategy in education, which, when combined with GBRA, can significantly enhance students' learning. It involves the teacher or a peer demonstrating a particular skill or process (Schutz & Rainey, 2019) to guide students in understanding how to approach tasks, solve problems, or make decisions. In reading, modeling typically means demonstrating how to approach reading strategies (Loh, 2009; Rexhepi, 2021), such as phonemic awareness. Using GBRA creates a dynamic and interactive environment, allowing students to observe, practice, and refine their reading skills. The teacher can model the game's rules and demonstrate how to use reading strategies for the students.

Constructivism is another theory supporting the use of educational games in reading (Griffin & Richard, 2023), underpinning the idea that students build knowledge through active engagement and interaction with their environment. The use of GBRA aligns well with this theory since it provides opportunities for students to engage with content actively and hands-on rather than passively receiving information. Constructivism and using educational games in reading are closely linked because both promote active, hands-on learning, scaffolded support, problem-solving, collaboration, and reflection. Educational games offer an immersive environment where students are encouraged to engage deeply with reading content, build on prior knowledge, and collaborate with peers or their teachers, all while experiencing reading as a meaningful, socially interactive, and enjoyable activity. By incorporating GBRA, a constructivist classroom can be created, fostering curiosity, critical thinking, and a deeper understanding of language and reading.

Social learning theory also supports the utilization of GBRA. It emphasizes the role of social interaction in learning, as observation, imitation, and modeling play a significant role in acquiring new skills (Bandura, 1977; Schunk & DiBenedetto, 2023). Accordingly, learning occurs through social interaction and observation of others rather than purely direct instruction. This theory is highly relevant when integrating GBRA into the classroom because educational reading games provide a naturally interactive and collaborative environment where students can observe, engage with, and learn from their peers, teachers, and the games to develop their reading skills. Through this social interaction, students can observe and learn from others, receiving guidance or support to enhance their understanding. This collaboration can help reinforce reading skills and build confidence, especially for students needing additional support.

Integration of Games in English Classes

Recently, there has been a growing interest in using educational games to develop specific skills and improve students' engagement. Klimova (2015) noted this and presented the



favorable benefits of using games in the classroom. Gozcu and Caganaga (2016) revealed that games create a fun and satisfying environment that heightens students' motivation for learning English. Regardless, von Gillern and Alaswad (2016) emphasized that digital and non-digital games help promote engagement and learning. When used appropriately, educational games can provide teachers and students advantages. That said, teachers should choose appropriate educational games to teach students reading based on their interests.

Jolly Phonics has been widely used to enhance children's early reading and literacy skills. It is a fun, systematic activity for young or beginner students to develop reading and literacy skills (Ariati et al., 2018; Lloyd, 1998). It incorporates a multisensory approach, delivering information through sight, sound, and kinesthetic means, suitable for young students' characteristics (Jolly Learning, 2025). Farokhbakht and Nejadansari (2015) disclosed that students taught through Jolly Phonics perform better in English reading, spelling, and literacy than those who were conventionally taught.

Derakhshan and Khatir (2015) suggested the relevance of using games to engage students in their vocabulary and communication. Hashemi (2021) divulged that educational games were compelling in teaching vocabulary and reading comprehension. They furthered that educational games improved students' vocabulary knowledge, were more fun and appealing, and were helpful in teaching. Darvenkumar and Devi (2022) found that text-based games were feasible in English language classrooms for deepening critical reading, comprehension, and critical thinking. Ostovar-Namaghi et al. (2024) determined that interactive games affected students' reading comprehension in English as a Foreign Language (EFL) class. They further cited that interactive games improve students' learning outcomes, motivation, and engagement.

Reading Performances in the Philippines and the Locality

Students' reading skills and academic performance are highly recognized in the Philippines. Sadly, many students are at the frustration level and, thus, can only recognize and decode words without comprehension. As accentuated, comprehending written texts is vital to growth and progress; hence, the deteriorating reading proficiency of students in the country has become a significant concern of the Philippine educational system, especially with the consistently unsatisfactory Programme for International Student Assessment (PISA) results. The 2022 PISA results showed that the Philippines ranked among the lowest in reading performance. Among 79 participating countries, the Philippines ranked last in reading comprehension (Organization for Economic Co-operation and Development [OECD], 2023). It reiterated the 2018 PISA results, showing that the Philippines lagged globally in reading.

In response to students' poor reading performances, the Department of Education (DepEd) recognized the need to make every student a proficient reader. All schools nationwide are tasked to develop students' reading skills (DepEd, 2024). Reading interventions must be planned and implemented to address students' reading issues. In a local school, Canuto, Lumidao et al. (2024) observed that students had average English reading fluency. Most of the students were found to be at risk of reading difficulties, with reading skills below their grade level.

In the selected school where the study was conducted, the result of the Philippine Informal Reading Inventory (Phil-IRI) in English, a standardized assessment tool mandated by DepEd



(2018), revealed that most Grade 3 students were categorized under the reading frustration level at the beginning of the academic year 2023 – 2024. Belonging to the reading frustration levels, these students struggled to grasp the essential reading skills necessary for academic success and overall literacy development. They refused to read and/or had a short reading tolerance. According to their class adviser, the major problem these students had was phonemic awareness, which greatly affected their sound production. In light of this concern, this study aimed to enhance the reading performance of Grade 3 students with reading frustration levels using three GBRA interventions: Letter Ladder Slide, Dot-a-Dot, and Flower Collage.

Methodology

Research Design

The study used classroom action research. This method is used to support and help teachers address problems that occur in the teaching-learning environment and pursue effective pedagogy (Mertler, 2021). It includes methodical observation and data collection that can be used to reflect, choose, modify, and create better teaching-learning practices (Clark et al., 2020). Specifically, the present undertaking employed practical action research to solve specific problems through four stages: planning, acting, developing, and reflecting (Mertler, 2021). For quantitative analysis, the study utilized the pre-and post-test design, providing a fast and practical means of assessing a group undergoing an intervention (Stratton, 2019).

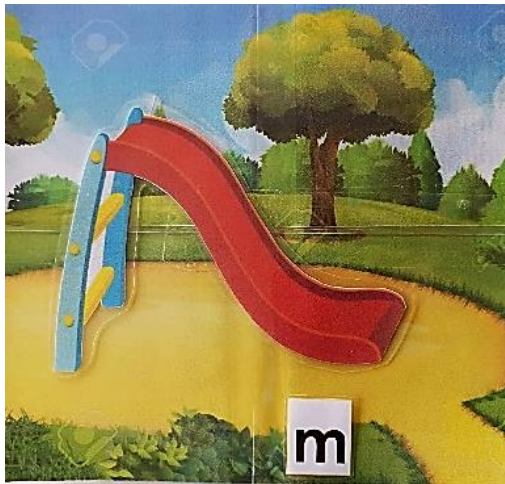
Participants

The participants involved 14 Grade 3 students in a class section at Impugong Elementary School (IES), Impugong, Tinoc, Ifugao, Philippines. The study was conducted from March to May 2024. The students were purposely selected as suggested by their Class Adviser based on their phonemic awareness issues and reading frustration levels evaluated at the beginning of the academic year using the Phil-IRI for English. Working with this small group using GBRA interventions allowed for a more targeted and intensive approach. This made it possible for the authors to offer focused attention and support. This was advantageous because it required careful monitoring and tailored adjustments to meet the specific needs of each student. It also provided more flexibility, enabling the authors to modify the interventions based on real-time feedback from the students.

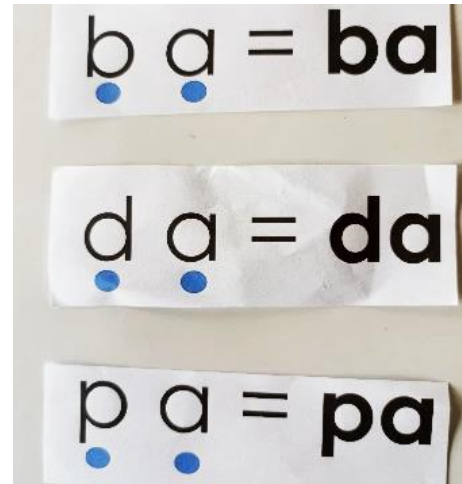
Instrumentation: Letter Ladder Slide, Dot-a-Dot, and Flower Collage Game-Based Reading Activities

The essentiality of using appropriate reading interventions and activities among elementary students, particularly those at the frustration level, cannot be overstated. The present endeavor utilized three GBRA to enhance students' reading capabilities. To foster a more inclusive and respectful learning environment, the authors made sure that the GBRA conform to appropriate reading materials (DepEd, 2018, 2024), quality education (Ifugao State University [IFSU], 2025), and gender sensitivity (Bando, 2024; Canuto & Espique, 2023; Lumidao, Bando et al., 2024; Lumidao, Espique et al. 2024).

In implementing the GBRA, the 'I, We, and You' strategy was used. The authors did each activity first, then performed it with the student participants, and finally, the latter performed the task independently. The physical materials used in each GBRA are presented in Figure 1.



a. Letter Ladder Slide



b. Dot-a-Dot



c. Flower Collage

Figure 1: The GBRA Physical Reading Materials Developed and Used by the Authors

Letter Ladder Slide. It was used to enhance students' recall and mastery in producing letter sounds. The authors introduced the game, explaining its mechanics to the students, and showed them an image of the slide with a ladder against a beautiful background (Figure 1.a). The authors presented a box containing the 26 letters of the English alphabet. The authors selected a letter from the box and slid it up. While moving the letter, the authors produced its sound. As the letter was continuously moved up, the students were asked to join the authors in producing the letter's sound. Afterward, the authors slid the letter down and asked the students to produce its sound. This process was repeated several times to ensure mastery.

Dot-a-Dot. It was employed to recall and master the blending of consonant-vowel (CV) sounds. Two letters printed on A4-sized cardboard with large dots beneath each letter were shown to the students (Figure 1.b). For example, with the CV pair "b – a," the authors pointed to the dot under the first letter, "b," and produced its sound, then slid the pointer to the dot under the next letter, "a," while producing its sound. The authors then returned to the first letter and asked the students to produce the sound with them, moving the pointer to the next letter while still producing the sound with the students. This process was repeated several times, gradually



increasing the speed to blend the CV sounds. Finally, the authors had the students blend the CV sounds independently, repeating the activity several times to ensure mastery.

Flower Collage. Similar to the Dot-a-Dot, the Flower Collage was used as a strategy for the mastery of CV sounds in a faster manner. An image of a flower was divided into two parts, each containing a letter (Figure 1.c). For example, the first half of the flower had the consonant "d," while the second half had the vowel "i." The authors showed the first half of the flower with the consonant letter and produced its sound. The students were then asked to join in producing the consonant sound. After that, the students were asked to produce the consonant sound independently. The same procedure was followed to produce the vowel sound in the second half of the flower. Once the flower was wholly joined, the CV sounds were blended faster, first by the authors, then with the students, and finally, by the students alone.

Procedures

The study's conduct followed the four stages of action research. First, the planning stage involved determining the students' reading scores and levels. Since the students were evaluated beforehand, the initial scores were solicited from their Class Adviser, serving as the pre-test data. This stage was used to determine students' reading strengths and weaknesses regarding phonemic awareness. It also involved making the action plan, including designing the reading interventions. Second, the authors proposed, self-developed, designed, and implemented the three GBRA in the acting stage. The implementation of the GBRA began with Letter Ladder Slide, followed by Dot-a-Dot and Flower Collage. This allowed for increasing complexity of reading recall and mastery. Feedback and monitoring were done to determine students' progress. The GBRA interventions were conducted during students' class breaks for about 20 – 30 minutes per session. The GBRA were scheduled accordingly and done individually with the students. In some cases, it was also done in pairs for student-peer collaborations.

The third stage involved the post-test using the same reading assessment tool used in the pre-test. This was to determine students' reading progress before and after the implementation of GBRA. The authors facilitated and conducted the post-test assessment following the Phil-IRI guidelines and principles of assessments. Finally, during the reflecting stage, the assessment results were used as feedback to evaluate the effectiveness of the GBRA interventions. It also involved modifying the reading materials used in the GBRA for future use. The study concluded with data presentations and discussions.

Before conducting the study, a letter seeking permission was given to the School Head of the participating school and the students' Class Adviser. Upon approval, the authors sought informed consent from students' parents or guardians regarding their child or wards' involvement in this study. The parents and guardians were also informed of the study's aims and procedure, the students' anonymity, confidentiality, and benefits, and their right to withdraw their permission without sanctions.

Data Analysis and Management

The pre-test scores were requested from the students' Class Adviser. In the post-test, the authors personally checked and scored the students' reading performances using the Phil-IRI English assessment for word recognition. The names of the students were presented in codes S1 – S14.

Means and percentages were used to determine the students' word recognition and to describe their academic reading performances. A t-test determined the significant difference between students' pre-test and post-test scores. The English Phil-IRI formula determined the students' word recognition performance scores.

$$\text{Word recognition} = \frac{\text{Number of miscued words}}{\text{Total number of words in the passage}} \times 100$$

The results were compared using the Phil-IRI criteria, shown in Table 1, specifying the different levels of each student along with word recognition.

Table 1: Phil-IRI English Word Recognition Performance Scores and Levels

<u>Word Recognition Performance Scores</u>	<u>Reading Levels</u>
97% – 100%	Independent
90% - 96%	Instructional
89% and below	Frustration

In the independent level, students can read and recognize the letters immediately without guidance, while in the independent level, students need lesser guidance and lesser time to recognize letters. At the frustration level, students refuse to read and/or have a short reading tolerance.

Results and Discussions

Table 2 indicates the students' academic reading performance before and after implementing the GBRAs. Before the intervention, the students were assessed to be at the frustration level. After integrating the GBRAs, students' overall performance progressed to the instructional level.

Table 2. Word Reading Performances of the Students Before and After Implementing the GBRA

Students	Pre-test			Post-test		
	Word Reading Score	Word Reading Score (in %)	Levels	Word Reading Score	Word Reading Score (in %)	Levels
1	25	50	Frustration	46	92	Instructional
2	27	54	Frustration	46	92	Instructional
3	30	60	Frustration	47	94	Instructional
4	31	62	Frustration	47	94	Instructional
5	22	44	Frustration	48	96	Instructional
6	24	48	Frustration	44	88	Frustration
7	24	48	Frustration	40	80	Frustration
8	32	64	Frustration	46	92	Instructional
9	25	50	Frustration	49	98	Independent
10	26	52	Frustration	50	100	Independent
11	27	54	Frustration	50	100	Independent
12	23	46	Frustration	44	88	Frustration
13	21	42	Frustration	48	96	Instructional
14	29	58	Frustration	50	100	Independent
Mean	26.14	52.29	Frustration	46.79	93.57	Instructional

The results show that four students, S9, S10, S11, and S14, advanced to the independent levels. Seven students, S1, S2, S3, S4, S5, S8, and S13, achieved instructional levels. The remaining three students, S6, S7, and S12, remained at the frustration level. However, it must be noted that even if the three students were still at frustration levels, their word reading scores increased impressively after the implementation of GBRA.

The overall positive progress denotes that the students have improved from frustration levels to independent and instructional levels in their reading performance and phonemic awareness after implementing the GBRA. They showed an improved reading of CV words. They can now recognize sounds and combine letters to make different words, thus emphasizing the importance of phonemic awareness in enhancing the reading capabilities of elementary students. This supports the importance of developing students' phonemic awareness, underscored by Carruth and Bustos (2019), Rice et al. (2022), and Rice et al. (2024).

The results in Table 3 indicate a significant difference between students' academic reading performances before and after the GBRA interventions. Students' academic reading performance is significantly higher after implementing Letter Ladder Slide, Dot-a-Dot, and Flower Collage.

Table 3. Comparison between Word Reading Performances of the Students Before and After Implementing the GBRA Interventions

Tests	<i>M</i>	<i>SD</i>	<i>N</i>	<i>df</i>	<i>t</i> -value	<i>p</i> -value
Pre-test	52.29	45.45	14	13	-19.633*	.001
Post-test	93.57	31.49	14			

Note: * = significant ($p < .05$); ns = not significant ($p > .05$)

This suggests that the proposed, self-developed, and implemented GBRAs effectively improved students' reading skills regarding word recognition in the frustration levels. This accords with the strengthening of students' reading literacy and language proficiency affected by educational games' engagement and motivation, as disclosed by Derakhshan and Khatir (2015), Farokhbakht and Nejadansari (2015), Gozcu and Caganaga (2016), Hashemi (2021), Darvenkumar and Devi (2022), and Ostovar-Namaghi et al. (2024). The results parallel the DepEd's (2018, 2024) aims to support students' reading development in the country. It reflects that effective reading interventions are crucial in developing elementary students' reading skills.

The Letter Ladder Slide, Dot-a-Dot, and Flower Collage GBRAs were designed to enhance and strengthen students' phonemic awareness. The students received focused attention to bridge gaps in their learning, build confidence, and enhance their reading abilities. Upon developing phonemic awareness, they became more confident and capable readers, which may positively impact their academic success. This could significantly improve students' academic performance and foster a love for reading.

The students' overall improved reading performance reflects the effectiveness of the GBRA interventions and students' growing ability to engage with texts, setting a foundation for lifelong learning and intellectual curiosity. Even though the GBRAs used non-digital, physical materials, crucially, these interventions were designed to remediate weaknesses and build on students' strengths, making reading accessible and enjoyable for the students. Early and consistent interventions ensure that struggling readers catch up with their peers, preventing long-term academic setbacks, and fostering a positive attitude toward reading.

Conclusion, Implications, and Limitations

Targeted reading interventions are vital for elementary students' academic success and cognitive development. This study developed and implemented three Game-Based Reading Activities (GBRAs), Letter Ladder Slide, Dot-a-Dot, and Flower Collage, to enhance phonemic awareness of students in the frustration level. After implementing the GBRAs, there was a significant improvement in students' reading performance. Most students achieved independent and instructional reading levels in word recognition, while those who remained in the frustration level showed increased word recognition scores.

The students' improved reading performances imply that the GBRA interventions effectively enhanced their phonemic awareness and addressed their reading needs, promoting reading skills development. These results demonstrate that tailored Game-Based Reading Activities (GBRAs) significantly improved students' reading performance, boosted confidence, and fostered a deeper enjoyment of reading. This outcome suggests the significance of early



intervention to help students meet grade-level expectations, paving the way for long-term reading literacy success.

Despite the progressive results, this study has limitations, including a small sample size focused on students with reading frustration levels, without considering those in other reading levels. The results are then restricted to the study's participants due to the small sample size and focus on specific reading levels. Further, it must be noted that the study utilized non-digital, physical reading materials due to technological limitations. Nonetheless, the proposed, self-developed, and implemented GBRA demonstrate potential for reading skills development, encouraging further research and adoption.

Acknowledgement

The authors are grateful to the Grade 3 students, their Class Adviser, and the School Head of IES for their participation and support in the conduct of the study.

Authors' Contributions

All authors contributed to the literature review writing, planning, implementing the research, and review-editing. All authors contributed to the data collection and analysis. All authors have read and approved the published on the article's final version.

Conflict of Interests

The authors declare no conflict of interests.

References

- Ariati, N. P. P., Padmadewi, N. N., & Suarnajaya, I. W. (2018). Jolly Phonics: Effective strategy for enhancing children English literacy. *SHS Web of Conferences*, 42, 00032. <https://doi.org/10.1051/shsconf/20184200032>
- Bando, D., Lumidao, Y., & Canuto, P. P. (2024). Campus voices: University students' awareness of gender-based violence against women, girls, and children. *Pakistan Journal of Life and Social Sciences*, 22(2), 590–604. <https://doi.org/10.57239/pjlss-2024-22.2.0043>
- Bandura, A. (1977). *Social learning theory*. Prentice-Hall.
- Canuto, P. P. (2023). Perceptions of primary pre-service teachers in the utilization of plant identification apps as educational tools. *Journal of Baltic Science Education*, 22(5), 799–812. <https://doi.org/10.33225/jbse/23.22.799>
- Canuto, P. P., Choycawen, M., & Pagdawan, R. (2024). The influence of teaching competencies on teachers' performance and students' academic achievement in primary science education. *Problems of Education in the 21st Century*, 82(1), 29–47. <https://doi.org/10.33225/pec/24.82.29>
- Canuto, P. P., & Espique, F. (2023). Gender equality in science classrooms: Examining the implementation of gender-responsive approach and its impact on science education. *International Journal of Learning, Teaching and Educational Research*, 22(6), 659–678. <https://doi.org/10.26803/ijlter.22.6.33>



- Canuto, P. P., Lumidao, Y., Ballagan, A., Calya-en, P. Jr., Laoyan, R. K., & Oplas, A. (2024). Enhancing elementary students' oral reading fluency through repeated reading and Big Books. *International Journal of Learning, Teaching and Educational Research*, 23(4), 376–393. <https://doi.org/10.26803/ijlter.23.4.20>
- Canuto, P. P., Pagdawan, R., Choycawen, M., Lumecio, D., & Dupais, N. (2024). Pre-service teachers' experiences in developing and using science comics as educational materials for elementary science education. *Pakistan Journal of Life and Social Sciences*, 22(2), 7165-7187. <https://doi.org/10.57239/pjlss-2024-22.2.00542>
- Capodiecici, A., Cornoldi, C., Doerr, E., Bertolo, L., & Carretti, B. (2020). The use of new technologies for improving reading comprehension. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.00751>
- Carruth, L., & Bustos, C. (2019). Phonemic awareness: It's all in the sounds of language. *Texas Association for Literacy Education Yearbook*, 6, 55-58. <https://files.eric.ed.gov/fulltext/EJ1291358.pdf>
- Choycawen, M., Pagdawan, R., & Canuto, P. P. (2024). Unveiling the benefits and challenges of using printed modules during pandemic: Examining university teachers' experiences in a higher education institution. *Pakistan Journal of Life and Social Sciences*, 22(2), 14595–14621. <https://doi.org/10.57239/PJLSS-2024-22.2.001051>
- Clark, J. S., Porath, S., Thiele, J., & Jobe, M. (2020). Action research. *NPP eBooks*. 34. <https://newprairiepress.org/ebooks/34>
- Darvenkumar, T., & Devi, V. A. (2022). Text-based game — A tool to enhance critical reading and critical thinking skills in English classrooms. *Theory and Practice in Language Studies*, 12(11), 2298–2306. <https://doi.org/10.17507/tpls.1211.09>
- Department of Education. (2018). *DO 14, s. 2018 – Policy Guidelines on the Administration of the Revised Philippine Informal Reading Inventory*. <https://www.deped.gov.ph/2018/03/26/do-14-s-2018-policy-guidelines-on-the-administration-of-the-revised-philippine-informal-reading-inventory/>
- Department of Education. (2024). *DepEd Memorandum No. 001, s. 2024. Implementation Of Catch-Up Fridays*. <https://www.deped.gov.ph/2024/01/10/january-10-2024-dm-001-s-2024-implementation-of-catch-up-fridays/>
- Derakhshan, A., & Khatir, E. D. (2015). The effects of using games on English vocabulary learning. *Journal of Applied Linguistics and Language Research*, 2(3), 39-47. http://www.jallr.com/index.php/JALLR/article/download/40/pdf_38
- Donegan, R. E., & Wanzek, J. (2021). Effects of reading interventions implemented for upper elementary struggling readers: A look at recent research. *Reading and writing*, 34(8), 1943–1977. <https://doi.org/10.1007/s11145-021-10123-y>
- Erdem, A. (2015). A research on reading habits of university students: (Sample of Ankara University and Erciyes University). *Procedia - Social and Behavioral Sciences*, 174, 3983–3990. <https://doi.org/10.1016/j.sbspro.2015.01.1145>
- Fabillar, R., Ummas, J., Pateyec, J., Domingo, M. G., Canuto, P. P., Choycawen, M., Pagdawan, R., & Lumidao, Y. (2024). Science comics as educational materials and its impact on elementary students' science academic performance. *Pakistan Journal of Life and Social Sciences*, 22(1), 6176–6188. <https://doi.org/10.57239/pjlss-2024-22.1.00456>
- Farokhbakht, L., & Nejadansari, D. (2015). The effect of using synthetic multisensory phonics in teaching literacy on EFL young learners' literacy learning. *International Journal of Research Studies in Education*, 4(4). <https://doi.org/10.5861/ijrse.2015.1196>
- Jolly Learning. (2025). *Jolly Phonics, Jolly Grammar - A programme that grows with your children*. <https://www.jollylearning.co.uk/jolly-phonics/>

- Hashemi, A. (2021). The effects of using games on teaching vocabulary in reading comprehension: A case of gifted students. *Journal for the Education of Gifted Young Scientists*, 9(2), 151–160. <http://dx.doi.org/10.17478/jegys.846480>
- Ifugao State University. (2025). *Vision, Mission, Goals, and Objectives*. <https://rb.gy/id8ji8>
- Gozcu, E., & Caganaga, C. K. (2016). The importance of using games in EFL classrooms. *Cypriot Journal of Educational Sciences*, 11(3), 126. <https://doi.org/10.18844/cjes.v11i3.625>
- Griffin, L. L., & Richard, J. F. (2023). Games based approach as a constructivist model of games teaching. In *Teaching games and sport for understanding* (pp. 87–97). Routledge.
- Ketelhut, D. J., & Schifter, C. C. (2011). Teachers and game-based learning: Improving understanding of how to increase efficacy of adoption. *Computers & Education*, 56(2), 539–546. <https://doi.org/10.1016/j.compedu.2010.10.002>
- Klimova, B. F. (2015). Games in the teaching of English. *Procedia – Social and Behavioral Sciences*, 191, 1157–1160. <https://doi.org/10.1016/j.sbspro.2015.04.312>
- Libiado, F. D., & Canuto, P. P. L. (2023). Examining the teaching competencies and their relation to the mathematics performance of primary school students. *International Journal of Multidisciplinary: Applied Business and Education Research*, 4(7), 2401–2419. <https://doi.org/10.11594/ijmaber.04.07.22>
- Liu, F., Vadivel, B., Rezvani, E., & Namaziandost, E. (2021). Using games to promote English as a foreign language learners' willingness to communicate: Potential effects and teachers' attitude in focus. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.762447>
- Lloyd, S. (1998). *The Phonics Handbook (3rd ed.)*. Jolly Learning Ltd., England
- Loh, J. K. K. (2009). Teacher modeling: Its impact on an extensive reading program. *Reading in a Foreign Language*, 21(2). <https://files.eric.ed.gov/fulltext/EJ859582.pdf>
- Lumidao, Y., Bando, D., & Canuto, P. P. (2024). Assessing the gender-based violence awareness of university employees. *Pakistan Journal of Life and Social Sciences*, 22(1), 5142–5155. <https://doi.org/10.57239/pjlss-2024-22.1.00378>
- Lumidao, Y., Espique, F., & Canuto, P. P. (2024). Gender-responsive pedagogy of Kalanguya MTB-MLE teachers in promoting gender role awareness. *Pakistan Journal of Life and Social Sciences*, 22(2), 4110–4126. <https://doi.org/10.57239/pjlss-2024-22.2.00304>
- Mertler, C. A. (2021). Action research as teacher inquiry: A viable strategy for resolving problems of practice. *Practical Assessment, Research & Evaluation*, 26(19). <https://files.eric.ed.gov/fulltext/EJ1314304.pdf>
- Organization for Economic Co-operation and Development. (2023). *PISA 2022 Results: Factsheets – Philippines*. https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/philippines_a0882a2d-en.html
- Ostovar-Namaghi, S. A., Morady Moghaddam, M., & Rad, E. (2024). The effect of interactive games on English language learners' reading comprehension and attitudes. *Asia Pacific Education Review*, 25(2), 399–409. <https://doi.org/10.1007/s12564-023-09883-9>
- Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. *Educational Psychologist*, 50(4), 258–283. <https://doi.org/10.1080/00461520.2015.1122533>
- Rexhepi, B. (2021). Modelling as an instructional strategy in language teaching process. *Jurnal Pendas Mahakam*, 6(1), 8–16. <https://files.eric.ed.gov/fulltext/EJ859582.pdf>
- Rice, M., Erbeli, F., Thompson, C. G., Sallese, M. R., & Fogarty, M. (2022). Phonemic awareness: A meta-analysis for planning effective instruction. *Reading Research Quarterly*, 57(4), 1259–1289. <https://doi.org/10.1002/rrq.473>



- Rice, M., Erbeli, F., & Wijekumar, K. (2024). Phonemic awareness: Evidence-based instruction for students in need of intervention. *Intervention in School and Clinic*, 59(4), 269-273. <https://doi.org/10.1177/10534512231156881>
- Schutz, K. M., & Rainey, E. C. (2019). Making sense of modeling in elementary literacy instruction. *The Reading Teacher*, 73(4), 443–451. <https://doi.org/10.1002/trtr.1863>
- Schunk, D. H., & DiBenedetto, M. K. (2023). Albert Bandura's legacy in education. *Theory Into Practice*, 62(3), 205–206. <https://doi.org/10.1080/00405841.2023.2226560>
- Schwanenflugel, P. J., Meisinger, E. B., Wisenbaker, J. M., Kuhn, M. R., Strauss, G. P., & Morris, R. D. (2006). Becoming a fluent and automatic reader in the early elementary school years. *Reading Research Quarterly*, 41(4), 496–522. <https://doi.org/10.1598/rrq.41.4.4>
- Sonnenschein, S., & Munsterman, K. (2002). The influence of home-based reading interactions on 5-year-olds' reading motivations and early literacy development. *Early Childhood Research Quarterly*, 17(3), 318–337. [https://doi.org/10.1016/s0885-2006\(02\)00167-9](https://doi.org/10.1016/s0885-2006(02)00167-9)
- Stratton, S. J. (2019). Quasi-experimental design (pre-test and post-test studies) in prehospital and disaster research. *Prehospital and Disaster Medicine*, 34(6), 573–574. <https://doi.org/10.1017/S1049023X19005053>
- von Gillern, S., & Alaswad, Z. (2016). Games and game-based learning in instructional design. *The International Journal of Technologies in Learning*, 23(4), 1–7. <https://doi.org/10.18848/2327-0144/cgp/v23i04/1-7>
- Wanzek, J., Wexler, J., Vaughn, S., & Ciullo, S. (2010). Reading interventions for struggling readers in the upper elementary grades: A synthesis of 20 years of research. *Reading and writing*, 23(8), 889–912. <https://doi.org/10.1007/s11145-009-9179-5>
- Windingstad, S. (2011). Phonemic awareness. In: Goldstein, S., Naglieri, J. A. (Eds) *Encyclopedia of Child Behavior and Development*. Springer, Boston, MA. https://doi.org/10.1007/978-0-387-79061-9_2140

VOICE-ACCESSIBLE IOT HYDROPONIC MONITORING FOR THE VISUALLY IMPAIRED INDIVIDUAL

Anding Nyuak¹
Nurzawani Mohamad Zani²
Johari Ahmad Ghazali³
Nazrina Bakar⁴
Mohamad Sharin L Bari⁵
Wu Jia Wang⁶

¹JTMK, Politeknik Kuching Sarawak, Malaysia, (andingnyuak@poliku.edu.my)

²JTMK, Politeknik Kuching Sarawak, Malaysia, (zawanizani@poliku.edu.my)

³JTMK, Politeknik Kuching Sarawak, Malaysia, (johari@poliku.edu.my)

⁴JTMK, Politeknik Kuching Sarawak, Malaysia, (nazrina@poliku.edu.my)

⁵JTMK, Politeknik Kuching Sarawak, Malaysia, (mohamadshahrin@poliku.edu.my)

⁶JKM, Politeknik Kuching Sarawak, Malaysia, (jhwu@poliku.edu.my)

Abstract: *This paper presents the development of a voice-accessible IoT hydroponic monitoring system, specifically designed for individuals with visual impairments. The integration of sustainable hydroponics with IoT technologies provides an inclusive and empowering experience. The system's hardware comprises ESP32 microcontrollers that collect data and manage devices, in addition to water levels and TDS sensors that assess critical parameters such as water availability and nutrient concentrations. Environmental sensors monitor temperature and humidity, facilitating accurate climate regulation, while automatic water pumps manage irrigation, promoting optimum plant development with little operator intervention. The system employs a website for real-time data reporting for blind individuals. This allows blind users to remotely get essential agricultural data and acquire clear insights into their system's operation. By supplementing critical information with audio assistance via voice-assistive technology, an accessible web interface enhances monitoring. The voice-activated interface enables users to monitor essential factors like water levels, fertilizer concentrations, temperature, humidity, and plant development stages via straightforward audio instructions. The Sarawak Branch of the Society of the Blind, Malaysia, in collaboration with Politeknik Kuching, funded this project. Sarawak's Information Technology and Communication Department has initiated a project to create a hydroponic system that connects to the Internet of Things (IoT). This effort not only incorporates technology breakthroughs but also empowers blind persons by providing essential skills, promoting autonomy, and generating sustainable revenue prospects. It underscores the significance of teamwork in fostering community-oriented ideas. By using IoT and voice-accessible technologies, the initiative eliminates obstacles, fosters social inclusion, and illustrates the transformative potential of technology in agriculture and other sectors.*

Keywords: *IoT, Visually Impaired, ESP32, Hydroponic, Voice Assistive*

Introduction

Creating opportunities for persons with disabilities through innovative and inclusive technology is a significant step toward building a more equitable society. Recognizing this, the



Sarawak Branch of the Society of the Blind, Malaysia, in collaboration with Politeknik Kuching Sarawak's Information Technology and Communication Department, has launched a hydroponic farming project powered by the Internet of Things (IoT). This initiative is designed to empower visually impaired individuals by equipping them with new skills and greater independence in managing hydroponic farming. With RM10,000 in funding, the project aims to develop a fully accessible and efficient hydroponic system, making modern soilless farming more inclusive. Hydroponics is especially beneficial for urban and small-space agriculture, and by integrating IoT technology, the system can offer real-time monitoring, automated nutrient management, and climate control. These advancements significantly reduce manual labor, making hydroponic farming more manageable for individuals with visual impairments while optimizing productivity. This collaboration between Politeknik Kuching Sarawak and the Society of the Blind Malaysia highlights the power of teamwork in driving meaningful change. Beyond just providing technological solutions, this initiative builds confidence, fosters independence, and creates sustainable income opportunities for visually impaired individuals. More than just a farming system, it's a step toward inclusivity, proving how technology can remove barriers, promote social participation, and drive economic empowerment for underprivileged communities. Through IoT-powered agriculture, this project exemplifies how innovation can transform lives and make the world a more accessible place for everyone.

Literature Review

Urban agriculture (UA) is increasingly recognized as a key solution to sustainability challenges in urban environments. According to Yuan et al. (2022), UA offers significant socio-environmental benefits, including enhanced food security, improved public health, disaster risk mitigation, and strengthened urban resilience. However, economic barriers limit its widespread adoption. To address these challenges, advanced technologies such as vertical farming and plant biotechnology can enhance UA's feasibility and efficiency. The authors highlight the importance of adaptive policies that integrate UA into urban planning and align with sustainable development goals (SDGs). By merging technology with agriculture, UA has the potential to create inclusive food systems that serve diverse urban populations.

Building on this integration of technology in agriculture, aquaponics presents an innovative approach that combines aquaculture and hydroponics. Goddek et al. (2019) examine the environmental, economic, and technical advancements that make aquaponics a viable solution for global food security challenges. Innovations such as decoupled systems, advanced nutrient cycling, and energy-efficient designs have improved its efficiency and scalability. The study emphasizes the need for interdisciplinary strategies to address high startup costs and regulatory hurdles, reinforcing the role of technology in enhancing resource efficiency and reducing environmental impact. While aquaponics has primarily been explored for sustainable food production, similar technological advancements can be applied to hydroponics to improve accessibility for individuals with disabilities.

Hydroponics, a controlled-environment agricultural method, has been investigated as an accessible and automated solution for individuals with impairments. Juneja et al. (2023) developed an automated hydroponic system using Arduino microcontrollers and Tinkercad software, enabling automated temperature regulation and fertilizer delivery. This system enhances accessibility for visually impaired individuals by reducing the need for manual labor and thereby promoting sustainability and inclusivity. The integration of hydroponics with



the Internet of Things (IoT) demonstrates its potential to empower marginalized communities while addressing urban resilience and food security concerns. Further emphasizing the role of inclusive agricultural systems, Akter (2022) examines how accessible gardens impact the well-being and social integration of individuals with spinal cord injuries. The study highlights the significance of inclusive designs—such as elevated beds and wheelchair-accessible pathways—in fostering psychological and physical well-being. These findings align with the broader goal of creating tailored agricultural solutions to meet the needs of people with disabilities, providing valuable insights into designing accessible hydroponic farming systems. Similarly, Saarani et al. (2024) explore hydroponics as a low-effort agricultural method that accommodates persons with disabilities. Their research underscores the therapeutic, educational, and economic benefits of hydroponic farming, demonstrating how automated equipment and practical training can enhance food security, independence, and meaningful participation for individuals with disabilities. The study further supports the integration of IoT with hydroponics to overcome physical barriers, particularly for visually impaired individuals, thereby making agriculture more inclusive and accessible. Expanding on this theme of inclusion, Billah et al. (2022) introduce the concept of "Inclusive Villages" in Indonesia, where communities empower persons with disabilities through skills training and inclusive employment opportunities. The study highlights the role of community-driven initiatives and legislative support in fostering independence and economic self-sufficiency through agricultural activities. These results support the idea that hydroponic and IoT-based solutions can be scaled up at the community level. They are in line with larger efforts to include inclusive practices in farming systems. At a policy level, Fundación ONCE and the ILO (2023) explore the intersection of disability and sustainable development, advocating for inclusive employment within the green economy. Their research identifies agriculture as a key sector for creating green jobs for persons with disabilities, aligning with the SDGs. Using the Internet of Things (IoT) and hydroponics as tools to help people who are blind or have low vision is similar to ideas that have already been put forward for incorporating technology and inclusive design into farming. This makes the case for sustainable and accessible food production systems even stronger.

The impact of community-based agricultural initiatives is further illustrated by the Perlis Special Teens Centre (PeSTeC) in Malaysia. Abdullah et al. (2023) evaluate how PeSTeC empowers individuals with learning impairments through organized training programs that involve families, communities, and stakeholders. By integrating agriculture, food production, and craft-making, PeSTeC promotes social and economic independence. A thematic analysis of qualitative case studies and in-depth interviews shows that these kinds of programs are very important for removing social and cultural barriers that keep disabled people from participating. These findings reinforce the importance of community-led approaches in fostering inclusion and independence through agriculture. From a global perspective, Oba (2023) compares Japan's Noufuku Renkei project with similar social agricultural programs in the U.S., the Netherlands, and Italy. While social farming has proven to be an effective means of addressing labor shortages and promoting inclusivity, implementation challenges persist due to financial constraints, limited government support, and a shortage of experienced specialists. The study calls for stronger legislation, specialized training, and increased collaboration to enhance the effectiveness and scalability of inclusive agricultural programs.

Collectively, these studies underscore the transformative potential of integrating hydroponic gardening with IoT to empower visually impaired individuals and other marginalized groups.



Inclusive design principles in gardening provide a foundation for adapting hydroponic systems to offer accessible, autonomous agricultural solutions. The research demonstrates that hydroponics, as a low-effort farming method, can meet the needs of persons with disabilities while benefiting from IoT-driven automation to optimize environmental conditions and improve efficiency. Furthermore, community engagement and sustainable practices support the idea that combining IoT with hydroponics can facilitate community-based, scalable farming solutions. This approach not only enhances agricultural accessibility but also promotes long-term sustainability and social inclusion. This research framework uses technology to connect agriculture, disability inclusion, and sustainability. It provides a useful example for giving visually impaired people more power in the agricultural sector. Incorporating IoT ensures accessibility and operational efficiency, reducing both physical and sensory barriers while fostering social and economic empowerment.

Material and Methodology

Hydroponic System

Silva et al. (2021) look at the Nutrient Film Technique (NFT) hydroponic system as a long-term solution for urban farming. They highlight how research interest in this system grew from 2016 to 2019 because it is effective and good for the environment. Their findings highlight NFTs' ability to enhance productivity, conserve resources, and support future agricultural development. The system's compact design makes it an effective solution for small-scale agricultural initiatives, particularly in urban settings where space optimization is crucial. The NFT hydroponic system consists of 40 planting pots and is structured with dimensions of 34 inches in height, 25 inches in width, and 69 inches in length, making it suitable for limited spaces. This complete system has everything you need for hydroponic farming, like an NFT setup, a long-lasting water reservoir, and a reliable water pump that makes sure there is a steady supply of nutrients. The inclusion of 40 white net pots facilitates easy plant installation, while growth media like rockwool provide superior water retention and aeration, promoting strong root development. To optimize plant growth, the system integrates a pipe mechanism for efficient water circulation and utilizes Micronutrient Hydro AB fertilizer to meet the nutritional needs of the plants. Gillani et al. (2023) compared the energy-use efficiency (EUE) of NFT and deep-water culture (DWC) systems in hydroponic lettuce production, which shows that NFT is a more effective way to grow plants. Their research showed that both systems produced about the same number of leaves and plant heights, but NFT did better in terms of shoot fresh weight, leaf area, and root length, resulting in a higher EUE (31.3 g kWh⁻³ vs. 24.53 g kWh⁻³). These findings suggest that NFT is a more energy-efficient option for controlled environment agriculture, particularly in plant factories and aquaponic systems. The NFT system's simplicity, compact structure, and comprehensive setup ensure a user-friendly and sustainable solution for optimizing crop production. Its ability to enhance productivity while minimizing resource consumption makes it a promising technology for modern agriculture, aligning with efforts to develop efficient and scalable hydroponic solutions. The Nutrient Film Technique (NFT) system, as illustrated in Figure 1, is designed to support 40 planting pots at our location, reinforcing its practicality for urban and controlled-environment farming.



Figure 1: The Nutrient Film Technique

Planting Process for the Nutrient Film Technique (NFT) System

The planting process for the Nutrient Film Technique (NFT) system involves a series of steps designed to ensure optimal plant growth and efficient nutrient delivery. The process is outlined as follows:

1. Preparation of growing medium

In our experiment, we use rock wool as the growing medium for our hydroponic system. Rockwool, a widely used medium in hydroponics, is manufactured by melting basalt rock and spinning it into fine fibers, resulting in a lightweight, porous structure as shown in Figure 2. This unique composition allows it to retain moisture efficiently while still providing ample oxygen to plant roots, creating an ideal environment for healthy growth. One of the key advantages of Rockwool is its ability to maintain an optimal balance between water and air, which is crucial for root development. Its high-water retention minimizes the need for frequent irrigation, reducing water waste while ensuring consistent hydration for plants. Additionally, its excellent aeration properties help prevent root diseases caused by excessive moisture, making it particularly useful in controlled hydroponic environments. Rockwool comes in different sizes and shapes, like cubes, slabs, and loose granules. This makes it useful for a range of hydroponic systems, such as drip irrigation, nutrient film technique (NFT), and deep-water culture (DWC). The cubes are particularly beneficial for seed germination and early-stage plant growth, while slabs are commonly used for larger plants requiring extended root space. Despite its benefits, Rockwool requires proper handling and preparation. Before use, it must be pre-soaked in a pH-adjusted solution to neutralize its naturally high pH, ensuring a suitable environment for plant roots. Additionally, protective gear such as gloves and masks should be worn when handling dry Rockwool, as its fine fibers can cause irritation to the skin and respiratory system.



Figure 2: Rock Wool Medium

2. Seed Germination

Place 2–3 seeds in the center of each prepared net pot using a chopstick or tweezers to position them gently into the growing medium. Ensuring proper seed placement helps improve germination rates and prevents overcrowding as the seedlings develop. When using Rockwool, make a small indentation in the center of the cube to accommodate the seeds, ensuring they are not buried too deep, as this can affect sprouting. Lightly water the seeds to moisten the growing medium, ensuring even hydration without excessive soaking. Using a spray bottle or a gentle stream of water helps prevent the seeds from being displaced. Rockwool and other hydroponic media retain moisture effectively, so it is important to avoid overwatering, which can lead to fungal growth or seed rot. As shown in Figure 3, our team is actively engaged in preparing and seeding the hydroponic system.



Figure 3: Seedling Preparation

Allow the seeds to germinate in a shaded area or indoors for 3–5 days, ensuring they are kept moist but not waterlogged. Consistent temperature and humidity levels play a crucial role in successful germination. Budiman et al. (2022) used IoT monitoring to look at how physical factors affected bok choy (*Brassica rapa*) and water spinach (*Ipomoea aquatica*) in a hydroponic system. They found that TDS and light intensity significantly influenced growth, with optimal conditions at 25.4–31°C temperature and 70 g/m³ humidity. The study emphasizes the role of automated nutrient control in improving yield. The study conducted by Chowdhury et al. (2021) on kale cultivation in controlled plant factories revealed that the ideal conditions for glucosinolate accumulation are not the same as those for physical growth. The optimal conditions are 20–23°C, 85% RH, and 700–1000 ppm CO₂. The study also found that temperature and glucosinolate levels are inversely related, suggesting a trade-off between yield and bioactive compounds. The findings offer valuable insights for optimizing environmental settings in controlled agriculture, but their focus on a single plant species limits its scope. Covering the net pots with a humidity dome or placing them inside a propagator can help maintain adequate moisture and warmth. Check daily for signs of germination and ensure the medium remains damp. If using a hydroponic system, avoid placing the net pots directly under grow lights during the early stages, as excessive heat or light intensity can dry out the seeds. Once the seedlings emerge and develop their first true leaves, gradually introduce them to light, preparing them for the next growth phase in the hydroponic system. The Hooks et al. (2022) study explores the impact of nutrient solutions on the growth of leafy baby vegetables like lettuce, pak choi, and spinach in deep-water hydroponic systems. They found that cooling solutions to 24°C during summer improve plant biomass, especially for heat-sensitive species like spinach, while heating solutions to 22°C in winter enhance lettuce growth. However, the study highlights the need for further research on optimal temperature ranges. Figure 4 shows the vegetables at the early seedling stage, after 3–5 days of germination. At this point, the seedlings have successfully sprouted and started developing their first true leaves, which are

essential for photosynthesis and further growth. The true leaves, distinguishable from the initial cotyledons, indicate that the young plants are ready to transition from the germination phase to active growth. As part of this transition, the seedlings are gradually introduced to light. Initially, they are exposed to indirect light or placed under grow lights with low intensity to prevent shock or dehydration. Over the next few days, the light exposure is increased progressively to mimic natural growing conditions, allowing the plants to adjust and strengthen. During this period, the seedlings are carefully monitored for signs of healthy growth, such as vibrant green leaves and strong stems. Any weak or underdeveloped seedlings are removed to ensure only the healthiest plants are transplanted into the main hydroponic system. Once the seedlings have adapted to the light conditions and their root structures have developed sufficiently, they are prepared for transplanting. The net pots containing the seedlings are transferred into the hydroponic setup, where they will receive a continuous supply of water and nutrients. The nutrient solution is adjusted based on the plant's growth stage to ensure optimal absorption and development. This stage marks the beginning of the vegetative growth phase, where the plants will rapidly increase in size, developing a more robust root system and expanding their leaf structures. Regular monitoring of pH levels, nutrient concentration, and light exposure is crucial during this period to support strong, healthy plant development in the hydroponic system.



Figure 4: 3–5 Days of Germination

3. Transplanting the Seedlings

Once seedlings develop their first set of true leaves (approximately 7–10 days after germination), they are ready for transplanting. At this stage, their root systems are strong enough to absorb nutrients efficiently, ensuring a smooth transition into the hydroponic setup. True leaves indicate that seedlings can sustain growth in a nutrient-rich environment, making this stage critical for their development. Before transplanting, seedlings in net pots are inspected, and only healthy plants are selected as illustrated in Figure 5. Weak or underdeveloped seedlings are removed to prevent nutrient competition. The NFT channels are then cleaned to remove any debris and ensure a steady water flow.

To transplant, seedlings in net pots are carefully placed into designated slots in the NFT channels, ensuring that their roots extend slightly beyond the pot to make direct contact with the nutrient solution. This setup allows roots to absorb water, oxygen, and nutrients efficiently, supporting rapid plant growth. After placing the net pots, the water flow is checked to confirm even distribution across all pots. Proper circulation prevents nutrient imbalances and ensures optimal oxygen supply. If needed, adjustments are made to the water pump and flow rate to maintain a thin film of nutrient solution running along the base of the channels. During the initial days after transplanting, regular monitoring is performed to observe root adaptation and

seedling response. Signs of stress, such as wilting or yellowing leaves, are addressed promptly by adjusting the nutrient concentration. This transition phase is crucial for establishing strong root systems, promoting healthy vegetative growth, and ensuring successful crop development under hydroponic conditions.



Figure 5: Healthy Seedlings

4. Monitoring and harvesting

Visually impaired individuals can effectively monitor and harvest spinach and pakcoy using assistive technologies, sensory-based techniques, and structured workflows. Covarrubias et al. (2024) introduce an innovative AR-based learning platform designed to enhance hydroponic agriculture and vertical farming training for young students with disabilities. Developed in collaboration with the Association for Cognitive Enhancement, the platform increases engagement, interactivity, and real-time feedback, creating a more inclusive learning environment. This research advances assistive technology in education and highlights AR's potential in sustainable agriculture. By integrating smart monitoring systems and tactile feedback, blind individuals can efficiently manage hydroponic crops with minimal assistance. Figure 6 illustrates one of our visually impaired participants inspecting the spinach.



Figure 6: Tactile Plant Inspection

Internet of Things for Monitoring NFT System

1. Role of ESP32 in the Hydroponic System

The ESP32 microcontroller was used to collect, process, and transmit data from various sensors and actuators in the hydroponic system. It served as the central controller, ensuring real-time

monitoring and automated adjustments. The ESP32 was interfaced with multiple sensors and actuators to monitor critical hydroponic parameters as listed in Table 1 and 2 respectively:

Table 1: Sensors

Sensor	Parameter Measured	Function
TDS Sensor	Nutrient concentration (ppm)	Ensures optimal nutrient strength in the mixing tank
Water Level Sensor	Tank water levels (ON/OFF)	Prevents pump dry running and nutrient depletion
DHT11 Sensor	Temperature & Humidity	Monitors environmental conditions
Flow Sensor	Water flow rate	Ensures smooth nutrient circulation in NFT channels

Table 2: Actuators

Actuator	Function	Purpose in NFT Hydroponics
Peristaltic Pumps	Doser Adds Fertilizer A & B based on TDS readings	Ensures precise and automated nutrient dosing
Solenoid Valves	Regulates water flow for nutrient dilution	Prevents over-fertilization by controlling dilution levels

Dual-Tank Fertilizer Dosing System for NFT Hydroponics

In this experiment, a dual-tank system was implemented to store and dispense Fertilizer A and Fertilizer B, ensuring precise nutrient delivery to plants in the NFT hydroponic system. The two separate tanks were equipped with doser pumps, which functioned to transfer each fertilizer solution into a mixing tank, where they were combined in accurate proportions before being distributed into the hydroponic channels as depicted in Figure 7. The primary reason for keeping Fertilizer A and Fertilizer B in separate tanks is to prevent chemical reactions that might lead to precipitation, rendering the nutrients unavailable for plant uptake. Many hydroponic fertilizers contain calcium-based and phosphate-based nutrients, which, if mixed directly in concentrated form, form insoluble precipitates that can clog the system and reduce nutrient efficiency. By keeping them separate and only mixing them in diluted form, the system ensures maximum nutrient availability and absorption by plant roots.

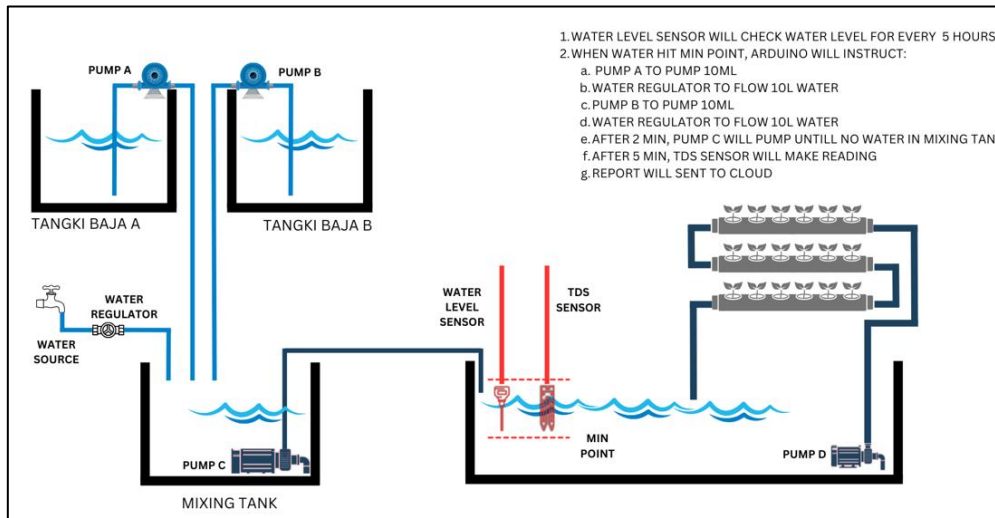


Figure 7: Dual-Tank Fertilizer Dosing System

1. Components of the Fertilizer Dosing System

To ensure precise and efficient nutrient delivery in the NFT hydroponic system, a structured fertilizer dosing system was implemented, consisting of fertilizer storage tanks, peristaltic doser pumps, and a mixing tank. Fertilizer A and B were stored in separate tanks to prevent chemical precipitation, with each tank labeled and calibrated for accurate volume monitoring and timely refilling. Peristaltic doser pumps were integrated to extract measured quantities of fertilizers and transfer them to the mixing tank, ensuring contamination-free and programmable dosing for consistent nutrient balance. In the mixing tank, fertilizers were blended in the correct ratio, with a stirring mechanism ensuring even distribution before delivery to the plants. To further optimize nutrient management, a TDS sensor was installed to measure the concentration of dissolved ions, converting the data into electrical conductivity (EC) levels, which were then translated into ppm values to indicate nutrient strength. The sensor continuously transmitted data to the ESP32 microcontroller for real-time monitoring via a cloud-based dashboard. If TDS levels deviated from the optimal range, an alert system notified the grower to adjust the nutrient concentration, ensuring an automated and precise hydroponic nutrient management system. The Hydroponic Vegetable Chart outlines optimal pH, EC, cF, and PPM values to ensure proper nutrient balance for vegetable growth. It helps hydroponic growers adjust nutrient solutions for healthy plant development and maximum yield as shown in Table 3.

Table 3: Hydroponic Vegetable Chart

Vegetable	pH	EC	PPM (500 Scale)
Pak-choi	7.0	1.5 – 2.0	750 – 1000
Spinach	5.5 – 6.6	1.8 – 2.3	900 – 1150

Source:(<https://ponicslife.com/hydroponic-charts-for-fruits-and-vegetables-ph-tds-ec-cf-ppm/>)

Cloud-Based Monitoring for Visually Impaired Individuals

To enhance accessibility and inclusivity in hydroponic farming, the monitored parameters of the NFT system were transmitted to the cloud in real time. This enabled visually impaired individuals to remotely monitor and manage their hydroponic setup via a smartphone. The cloud platform stored and processed data from the system's sensors, including nutrient concentration, temperature, and humidity, allowing users to receive real-time updates and alerts

about the system's status. The screenshot of the website illustrating the voice-assisted hydroponic monitoring system is presented in Figure 8. The website is available at <https://infotex.site/sbm/>.

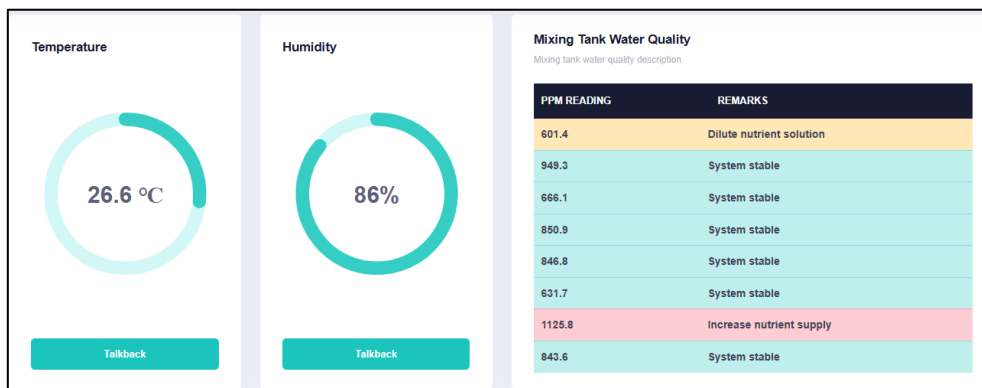


Figure 8: Voice-Assisted Hydroponic Monitoring

To facilitate accessibility, we integrated TalkBack, a screen reader accessibility app that provides audio feedback for individuals with visual impairments. With this setup, users could receive verbal notifications about system parameters, enabling them to take necessary actions, such as adjusting nutrient levels, regulating water flow, or modifying environmental conditions. Furthermore, the cloud platform was designed to send automatic alerts through voice notifications feedback when critical thresholds were exceeded, such as a drastic nutrient levels imbalance or a significant drop in water flow rate. This ensured that individuals could respond promptly to maintain optimal growing conditions without requiring visual inspection. Steps for blind individuals to use talkback for hydroponic monitoring as follow:

1. Enabling TalkBack

- To activate TalkBack, users can:
- Navigate to Android Accessibility settings and enable the feature manually.
- Press both volume buttons for three seconds as a shortcut to activate TalkBack instantly.
- Upon activation, TalkBack provides spoken feedback, describing each element on the screen to assist navigation.

2. Navigating the Website

Once TalkBack is enabled, users can interact with the hydroponic IoT dashboard using intuitive gestures:

- Swipe left or right to navigate between different sensor readings, system parameters, and alerts.
- Single tap to select an element, allowing TalkBack to describe it.
- Double tap to activate a selected item, such as opening detailed sensor logs or triggering water pump controls.

3. Accessing Real-Time Hydroponic Data

TalkBack enables users to access and interpret sensor readings through audio feedback, making real-time monitoring possible:

- TalkBack reads aloud numerical values for key hydroponic parameters, including:
- TDS reading – monitoring nutrient concentration.

- Temperature and humidity – optimizing plant growth conditions.
- If critical thresholds are exceeded, automated voice alerts notify users with messages such as:
 - Low water level detected, please refill the tank.
 - Nutrient concentration too high, adjust dilution.

While the hydroponic monitoring system provides real-time accessibility through TalkBack and voice alerts, it is not yet fully automated, requiring manual intervention for adjusting water levels. Blind individuals can monitor the system independently, but assistance from family members is needed when physical adjustments are required.

Result and Discussion

Over the 28-day monitoring period, temperature, humidity, water level, and nutrient PPM were tracked to ensure optimal conditions for hydroponic plant growth. The collected data helped identify necessary actions to maintain a stable growing environment. The temperature was monitored between 22°C and 30°C, with corrective actions such as activating cooling systems when exceeding 25°C or increasing temperature if dropping below 22°C as depicted in Figure 9.

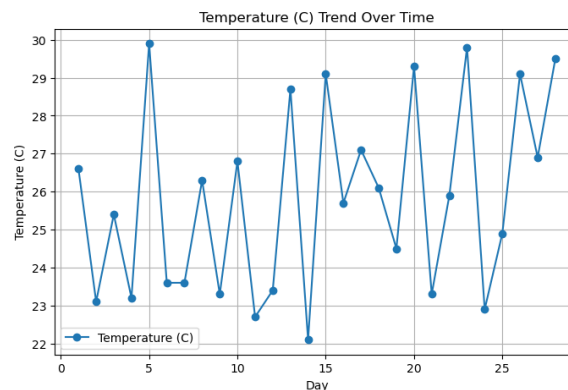


Figure 9: Temperature

Humidity levels fluctuated between 85% and 96%, necessitating adjustments such as ventilation or misting control when values surpassed 70% or fell below 50%. These readings were influenced by the rainy season and the sensor's placement in an open area with a roof overhead as shown in Figure 10.

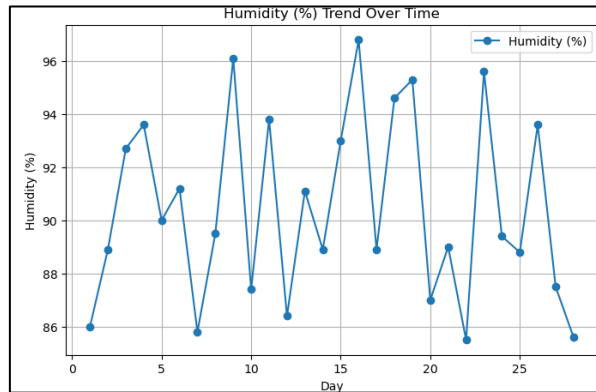


Figure 10: Humidity

Nutrient PPM readings ranged from 600 to 1200, requiring adjustments such as increasing nutrient supply when values fell below 700 or diluting solutions when exceeding 1100.

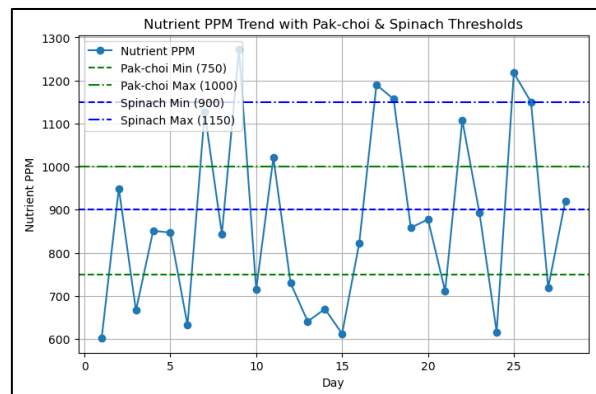


Figure 11: Nutrient Readings

The generated graphs illustrate trends in temperature, humidity and nutrient PPM over the 28-day period, providing insights into fluctuations and necessary interventions to maintain optimal hydroponic conditions.

Conclusion

The development of a voice-accessible IoT hydroponic monitoring system for visually impaired individuals demonstrates the transformative potential of assistive technology in agriculture. By integrating ESP32 microcontrollers, environmental sensors, and automated water pumps, the system ensures real-time monitoring and efficient hydroponic management. The incorporation of voice-assistive technology and cloud-based reporting enables users to access critical data independently, enhancing their ability to manage hydroponic farming without requiring constant visual assistance. The findings from this study highlight the effectiveness of IoT-based automation in improving accessibility and operational efficiency. Users reported increased confidence in managing nutrient levels, monitoring environmental conditions, and making informed decisions based on the system's real-time alerts. Additionally, environmental data analysis emphasizes the impact of external factors such as humidity fluctuations due to seasonal variations, which necessitate adaptive control strategies.



This initiative, supported by the Sarawak Branch of the Society of the Blind Malaysia and Politeknik Kuching Sarawak, underscores the importance of inclusive technology in empowering visually impaired individuals. Future enhancements should focus on further automation, AI-driven optimizations, and broader accessibility features to improve system usability and scalability. By leveraging IoT and voice-assisted systems, this research contributes to sustainable agriculture, digital inclusion, and economic empowerment for visually impaired individuals, paving the way for a more inclusive agricultural sector.

References

- Abdullah, N. S., binti Yussof, R., binti Razak, N. N., binti Romly, N., & bin Azmi, M. S. F. (2023, October). Fostering Independence: Perlis Special Teens Centre Engages Families, Communities, And Stakeholders. In *Proceedings of International Conference on Special Education (Vol. 5)*.
- Akter, T. (2022). Experience of participating in accessible garden of persons with spinal cord injury: a qualitative study (Doctoral dissertation, Bangladesh Health Professions Institute, Faculty of Medicine, the University of Dhaka, Bangladesh).
- Billah, N. S., Saputra, Y. A., & Arintyas, A. P. R. D. A. (2023, October). Inclusion Village Based on Disabled Talent Career: Towards Accessibility of Labor Market as a G20 Priority in Wahyuharjo Kulon Progo. In *Proceeding Book of The International Conference on Manpower and Sustainable Development: Transformation of Manpower in the Changing World of Work (Vol. 1)*.
- Budiman, M., Partogi, E., Kristi, A. A., Anggara, P., & Aminah, N. S. (2022). Study of the Effect of Physical Parameters on Commercial Hydroponics Based on Internet of Things (IoT): A Case Study of Bok Coy Plants (*Brassica rapa*) and Water Spinach (*Ipomoea Aquatica*). *Journal of Mathematical & Fundamental Sciences*, 54(2).
- Chowdhury, M., Kiraga, S., Islam, M. N., Ali, M., Reza, M. N., Lee, W.-H., & Chung, S.-O. (2021). Effects of temperature, relative humidity, and carbon dioxide concentration on growth and glucosinolate content of kale grown in a plant factory. *Foods*, 10(1524). <https://doi.org/10.3390/foods10071524>
- Covarrubias, M., Mencaci, E., Roma, S., Bodega, D., & Calcagno, A. (2024, August). Empowering Young Students with Disabilities Through AR-Enabled Hydroponic Agriculture. In *the International Conference on Innovations in Computing Research (pp. 261-268)*. Cham: Springer Nature Switzerland.
- de Castro Silva, M. G., Hüther, C. M., Ramos, B. B., da Silva Araújo, P., da Silva Hamacher, L., & Pereira, C. R. (2021). AA global overview of hydroponics: nutrient film technique. *Revista Engenharia na Agricultura-REVENG*, 29(Contínua), 138-145.
- Fundación, O. N. C. E. (2023). Making the green transition inclusive for persons with disabilities.
- Gillani, S. A., Abbasi, R., Martinez, P., & Ahmad, R. (2023). Comparison of energy-use efficiency for lettuce plantation under nutrient film technique and deep-water culture hydroponic systems. *Procedia Computer Science*, 217, 11-19.
- Goddek, S., Joyce, A., Kotzen, B., & Burnell, G. M. (2019). Combined aquaculture and hydroponic production technologies for the future. *Aquaponics food production systems*. Springer Nature, Inc., Cham, Switzerland, 619-620.



- Hooks, T., Sun, L., Kong, Y., Masabni, J., & Niu, G. (2022). Effect of nutrient solution cooling in summer and heating in winter on the performance of baby leafy vegetables in deep-water hydroponic systems. *Horticulturae*, 8(749).
- Juneja, P., Yadav, P., Dhingra, M., & Bhagauli, V. Empowering People with Disabilities: Designing an Innovative and Sustainable Hydroponics System.
- Oba, S. (2023). Potential People of Disability in Agriculture, as Social Farming in Japan, Compared with Other Countries. *Reviews in Agricultural Science*, 11, 181-202.
- Saarani, Puteri Sidrotul Nabihah, Siti Nur Aishah Mohd Noor, Zailawati Khalid, Asniza Hamimi Abdul Tharim, Asmalia Che Ahmad, Norhafizah Abdul Rahman, and Mohamad Haizam Mohamed Saraf. "Hydroponic as a Friendly Farming Technique for Persons with Disabilities (PWD)." *International Journal of Business and Technology Management* 6, no. S1 (2024): 259-269.
- Yuan, G. N., Marquez, G. P. B., Deng, H., Iu, A., Fabella, M., Salonga, R. B., ... & Cartagena, J. A. (2022). A review on urban agriculture: technology, socio-economy, and policy. *Heliyon*, 8(11).

INTEGRATION OF GARBOLGY AND BIOMORPHIC: REPRESENTATION OF PLASTIC WASTE THROUGH NATURE-INSPIRED CREATIVITY IN VISUAL ARTS

Abdullah Ehlid Al Walid Luli¹

¹Faculty of arts and social science (UTAR), Malaysia, (ehlid@utar.edu.my)

Abstract: *This research aims to apply and adapt the theme of nature, inspired by the resilience of plastic materials, by integrating garbology and biomorphic approaches. The term garbology refers to the study of waste, and in the context of visual art, it becomes an exploratory theme for understanding modern consumer culture and its negative impact on the environment (Rathje & Murphy, 1992). Meanwhile, biomorphic refers to artistic designs that imitate or apply natural forms, offering opportunities to transform waste materials like plastic into artworks that reflect aesthetics, symbolism, and ecological awareness. Plastic, as a material that is resistant to degradation, originates from natural resources such as oil and natural gas through complex chemical processes. Therefore, biomorphic design connects artistic elements with ecological functions through inspiration drawn from natural forms and structures (Nurul Asyifa, Yohannes Firzal, and Gun Faisal, 2020). Studio-Based Research is the approach adopted in this artistic study, where the creative process model by S.P. Gustami (2007) is applied in the creation of artworks, encompassing exploration, planning, and realization. Meanwhile, the analysis of artworks uses the 'organic unity' model by Ocvirk (2001), which is divided into three main aspects: subject, form, and meaning. The artwork titled "Dia Masih Di Awang-Awangan" (he/she is still floating) is the outcome of this research, visualizing natural elements that form complex structural clusters. This study finds that the biomorphic concept not only provides a unique platform to highlight the beauty of nature and its aesthetic value but also an ecological function that elevates this artwork as a symbol of the complex relationship between humans, waste, and nature in the context of modern consumerism. This research is expected to contribute to the discourse on the impact of plastic on the environment while inspiring creative steps to support environmental sustainability.*

Keywords: *Garbology, Biomorphic, Plastic Waste, Consumerism, Visual Art, Ecological Awareness.*

Background of the Study

Plastic was initially considered a revolutionary innovation capable of reducing production costs. In the modern world, plastic has become one of the most prevalent materials, widely used in various industrial applications due to its durability, inertness, insulation properties, flexibility, and lightweight characteristics (Petroleum Nasional Berhad (Petronas), 2019). One of the most significant attributes of plastic is its low production cost, making it highly valuable (Nur Ruqiyah, 2015). Since the 1950s, plastic has become an essential material in human life up to the present day (Geyer, Jambeck & Law, 2017). Figure 1 depicts the revolution showcasing the diversity and innovation based on plastic materials.

However, today, we cannot ignore the problems posed by plastic in daily life. Classified as an inorganic material, plastic has detrimental effects on the environment and human life. One critical issue is the nature of plastic, which contains components that take a very long time to decompose (Bianchini & Rossi, 2021; Horodytska, Valdés, & Fullana, 2018; Lee et al., 2021). Unlike natural materials that undergo decomposition and return to the earth, petroleum-based plastics do not interact with microorganisms responsible for decay, causing them to persist in the environment for an extended period (Browning et al., 2021; Gunjan et al., 2021; Napper et al., 2022 in Muhammad Fauzan Abu Bakar et al., 2023; Hanif & Marzuki, 2006).



Figure 1: The Plastic Revolution

Source: 2019 Petrolia Nasional Berhad (Petronas)

Artists, in the context of creative arts, are very important in observing and interpreting plastic through its complex interrelationship of human, waste, and nature. Thus, artists become agents of change when they do not just create art but instead creation helps in prompting society to rethink the way they use waste because it mirrors its consumption and the complicated associated behaviors embedded in cultural or lifestyle practices. In this regard, art does not merely convey value by the material employed but is based on significance. Art is an endeavor to produce something pleasing (Sidi Gazalba, 1977), and enjoyable art can lead to an appreciation linking the artwork to the audience (Read, 1959). That is how plastic recycling art not only defies norms of aesthetics but also gets audiences to realize and understand the context of modern consumer lifestyles with ecological awareness.

In "Garbology: The Archaeology of Contemporary Trash" (Duneier, 2004), it emphasized how waste, including plastics, reflects human values and behavior, which can be processed into art to reveal more general societal and environmental implications. As such, the artwork is inspired by nature to interpret the human and environmental responsibilities. It also broadens the perspective and approach of the scholar regarding the theme of nature based on the origins of the creations of plastic materials. Hence, this knowledge can facilitate the researcher to be able to do works that are not only well conceived aesthetically but also meaningful and impactful.

That is why planning the creative activities needs an architecture built up by the traits and constituents of the life forms. The perfect way of this research is biomorphic design. It literally is an artistic design approach that applies ideas or mimics forms found in nature (Nurul Asyifa, Yohannes Firzal, Gun Faisal, 2020). Biomorphics arts are known to be derived from early 20th-century movements such as Surrealism and Abstract Expressionism, which had artists looking for their inspiration from organic forms and processes: Joan Miró and Roberto Matta (Robins.N.R, 1976).

Research Problem

The extent to which plastic consumption has been elevated can be drawn from the many values: convenience and use-durability, lightweight, malleable, inexpensive, and available. As societies advance, so does a practice, bringing with it the emblem that defines it. Plastic is that practice and that emblem in modern society. But plastic is not a natural material; it has no decomposition or degradation occurring by itself when it is thrown into the environment. It only changes its shape with heating but does not react with micro-organisms acting as decomposition agents. Thus, it can be reused, bent, and shaped like anything, and it would not lose its original form (Hanif & Marzuki, 2006). Although this sounds like very new-modern material (Fong et al., 2020), it has derived from natural resources. For example, plastics in the manufacture of oil and natural gas underwent some extensive chemical processes. Unless for other organic compounds, which easily return to nature through decomposition, plastic does entail the presence of permanence in nature (Liu et al., 2022). In the realm of art, the making of plastics resembling forms in nature can work strong effects on environmental awareness (Rees, 2018). Hence, this creative study will take up that theme of nature through artistic creativity inspired by the character of plastic as a means of conveying natural resources.

Literature Review

The study of plastic as an artistic medium can frequently be correlated with environmental concerns, creative concepts, Garbology theory, and a biomorphic approach. Garbology, rooted in anthropology, studies the analysis of waste as a classifier to reveal human behavior patterns and environmental impacts associated with them (Rathje & Murphy, 1992). In the realm of art, this theory extends to works focused on reuse of discarded plastic material as criticism of consumptive culture and pollution; for instance, Maher (2017) illustrates in his research on how artists use discarded plastics in sculpting installations as critiques of society's habits of disposing of a reusable resource. On the contrary, the biomorphic approach relies pretty much on organic-designed elements with reference to natural forms and structures. Creating marks through biomorphic elements in plastic form grants artists a potential for linking plastic pollution to an endangered natural beauty, as shown by Smith et al. (2015). Such as Aurora Robson, who uses waste plastics to create sculptures that look like marine living organisms to



convey messages about plastic hazards to marine ecosystems through her works. The past survey shows the combined strength of Garbology and biomorphic in the art narrative. The artworks that include both approaches not only advocate awareness about plastic pollution but also set up debates concerning humankind's obligation toward the environment. For example, the research of Gregory (2018) concerns the effects of visual and emotional responses that are produced by the use of plastic materials in art when making biomorphic forms construed as symbols of endangered life and sustainability.

Overall, the literature substantiates that plastic in Garbological and biomorphic art focuses not only on environmental politicking but also spurs a paradigm shift in society's thinking about and dealing with waste. These studies provide important groundwork for further explorations of contemporary art in responding to urgent global issues.

Methodology

A studio-based Research approach is adopted in this artistic research, where creative works are developed based on the creation model by S P Gustami (2007), which also includes exploration, planning, and realisation. Models of work creation by S.P. Gustami (2007) provide systematic approaches to the creation of works of art. The process is undertaken in three main steps: exploration, design, and actualization. Each of these steps is important in framing works of art to be meaningful, innovative, and relevant to the issues or concepts to be conveyed. The very first step in the model is exploration, which consists of idea excavation and looking for inspiration through theoretical studies, experiments with materials, and the observation of surrounding phenomena. The process turns out to yield a theme or relevant issue to be addressed in the art work. Artists usually resort to methods such as visual analyses, art history, or observation of the natural world and society for sources of inspiration. In the context of the arts using Garbology theory and biomorphic aesthetic, exploration might include a study of plastic waste, organic forms, and the interface of man with nature. This process helps artists understand the potential of medium and concept before moving on to the next level. The second stage of this process is planning. At this stage, an artist details his planned structures and concepts of the piece of art. In planning, an artist chooses materials, prepares sketches or prototypes, and integrates strategies to realize the idea. S.P. Gustami emphasizes much the importance of planning as a basis for close continuity between theme, medium, and message in a work of art. For instance, an artist wishing to use leftover plastics in making a biomorphic sculpture might plan for how the plastic elements could be manipulated into organic forms while still being kept conscious of the pollution issue. Documentation also plays a major role at this stage for recording the process and decisions made. The last stage is embodiment, where the designed artwork is made physically real. It involves the application of artistic techniques and the manipulation of materials according to how they were planned. Embodiment also requires flexibility as the artist might need to adjust or change their approaches to technical or aesthetic challenges that may occur. It is at this stage that aspects like texture, color, and form are harmonized to produce a piece that is not only aesthetically appealing but also capable of sending a clear message to the audience. For example, within works using waste materials, the contrast of "worthless" materials with beautiful forms may take greater emphasis in calling for critical reflection by the audience. Overall, the exploration, planning, and embodiment model by S.P. Gustami offers a clear frame for artists to create high-quality artworks. This model emphasizes the importance of balancing creative experimentation with systematic structure to create works that are not only aesthetic but meaningful as well.

Meanwhile, the analysis of art in this study employs the organic unity model defined by Ocvirk (2001). This model emphasizes three basic aspects in the assessment of any work of art: subject, form, and meaning. The first aspect, subject, refers to the theme or main content of the work of art. In terms of the subject matter, it is the message that the artist tries to convey. The form refers to the visual elements in the work, including composition, color, line, texture, and shape, that an artist uses to transmit the subject in a captivating manner. Lastly, meaning refers to the interpretation or the message contained in the artwork, which usually relates to human experience, cultural values, or social and environmental awareness. In an organic unity model, all these three elements function together and not separately because together they engender a harmonious wholeness in a work of art (Ocvirk, 2001).

Findings

"Dia Masih Di Awang-Awangan" (he/she is still floating) is a 2023 artwork, measuring 182.88 cm by 243.84 cm, and it is a combination of wasted plastic with ideas from both garbology and biomorphic art forms. This analysis of the work considers three main components—the subject, form, and meaning—in accord with the model of organic unity proposed by Ocvirk (2001).

*****6

The main subject of this piece is the representation of the complex relationship between human beings, plastic waste, and the natural environment in modern consumerism. Plastic, being the main symbolic medium representing pollution and detrition of human beings on the ecosystem, is, however, artistically manipulated to create this beautiful biomorphic form much like nature elements themselves, such as in flora and fauna. The use of plastics that are already thrown away shows how seemingly insignificant materials can be elevated into meaningful subjects that resonate with world issues on plastic pollution framed in an artistic approach (Haward, 2018).

The artwork, from a form perspective, also offers the harmony of visuals that comes from principles of balance, repetition, as well as rhythm. The biomorphic structure indeed looked like original organic forms such as flower petals and scales of birds, giving a distinctive, attractive dynamic. Bright colors like orange, pink, white, turquoise, red, blue, and green, along with that yellow, manifest the concept of life and energy together with well-structured compositions. The three-dimensional effect achieved through the technique of layering and folding plastics creates a distinctive texture that enriches the visual appeal. The principle also proves that despite the basic raw material being waste, aesthetic beauty can still be achieved, which reinforces the view that art can transform the value of the material (Krauss, 1979).

This work is significant in its symbolic dialogue on the relationship between humankind and the environment via plastics—one hallmark of modern consumeristic culture. Garbology, as employed in this work, is meant to be a critique of consumer society that emphasized creative recycling as an alternative to pollution (Thompson, 2017). In addition to this, the biomorphic approach adds an aesthetic dimension that brings spectators closer to nature, symbolizing a severance of relationship due to human exploitation of natural resources. These two approaches yield fine enough art not just visually, but also loaded with messages concerning ecology, namely, that one may need to reshape the relationship between humankind and artificial goods and surroundings.

Biomorphic not only provides a unique platform for showcasing the beauty of and aesthetic, but they also serve as ecological functions, elevating such works as symbols of the complexity of relationships between humans, waste, and nature in the context of modern consumerism. This is aligned with the studies done by Boudry et al. (2021), which emphasize the importance of awareness towards the recycling of materials in lessening negative influences towards the environment while enriching human experience through creativity.



Figure 2: Ehlid Luli, “Dia Masih Di Awang-Awangan”, 2023, Plastic & Mix media on Plywood, 182.88 cm by 243.84 cm (6fts x 8fts).

Source: National Art Gallery <https://www.youtube.com/watch?v=APqBdMjIgSc>

Conclusion

This piece of work, "*Dia Masih Diawang-Awangan*," deals intricately and multifacetedly with the relationship of humanity, plastic waste, and nature against the present-day backdrop of consumerism. What the artist does is also show that, combined with the use of garbology and biomorphic art, such things put into the discarded containers, like plastics, convert into thought-provoking and delightful works of art. Creating such art shows not just the possibility of beautifying waste but also criticizes the pollution and environmental issues pertaining to consumer culture. In Ocvirk's (2001) organic unity analysis, forms are interrelated along with the subject to elicit meaningful expression through the art, capable of even creating awareness of the ecology while appreciating beautiful forms in nature. This kind of project slightly rethinks the worth of waste materials and advocates for sustainability concerning the human-



environment relationship. Future research can include such digital technologies as augmented reality or interaction with other installations that widen the biomorphic and ecologic narrative within the artworks. This will heighten audience immersion and the message on environmental sustainability.

References

- Bianchini, C., & Rossi, F. (2021). The challenge of plastic waste management in modern society: Recycling, incineration, or landfilling? *Waste Management & Research*, 39(8), 1127-1136.
- Browning, S., Wren, J., Zeng, Z., Zhang, Q., Cheng, H., & Wang, W. (2021). Understanding the environmental persistence of petroleum-based plastics. *Environmental Science & Technology Letters*, 8(5), 408-418.
- Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Science Advances*, 3(7), e1700782.
- Gunjan, M., Kumar, S., Singh, V., & Gupta, K. (2021). Challenges and Opportunities of Plastics: A Global Perspective. *Environmental Reviews*, 29(2), 1-15.
- Hanif, H. M. and Marzuki, H. (2006). Plastic pollution problems and its impact on the environment. *Jurnal Alam Sekitar Malaysia*, 7(1), 15-21.
- Horodytska, O., Valdes, F. J., and Fullana, A. (2018). Plastic Waste Management: Current Status and Challenges. *Science of the Total Environment*, 630, 1104–1120.
- Lee, S., Kim, J., Choi, Y., Park, M., & Hong, S. (2021). Plastic waste and its impact on the global environment. *Journal of Environmental Science and Technology*, 15(5), 123-134.
- Muhammad Fauzan Abu Bakar, Abdul Halim Bin Abdul Halim, Fatin Nabilla Nasuha Md Nordin, & Nur Izzati Sofea Azmi. (2023). Creative arts in addressing plastic waste challenges. *Malaysian Journal of Environmental Sustainability*, 3(1), 45-55.
- Napper, I. E., Davies, B. F., Clifford, H., & Thompson, R. C. (2022). Understanding Plastic Persistence in Marine Environments. *Marine Pollution Bulletin*, 178, 113689.
- Ruqiyah, I. (2015). The Role of Plastics in Contemporary Industry: Problems and Prospects. *Jurnal Teknologi*, 75(2), 45-52.
- Petroleum Nasional Berhad (Petronas). (2019). Annual report: Plastic innovation and sustainability.
- Read, H. (1959). *The Meaning of Art*. 3rd ed. London: Faber and Faber.
- Sidi Gazalba. (1977). *Asas-asas seni*. Jakarta: Gramedia. 2nd ed.
- Maher, T. (2017). Art and sustainability: transforming waste into public consciousness. *Journal of Environmental Art*, 12(3), 45-60.
- Rathje, W. & Murphy, C. (1992). *Rubbish! The archaeology of garbage*. New York: HarperCollins.
- Smith, A., Johnson, R., & Lutz, K. (2015). Biomorphic Design in Art and Architecture: A Case Study of Plastic Waste Sculptures. *Art and Design Journal*, 8(2), 34-49.
- Gregory, P. (2018). Visualizing Sustainability: Plastic Art and Environmental Narratives. *Contemporary Art Review*, 15(1), 12-28.
- Ocvirk, G. L. (2001). *Art history: A critical introduction to novel methods*. Oxford University Press.
- Haward, M. (2018). Plastic pollution: A global governance challenge. *Science*, 364(6437), 188-190.
- Krauss, R. (1979). Sculpture in the expanded field. *October*, 8, 31-44.



- Thompson, R. C. (2017). Plastics and the Environment and Human Health: Current Consensus and Future Trends. *Philosophical Transactions of the Royal Society B*, 364(1526), 2153-2166.
- Boudry, C., Guislain, L., and Delanoe, O. (2021). Waste-to-art: Creative recycling and environmental awareness. *Journal of Ecological Art and Design*, 15(3), 45-60.
- Gustami, S. P. (2007). *Idea, concept, and process of creation in craft art*. Yogyakarta: Institut Seni Indonesia.
- Hanif, F., & Marzuki, M. (2006). Plastics in the Modern Age: Environmental and Societal Impacts. *Journal of Environmental Sciences*, 12(4), 201-210.
- Liu, Y., Zhang, T., & Wang, X. (2022). Challenges in Plastic Degradation and Environmental Risks. *Environmental Science and Technology*, 56(2), 134-142
- Fong, W. L., Chong, T. H., & Lee, S. K. (2020). The Role of Plastics in Consumer Culture and Its Environmental Impact. *Journal of Environmental Studies*, 24(3), 55-70.
- Rees. (2018). "Plastic: A Toxic Love Story"
- Nurul Asyifa, Yohannes Firzal, & Gun Faisal. (2020). *Konsep Biomorfik dalam Seni Visual dan Pengaruhnya terhadap Kesedaran Ekologi*.
- Robins.N. R, (1976). *Surrealism and Abstract Expressionism*. Masters Theses. 3375.

COMPARATIVE LEGAL APPROACHES TO THE RIGHT TO DISCONNECT

Harlida Abdul Wahab^{1*}
Rohana Abdul Rahman¹
Siti Zubaidah Othman²

¹School of Law, College of Law, Government & International Studies, Universiti Utara Malaysia (UUM), Malaysia, Kedah, Malaysia; Legal and Justice Research Centre, School of Law, College of Law, Government & International Studies, Universiti Utara Malaysia (UUM), Malaysia, Kedah, Malaysia
(harlida@uum.edu.my) (hana@uum.edu.my)

*Corresponding author

²School of Business Management, College of Business, Universiti Utara Malaysia (UUM), Malaysia, Kedah, Malaysia. (zubaidah@uum.edu.my)

Abstract: *The digital age has redefined work boundaries, making constant connectivity a workplace norm. However, this shift has raised concerns about work-life balance, mental health, and employee well-being, leading to the emergence of the right to disconnect as a legal and policy issue. This paper explores comparative legal approaches to the right to disconnect, analyzing how different jurisdictions have addressed this challenge through legislation, collective agreements, and judicial decisions. By examining legal frameworks in selected countries such as France, Spain and Italy this study highlights the diversity of regulatory strategies and enforcement challenges. The paper concludes with recommendations as a way forward for Malaysia in balancing business needs and employee rights in an increasingly digital world.*

Keywords: *Right To Disconnect, Legal Approach, Employment, Wellbeing, Legislation*

Introduction

Today's technological advancements and digital media platforms are available around-the-clock, expecting employees to entertain their work calls even after work hours. Connectivity becomes routine. Employees even find it difficult to escape from work during outside working hours. The smartphones, e-mail, social media and so on create “endless” work and blurry boundaries between the working and rest time. The traditional way of 9-5 working hours has been transformed into hybrid work, remote-working, telework, digital workplace, and many other modern arrangements of work. Physical office seems to be an option for certain industry, and remote working or working at home has been in-trend.

Before the internet was widely utilized, workers were shut off from work as soon as they reached home. Today, it is almost impossible for employees to detach from their jobs when work calls are accessible anywhere and anytime. A study in France showed that 79 percent of managers were reading their e-mails during the evening or on holidays, and the percentage rose to 96% for the executive managers, while 49 percent of non-managerial employees were working during evenings or while on annual leave (*Observatoire du Capital humain de Deloitte et Cadremploi*, 2015). A JobStreet.com (2021) survey found almost all 54 percent workers who indicated taking annual leaves responded that they still get emergency texts from their bosses,



with only 25 percent indicated they do not get any interruptions from work during the holiday. Moreover, 78 percent leave their handphone contactable by their boss all the time, and nearly 75 percent choose to stay late at the office to complete their heavy workloads.

While flexible working arrangement becomes widespread, the demand of employers requiring employees to complete tasks and projects outside their working hours become commonplace. This transformation has raised concerns about employee's rights and matters relating to their wellbeing, mental health and work-life balance. The aim of this paper is to address the right to disconnect from the legal perspective by looking into the approaches of selected European countries such as France, Italy and Spain. This paper concludes with recommendations, especially as a way forward for Malaysia.

Literature Review

Mastercard estimates that in 2023, 78 million people works in the global gig economy and relies on the internet platforms (Pellerin, Ollier-Malaterre, Kossek, et al., 2023). This transformation leads to connectivity at any time resulting in potential hazard to employees' health (Eurofound, 2021). The long-term health risks of not having a work-life balance include burnout, low productivity, absenteeism, anxiety, chronic stress, and depression that leads to increased employee turnover, lower workplace morale, and prove costly to employers in the long run. This practice has a profound detrimental impact on employee privacy and autonomy, safety and health, productivity and compensation, and rest and leisure (Shukullari, 2021).

Definition of Right to Disconnect

The term of "right to disconnect" (RTD) has developed to acknowledge employees right to be disengaged from work and refrained from engaging in work-related electronic communications, such as emails, telephone calls or other messages, outside normal working hours (Eurofound, 2021). The employee is entitled to switch off outside of their normal working hours and enjoy their free time away from work without being disturbed, unless there is an emergency or agreement to do so, for example when "on call" (Knowledge, 2021). To Keane (2021), employee should not be expected to answer calls and emails or communicate with bosses outside of working hours. Castro, Santacruz and Solano (2022, para. 1) defines it as "the right of a worker to be able to disconnect from work and refrain from participating in electronic communications related to their employment, such as emails and messages, calls or other forms of communication, for hours non-work". It is to respect employees' time so that they can "log off" outside of their normal working hours and enjoy their free time without being disturbed by employer.

Work-life Balance

The expectation that workers will be available at almost any time for online or mobile communication is considered hazardous to workers' health (Eurofound, 2021). According to JobStreet.com (2021), 63 per cent of Malaysian workers surveyed revealed they had not been spending enough time with family due to long working hours; and about 70 percent spent two to five hours working beyond their official work hours every day, with the main reason for working overtime was unreasonable deadlines and overloading works. With greater pressures on workers to complete their task, spending time in the office easily goes beyond the 9 to 5



office hours. The expectation of availability may have a substantial impact on the employees' mental health such as feeling burnt out, tired, and stressed out (Von Bergen & Bressler, 2019). A global study conducted jointly by WHO and the International Labour Organization found that 745,000 people died from stroke and heart disease due to long working hours (WHO, 2021). A study covering the years 2000-2016 (Shukullari, 2021) suggests the increase in remote working may have further upped the risks. The long-term health risks of not having a work-life balance include burnout, low productivity, absenteeism, anxiety, chronic stress, and depression that may lead to increased employee turnover, lower workplace morale, and prove costly to employers in the long run.

The right to disconnect can benefit both individual employees and organisations. The imbalance between work and other aspects of life, the difficulty to disengage from an "always-on" culture, the addictive nature of the digital environment, and the current organisational practices that reinforce the state of connectivity not only affect the wellbeing of employees but also their productivity (Pansu, 2018). Establishing an effective work-life balance for employees is likely to reduce staff burn-out and overload, leading to a more productive workforce during working hours (Dean, 2021). Pellerin, Ollier-Malaterre, Kossek, et al. (2023) suggested the potentials of right to disconnect such as, to provide workers with their work-life balance, offer the freedom to turn down work demands without the fear of reprisal, reduce stress and ensure employees are not penalized, and reduce the burden on the health-care system by sustaining employees' mental health. It is reported that workers in companies with a right to disconnect policy having a better work-life balance than workers in companies with no such policy (92% compared with 80%) (Eurofound, 2023).

Methodology

Focusing on a doctrinal legal approach, this socio-legal approach is relevant to examine the relationship of the law in many aspects, especially that relates to the social situation. Sood (2023) suggested that legal research can sustain and remain relevant when it evolves with the society where the socio-legal approach makes it possible. By relying most on the secondary sources and the legal provisions regarding the right to disconnect that imposed by the selected European countries namely France, Italy and Spain, the analysis is made to compare the approaches of these countries where a conclusion is derived for recommendation for future position and lesson for Malaysia.

Results

Many European countries have taken initiatives by introducing the legislation that acknowledge the right to disconnect with the examples of three below.

France

The French legislator has introduced a provision in the Labour Code that makes it compulsory to include a discussion on the issues of the right to disconnect and work-life balance in the framework of the annual collective bargaining on gender equality and quality of life at work (Law No. 2016-1088 of 8 August 2016). According to Article 6.2 of the agreement, the right to disconnect is intended to ensure compliance with rest and holiday periods as well as to help balance work with personal and family life (Weber, Hurley & Mandi, 2020). This requires



companies with 50 employees or more to negotiate with employee representatives to determine the conditions of use of electronic communication tools aiming to ensure that the employees' non-work hours, vacation time, and personal and family life be respected. Companies that do not follow these rules in theory face a potential €3,750 fine and up to one year in prison for senior management concerned. In 2018, the Cour de cassation (the French highest court) ruled that an employee is entitled to extra pay whenever required to take work-related phone calls outside the regular work hours.

Italy

Italy also protects workers' right to disconnect from work outside of regular hours through the legislation. Recognised as a fundamental employee right, a draft law has been introduced to the Italian Parliament to separate an employees' personal time from work-related communications (Strada & Erboli, 2020). A Law Decree (no. 30) issued in March 2021 stated that employees have the right to disconnect from their working devices without having to face negative consequences on their salary or employment relationship; and by the end of 2021, the National protocol on remote working regulated that remote working must be organized in time slots such as to guarantee a disconnection slot (Innangard, 2022). The law focuses on employees' right to avoid receiving communications from their employer or supervisor outside of regular working hours, ensuring a minimum 12-hour period of uninterrupted rest after the end of a workday. The draft Law defines 'work-related communication' as any form of contact between employers and employees via phone, email, instant messaging services, or any kind of platforms. Any work-related communications sent outside regular working hours would not require a response unless deemed urgent or necessary. Non-compliance with the right to disconnect would result in fines ranging from EUR500 to EUR3,000 for each affected employee (Strada & Erboli, 2020).

Spain

The foundation of this right is found in Organic Law 3/2018, of 5 December, which addresses Personal Data Protection and guarantees digital rights. Additionally, Article 20 of Royal Legislative Decree 2/2015, part of the Revised Text of the Workers' Statute, specifically grants workers the right to privacy in their use of digital devices provided by employers (Delaguia & Luzon, 2023). Article 88 of Organic Law 3/2018 establishes that "Public workers and employees shall have the right to switch off devices in order to guarantee that, outside of legal or conventionally established working hours, their time off, leave and holidays are respected, in addition to their personal and family privacy". This right to switch off devices covers holidays, days off, maternity or paternity leave, etc. It begins from the moment the employee finishes the working day until the time the next one starts. Companies shall have to create internal policies regarding this right in addition to training and awareness actions (Arintass, n.d.). Non-compliance with digital disconnection policies can result in significant penalties.

Discussion

The right to disconnect has been increasingly recognized as a fundamental labor right in many European countries, including France, Italy, and Spain. These nations have enacted laws that establish clear guidelines and protections for employees, ensuring that their work-life balance is maintained by regulating work-related communications beyond working hours. France



mandates that companies negotiate terms of digital disconnection and, if no agreement is reached, implement a company-specific charter. Italy enforces a minimum 12-hour rest period and imposes fines for non-compliance. Spain extends the right to disconnect to all forms of leave and requires organizations to develop internal policies.

Malaysia, like many other developing economies, faces challenges in ensuring work-life balance, especially in an era of digitalization and remote working. While Malaysia's Employment Act 1955 provides some protection for working hours, it lacks explicit provisions regarding the right to disconnect. The absence of such legal frameworks may potentially lead to burnout, decreased productivity, and adverse mental health outcomes. To address this gap, Malaysia can introduce the right to disconnect, drawing inspiration from France, Italy, and Spain. These reforms should clearly define work-related communication boundaries. Employer and employee can always negotiate to establish work-life balance policies. Other than this, there can also be workplace training programs that educate employers and employees on the importance of digital disconnection, emphasizing long-term productivity and well-being. By adopting these measures, Malaysia can align with global best practices and safeguard employees' rights while fostering a sustainable and healthy work environment.

Conclusion

As digitalization continues to blur the lines between work and personal life, Malaysia must take proactive steps to protect employees from the risks of constant connectivity. Learning from the legal frameworks of France, Italy, and Spain, Malaysia should introduce legislative reforms and enforce policies that uphold employees' right to disconnect. By implementing clear work-related communication boundaries, fostering collective bargaining agreements, and raising awareness, Malaysia can create a healthier and more productive workforce. Embracing these changes will not only benefit employees' well-being but also contribute to long-term economic and social sustainability.

Acknowledgement

This study was supported by the Ministry of Higher Education (MoHE) of Malaysia through the Fundamental Research Grant Scheme (Ref: FRGS/1/2022/SSI12/UUM/02/4). The appreciation also goes to the Research and Innovation Management Centre of UUM for the support (SO Code 21274).

Reference

- Arintass. (n.d.). Employees' right in Spain: switch off devices. Available from: <https://www.arintass.com/employees-right-in-spain/>
- Breathe. (2024). What is right to disconnect? Available from: <https://www.breathehr.com/en-gb/resources/templates/right-to-disconnect-policy-template>
- Castro, W.H.V., Santacruz, M.A.B., & Solano, M.O.C. (2022). The Right to Disconnect: Influence on Competitiveness, Productivity and Creativity. *Mercados y Negocios*, 46(23), 5-30. <https://doi.org/10.32870/myn.vi46.7667>

- Dean, I. (2021). The "right to disconnect"— what is it, why is it important and how can you support your employees with their right to disconnect? Dentons. Available from: <https://www.dentons.com/en/insights/articles/2021/august/19/the-right-to-disconnect>. Economics and Law, 21(4), 13-22.
- Delaguia & Luzon. (2023). Right to digital disconnection and holidays: Spanish employment law explained. Available from: <https://delaguialuzon.com/en/blog/right-to-digital-disconnection-and-holidays/>
- Eurofound. (2021). Right to disconnect – definition. Available from: <https://www.eurofound.europa.eu/observatories/eurwork/industrial-relations-dictionary/right-to-disconnect>
- Eurofound. (2023). Right to disconnect: Implementation and impact at company level. European Union: Luxembourg. Available from: https://www.researchgate.net/publication/376315253_Right_to_disconnect_Implementation_and_impact_at_company_level.
- JobStreet.com. (2021, Nov 29). Malaysian Workers Aren't Getting Enough Time with Their Families. Available from: <https://www.jobstreet.com.my/career-resources/work-life-well-being/malaysian-workers-arent-getting-enough-time-families/>
- Strada, F and Erboli, T. (2024). Right to disconnect: A draft Law is under debate at the Italian Parliament. Available from: <https://knowledge.dlapiper.com/dlapiperknowledge/globalemploymentlatestdevelopments/2024/Right-to-disconnect-A-draft-Law-is-under-debate-at-the-Italian-Parliament>
- Innangard. (2022). The Right to disconnect in Italy, Belgium, Ireland and the UK. Latest developments. From Work-Life Balance Podcast. Available from: <https://innangard.global/news/the-right-to-disconnect-in-italy-belgium-ireland-and-the-uk-latest-developments-131.html>
- Keane, J. (2021). The legal right to disconnect could become the norm in Europe. Available from: <https://www.cnbc.com/2021/06/22/right-to-disconnect-could-become-the-norm-in-europe.html>
- Knowledge. (2021). Right to Disconnect - What does it mean for Employers? Available from: <https://www.mccannfitzgerald.com/knowledge/employment/right-to-disconnect-what-does-it-mean-for-employers>
- Observatoire du Capital humain de Deloitte et Cadremploi. (2015), *Qualité de vie au travail Et le bonheur?* Neuilly sur Seine: Deloitte Conseil.
- Pansu, L. (2018). Evaluation of 'Right to Disconnect' Legislation and Its Impact on Employee's Productivity. International Journal of Management and Applied Research, 5(3), pp. 99-119. doi.org/10.18646/2056.53.18-008
- Pellerin, S., Ollier-Malaterre, A., Kossek, E. E., Afota, M., Cousineau, L., Lavoie, C., Leon, E., Beham, B., Morandin, G., Russo, M., Jaga, A., Ma, J., Lu, C. and Parent-Rochelleau, X. (2023). The Right to Disconnect. Stanford Social Innovation Review. Winter 2023, 41-45.
- Shukullari, K. (2021). Work-Life Balance & the Employee Right to Disconnect. Available from: <https://peninsulacanada.com/blog/human-resources/work-life-balance-the-employee-right-to-disconnect/>
- Sood, S. (2023) Socio-Legal Approach to Research. Journal Of Legal Studies and Research. Vol. 9 (5), 5-15.
- Weber, T., Hurley, J. and Mandi, I. (2020). Right to disconnect: Legal provisions and case examples. Eurofound. Available from: <https://euagenda.eu/upload/publications/untitled-300936-ea.pdf>



WHO. (2021). Long working hours increasing deaths from heart disease and stroke: WHO, ILO. Available from: <https://www.who.int/news/item/17-05-2021-long-working-hours-increasing-deaths-from-heart-disease-and-stroke-who-ilo>

CRITICAL SUCCESS FACTORS OF DIGITAL BUSINESS PERFORMANCE: THE MEDIATING ROLE OF DIGITAL COMPETENCIES

Nurul Hidayana Mohd Noor¹
Amirah Mohamad Fuzi²

¹Faculty of Administrative Science & Policy Studies, Universiti Teknologi MARA (UiTM), Seremban, Negeri Sembilan, Malaysia, (hidayana@uitm.edu.my)

²Faculty of Administrative Science & Policy Studies, Universiti Teknologi MARA (UiTM), Shah Alam, Selangor, Malaysia, (mirahmira12@gmail.com)

Abstract: *Digital business is an economic activity based on digital technology. It will change how people manage and conduct their business and how they market business products to a broader market level and up to the international level faster and at a higher cost. Following previous studies, the factors that cause the implementation of e-digital to be less well received by some entrepreneurs are limited skill and knowledge, attitude, cost, location, and productivity factors. This study aimed to identify the relationship between factors influencing digital business performance among small business entrepreneurs in the State of Selangor and Kuala Lumpur. These factors include attitude, subjective norm, perceived behavioral control, and digital competencies. The second is to examine the mediating effect of digital competencies. The study used cluster sampling to select respondents for this study. A total of 227 entrepreneurs were accepted as final respondents for the study. The study format was a questionnaire using an online method. The data collected were processed using SPSS and AMOS. Structural Equation Modelling (SEM) was used to form the proposed model. A pilot study was conducted first using a questionnaire to test its effectiveness, which was built on 30 respondents. Four variables, namely attitude, subjective norm, perceived behavioral control, and digital competencies, were found to have positive and significant relationships with performance. Digital competencies were found to mediate the proposed relationships partially. This finding opens space for stakeholders to see and evaluate room for improvement from the study that has been conducted. This study concludes with a discussion of the findings, limitations, and suggestions for future research.*

Keywords: *Attitude, Subjective Norm, Perceived Behavioral Control, Digital Competencies, Business Performance*

Introduction

Digital business is a term used to refer to economic activities based on digital technology. Any commercial transaction through digital technology, including providing promotional information and advertising, marketing, supply, and delivery of goods or services, although payment and delivery related to these transactions may be carried out offline (Lazo-Amado et al., 2021). Individuals or companies carrying out digital business are subject to income tax in Malaysia based on the Income Tax Act 1967. Digital technology in business has opened a variety of new opportunities for entrepreneurs. In 2023, e-commerce contributed 248.16 billion Malaysian ringgit to the gross domestic product (GDP), an increase of around nine billion

Malaysian ringgit compared to the previous year (Amanda, 2025). The limited use of social media and e-commerce shows that small businesses have achieved a high level of computerization but are still struggling to bridge the digitalization gap that can significantly increase business profits and productivity (Setkute & Dibb, 2022). Some businesses do not plan to use e-commerce because they are more confident in doing business traditionally. This shows that businesses have achieved a high level of computerization but face difficulties in digitizing their businesses, which requires changes and the development of a digital workforce (Akpan et al., 2022). Burns (2022) also stated that the online presence of most businesses is still lacking despite having an internet connection. This situation causes businesses to have limited customer access and less effective marketing and services. Businesses also face difficulty accessing talent due to a lack of capacity (Mohd Noor et al., 2024a). Bai et al. (2021) opined that a lack of digital literacy and an inability to adapt to new technologies are the main obstacles to implementing digital transformation. In the Malaysian context, studies by Minai et al. (2021) and Noor and Omar (2024) showed that the main challenges faced by small entrepreneurs are a lack of knowledge about digital marketing tools and challenges in gaining access to the required technology.

Therefore, this article will briefly review the factors that could influence the digital performance of small business entrepreneurs. This study aimed to identify the relationship between factors influencing digital business performance among small business entrepreneurs in the State of Selangor and Kuala Lumpur. These factors include attitude, subjective norm, perceived behavioral control, and digital competencies. The second is to examine the mediating effect of digital competencies. The study believes there is a lack of research and empirical evidence on digital competencies as a mediator that provides a meaningful contribution to explaining factors that influence small business performance. The difficulty of mastering new technologies significantly impacts the smooth digital transformation of businesses (Lee et al., 2021). Most social media platforms offer features that allow entrepreneurs to conduct business directly. In addition to Shopee, many small business owners who sell clothing, food, and cosmetics are increasingly passionate about making sales through live broadcasts on Instagram, Facebook, and TikTok accounts. It is easy to generate quick profits with only a smartphone and an attractive personality. Unfortunately, for small businesses, a lack of skills in the field of ICT is the main factor that hinders the efficiency of business transition to digital platforms (Lim & Teoh, 2021). Studies on digital competencies as a mediator in Malaysia are limited to date. Secondly, social researchers acknowledge the narrow scope of the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which includes three original components, namely attitudes, subjective norms, and perceptions of behavioral control; most of the research using TPB to predict intention in explaining behavior is less robust. In this study, the digital competencies variable was added to further increase the model. Therefore, further studies need to be conducted to determine whether the constructs of attitudes, subjective norms, perceived behavioral control, and digital competencies can increase small entrepreneurs' successful behavior, which leads to overall business performance.

Literature Review

Theory of Planned Behaviour

The study of human psychological factors began with a theory of planned behavior (TPB) introduced by a prominent social psychology professor named Icek Ajzen in the late 1980s. This social psychological theory aims to explain and predict human behavior by considering



the role of attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). This theory states that a person's behavioral intentions are influenced by their attitudes toward the behavior, their perceptions of the social norms surrounding the behavior, and their control over performing the behavior. These intentions, in turn, are believed to strongly influence the likelihood of engaging in the behavior. TPB has been widely used in various fields to understand and modify human behavior, such as health description, consumer behavior, and organizational psychology.

Attitude elements include beliefs (belief-cognitive), feelings (feeling-affective), and behavior, or are referred to as cognitive, affective, and action components. However, according to Ajzen (1991), there are also situations where a person shows a positive attitude but does not show the desired behavior. According to Ajzen (1991), this could be due to the subjective norm element that can overcome attitude in determining behavior. The subjective norm element is related to the normative pressure that comes from the belief formed from a person's perception of how people around them give feedback on behavior. Belief in acceptance comes from important people in the individual's environment such as peers, family, local community, and colleagues. Behavioral control perception is a new element added to the original TPB theory, namely the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975). TRA has been found to have limitations in predicting behavior when a person is faced with a situation outside of their control (Ajzen, 1991). The element of perceived behavioral control is a person's belief in the feasibility of the behavior based on considerations influenced by internal and external factors (Kobbeltvedt & Wolff, 2009). This element focuses on the individual's belief in the existence of factors that weaken or strengthen them to act. These factors include self-efficacy and the expected opportunity to carry out the behaviour successfully (Ajzen, 1991). Self-efficacy is an internal factor, namely self-confidence in being able to act and will be successful in carrying out the behavior (Malodia et al., 2023). Next, external factors such as the existence of environmental situations or resources can help the implementation of the behavior. Internal and external perceptions influence a person's intention to act, and vice versa.

Digital Business Performance

Digital business is a business activity that is carried out digitally with the use of advanced technology. In addition, the digital lifestyle is a cashless society, application-based businesses, a 'smart' country, and virtual service (Olson et al., 2021). In Malaysia, a unique corporation has been established to resolve issues related to digital SMEs, namely the Malaysia Digital Economy Corporation (MDEC). With the popularity of the Internet and mobile technology and the widespread reliance on online social media, sharing views and experiences with customers and brand knowledge has become a new thing in the marketing field (Wielgos et al., 2021). However, economists say that using smartphones alone is not enough to put SMEs at a proud level in the use of the digital economy. In addition, the spread of the COVID-19 pandemic has had a significant impact on the national economy, especially businesses. This is because they cannot conduct business as usual and comply with the movement control order (MCO) given by the government to combat the spread of the epidemic. Because of this, some entrepreneurs have had to go out of business or close their businesses due to insufficient financial resources to continue their business. Some entrepreneurs have low incomes and only have them when running a business. However, this pandemic situation is the best opportunity for businesses to conduct economic activities digitally. The government has helped entrepreneurs and business owners maintain operations through the implementation of promotional and advertising

initiatives. Some researchers have stated that specific product categories sold online are better than others (Broekhuizen et al., 2021; Noor, 2024).

Digital business consists of five essential elements: website, e-commerce, social media, communication medium, and marketplace (Palmié et al., 2022). The most important component in the digital business world is a business website that functions as a virtual store. This virtual store operates 24 hours a day and can be visited by anyone from all over the world who has access to the Internet (Noor, 2024). To attract the attention of website visitors, the website must be neat and systematically organized to make it easier for potential buyers to recognize the products or services offered (Dolega et al., 2021). The website can be combined with the e-commerce function for physical products to make it easier for buyers to place orders. Social media can attract traffic to visit the business website (Dolega et al., 2021).

E-commerce is a digital trading system used to purchase transactions directly via debit or credit methods using a payment gateway integrated into the website (Dolega et al., 2021). E-commerce systems can also be used to control incoming and outgoing inventory, monitor the delivery status of goods to customers, and collect customer information in a database (Santos et al., 2023). Social media is the door to a digital store. Facebook and Instagram are popular social media platforms that share information about a product or service. Links to websites can be placed on social media to attract traffic to a business website (Dwivedi et al., 2023). Facebook Messenger, WhatsApp, and email are the bridges that connect buyers or prospects with sellers. Communication mediums are used as a channel for prospects or potential buyers to obtain further information regarding a product or service or information regarding payment and delivery. The marketplace is a business ecosystem developed by third parties such as Lazada, Zalora, Mudah.my, and Ali Baba, which provides a complete business infrastructure and market space to sellers and buyers (Almunawar & Ansari, 2022). Sellers need to pay a certain service fee to use these facilities.

Attitude, Subjective Norm, Perceived Behavioural Control, and Digital Business Performance

Attitude is critical in predicting behavior that can determine digital business success (Qasim et al., 2024). According to Ajzen (1991), attitude refers to a clear picture of a person's feelings expressed through behavior. For example, suppose an entrepreneur has a high risk-taking attitude. In that case, he or she can become an entrepreneur who is brave enough to venture into various types of businesses, including digital business, according to current conditions (Fahmi & Savira, 2023). A positive entrepreneurial attitude provides opportunities for individuals to generate creative business ideas and develop unique products or services that have potential in the market (Wardana et al., 2023). The confidence of entrepreneurs to manage digital business is, to some extent, influenced by the social environment (Lyu et al., 2022). In social science, research on this social environment is a source of learning and knowledge for forming actual behavior (Soluk et al., 2021). Studies on the decision stage of entrepreneurs' behavior toward accepting e-commerce are evaluated from the influence of obstacles, feedback, and support from human and non-human elements (Nafees et al., 2021). Ajzen (1991) defines subjective norms as the perception of other people's reactions to the work that a person will carry out. In short, subjective norms focus on how the support given by individuals from the social environment has a strong enough influence to encourage the implementation of certain behaviors. When subjective norms have a significant influence on



the intention and subsequent behavior, this means that the role played by the reference group as a driver of behavioral decisions is considered successful (Ajzen, 1991).

Apart from attitudinal factors and subjective norms, perception of behavioral control is also important in predicting individual behavior to accept a technology (Al-Mamary & Alraja, 2022). Perception of behavioral control is an aspect of humanity that assesses the influence of self-efficacy and the environment of encouragement on the behavior of accepting a change (Mir et al., 2023). Taylor and Todd (1995) have broken down the structure of this control belief into three constructs: self-efficacy, resource, and technology-driven atmosphere. Perception of behavioural behavioral related to the individual's perception of his or her ability to control actions to carry out what is desired. This construct is reported to be able to influence the individual's desire or desire to carry out his or her actions. In the context of e-commerce adoption, entrepreneurs with a higher level of confidence and trust are seen to have the potential to perform behavior better than entrepreneurs who are less confident in their abilities (Malodia et al., 2023; Mohd Noor et al., 2023). Although entrepreneurs assume that they can control the degree of control of the actions they want to take, their behavioral decisions still depend on resources, opportunities, knowledge, and skills. This is in line with the statement by Ajzen (1991), which explains that an individual's degree of control and ability is based on the resources and opportunities that exist within and outside the individual.

Venkatesh et al. (2003) define a push environment as a situation where individuals are convinced that the existing organizational and technical infrastructure supports using an information system. A push environment also refers to the availability of efficient and extensive technological infrastructure facilities and supports the use of new technology. When resources that support digital business are not available and sufficient, this will hinder the implementation process of entrepreneurs' behavior (Jha et al., 2022). Among the obstacles that hinder the adoption of e-commerce are capital constraints, lack of technical skills and expertise, compromised system problems, and poor internet access (Sahut et al., 2021). Entrepreneurs who are primarily concentrated in developed regions have the advantage of enjoying a variety of sophisticated technological infrastructure facilities and high-speed and stable Internet networks (Kumar et al., 2024).

The Mediating Role of Digital Competencies

According to Bartolomé et al. (2022), factors that influence the use of ICT among individuals are the level of skills in using ICT, expertise in operating ICT equipment, and stagnant thinking about the advantages of ICT. It was found that entrepreneurs know about the importance of ICT in business, but still, many entrepreneurs do not apply ICT in their businesses (Triyono et al., 2023). Based on the SME Annual Report (2022), apart from low broadband quality, other significant challenges faced by businesses in overcoming digitalization barriers are lack of understanding about the use of digital tools, lack of information about technology, lack of awareness about financing options, and limited access to technology. To develop an ICT ecosystem conducive to businesses, most entrepreneurs need assistance in financing, followed by technology and the development of employee skill sets (Garcez et al., 2022; Noor, 2025). The current definition of competencies does not only mean mastery of reading, writing, and arithmetic, but also mastery of another knowledge (d'Ignazio et al., 2025). This includes mastering strategies and skills related to critical and creative thinking. Clearly, the general framework of becoming a digital entrepreneur shows that competencies are an important

element and must be present in a person (Mohd Noor et al., 2024b). According to Ostrovska et al. (2021), technical skills and knowledge involve the ability to use specific knowledge and techniques in the fields of finance, accounting, and marketing. These are acquired through formal education and experience in daily life. Garcez et al. (2022) state that competencies are essential especially in solving problems related to the business being carried out, how to market a product, how to prepare a budget, and how to prepare a profit and loss statement. According to Elnadi and Gheith (2023), digital competencies also involve analyzing, anticipating, identifying opportunities, recovering, making decisions, and monitoring to develop and continue a digital business. Digital competencies focus on several aspects, namely communication, collaboration, management, metacognitive abilities, design, and integration (d’Ignazio et al., 2025).

Based on the above reasonings, the following hypotheses are posited:

- H1: Attitude significantly predicts the digital business performance of small businesses.
- H2: Subjective norm significantly predicts the digital business performance of small businesses.
- H3: Perceived behavioural control predicts the digital business performance of small businesses.
- H4: Digital competencies predict the digital business performance of small businesses.
- H5: Digital competencies mediate the relationships between (a) attitude, (b) subjective norm, (c) perceived behavioral control, and digital business performance of small businesses.

Figure 1 portrays the research model of the study.

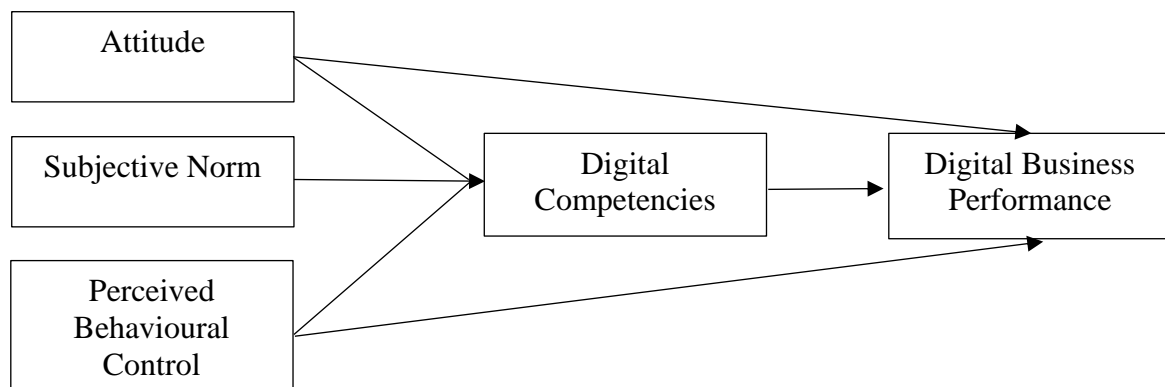


Figure 1: Research Model

Methodology

This study uses a quantitative approach through face-to-face surveys. A set of questionnaires was designed and used as a study instrument to obtain data. A total of 300 respondents were selected based on cluster sampling techniques to randomly obtain small business entrepreneurs in the Kuala Lumpur and Selangor areas. This is sufficient because, according to Hair et al. (2010), a sample size of 200-400 is sufficient for a research study. Several areas identified are around Kuala Lumpur and Selangor, namely around Cheras, Kerinchi, Bangsar, Putrajaya, Kajang, Bangi, Petaling Jaya, and Shah Alam. The sample was selected based on typical urban areas with metropolitan characteristics and more modern socioeconomics to obtain a good

population. In this regard, the selection of areas for this study considered urban residents with a high probability of being involved in the online business system.

The selection of this area is also based on the modernity characteristics, which coincide with the characteristics of ICT users and the position of the area, which is also near the Multimedia Super Corridor (MSC), which implements the rapid use of ICT. The measurement items used for the questionnaire were identified from previous research highlights. To capture three core components in the TPB, items were adopted from Liñán and Chen (2009). Among the items are “Being a digital entrepreneur implies more advantages than disadvantages for me,” “A career as a digital entrepreneur is attractive to me,” and “If I decided to create a digital firm, my closest family would approve of that decision.” Six items were adapted from the research of Rubach and Lazarides (2021) to measure digital competencies. Some examples of items are “I can identify and use appropriate sources in digital environments based on my information needs” and “I can use search strategies in digital environments.” Six items for sustainable performance were adapted from Mitra and Datta’s (2014) and Hanim Mohamad Zailani et al.’s (2012) studies. Examples include “We have well-managed relationship with suppliers” and “We strongly consider stakeholders’ welfare.”

All variables were measured with a Likert scale from (1) 'strongly disagree' to (5) 'strongly agree.' Structural Equation Modeling (SEM) analysis was used using two levels of structured modeling. The first level involved testing Confirmatory Factor Analysis (CFA) to test the unidimensionality, validity, and reliability of the measurement items used, while the second level involved testing structured modeling to test the effect. This study used IBM® SPSS® version 27 software to analyze the initial data and IBM®Amos version 26 to test the hypothesis of structured modeling.

Findings

Demographics Profile

A total of 227 entrepreneurs were accepted as final respondents for the study. Most respondents are in the age group of 31 to 40 years old (n=124, 54.7%). The age range of 51 to 60 is the smallest number of respondents, only five people or 2.2%. In terms of gender, most respondents who participated in this survey consisted of women, representing 189 people (83.3%) compared to men. Most respondents also have a high level of education, namely undergraduate qualifications, representing 89 people (39.2%). In addition, most respondents run a food-based business, representing 70 people (30.9%). When looking at the duration of the business, most respondents are still new to the business field. Most of them have been in business for less than three years, 71 people (31.3%). As for the monthly income profile, most respondents earn an income of RM2001 to RM3000 (n=100, 44.1%).

Confirmatory Factor Analysis (CFA)

AMOS analysis can identify the compatibility of the study model (goodness of fit), described in the Model of Fit. According to Arbuckle (2015), CMIN/DF is known as relative chi-square. Although there is no set value, according to Kline (1998), this ratio should be less than 3. This study obtained a CMIN/DF value of 2.554, which is less than 3, reflecting the quality of the model compared to the assumed model. The Normed Fit Index (NFI) (0.920), Tucker Lewis

Index (TLI) (0.910), and Goodness of Fit Index (GFI) (0.930) values are close to 1, indicating a good model (Byrne et al., 1989). The root mean square error of approximation (RMSEA) value obtained from this study is 0.0670. $RMSEA \leq 0.080$ are considered acceptable. Thus, it can be concluded that the model formed has compatibility between the variables. Figure 2 shows the CFA result.

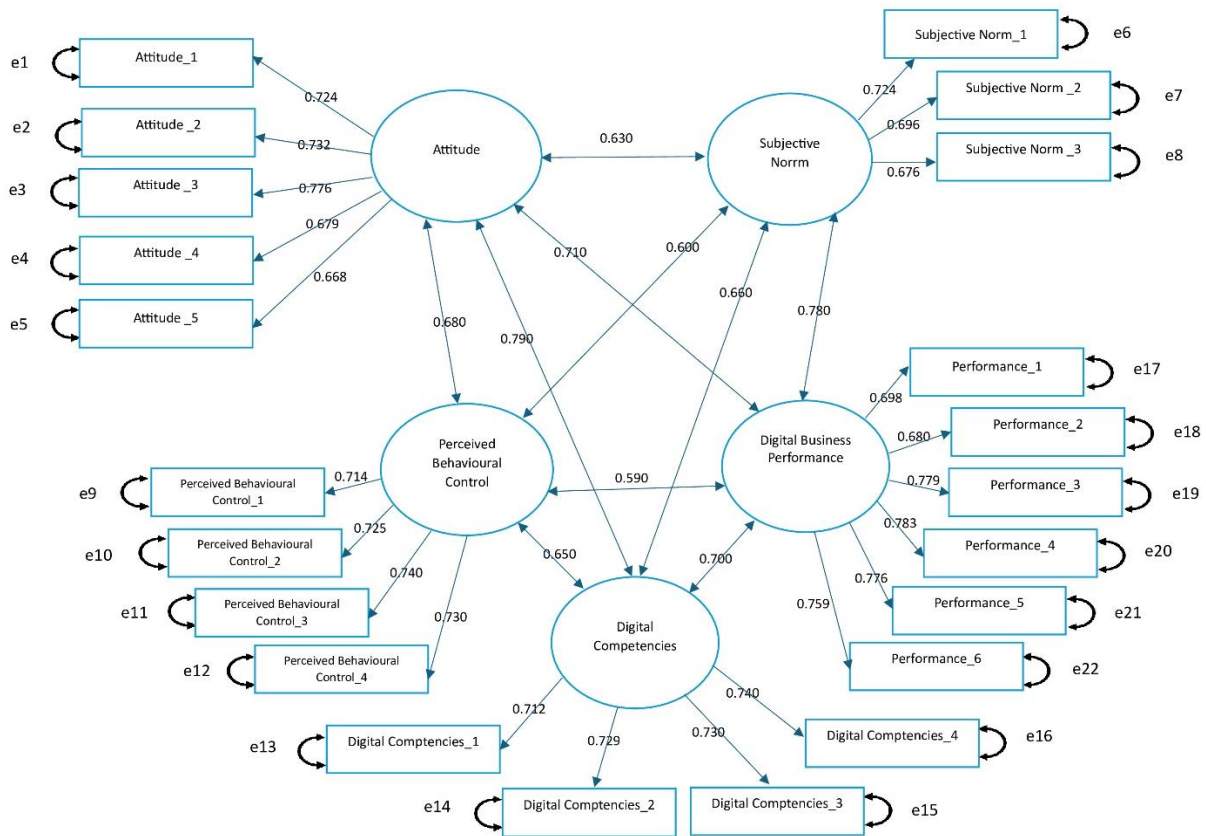


Figure 2: CFA Results

Validity and Reliability Tests

All items in this construct did achieve good factor weights (λ) of more than 0.50, the composite reliability (CR) exceeded 0.70, and the AVE value exceeded 0.50. Thus, all dimensions of the construct were accepted as achieving a good level of internal consistency reliability. The internal consistency reliability test is also at a reasonable level based on Cronbach's alpha (α) value exceeding 0.60. Table 1 details the results of the convergent validity and internal consistency reliability analysis of the constructs.

Table 1: Validity and Reliability Test Results

Variable	Items	Item Loadings	α	AVE	CR
Attitude	Attitude_1	0.724***	0.772	0.680	0.820
	Attitude_2	0.732***			
	Attitude_3	0.776***			
	Attitude_4	0.679***			
	Attitude_5	0.668***			
Subjective Norm	Subjective Norm_1	0.724***	0.804	0.700	0.854
	Subjective Norm_2	0.696***			
	Subjective Norm_3	0.676***			
Perceived Behavioural Control	Perceived Behavioural Control_1	0.714***	0.815	0.688	0.862
	Perceived Behavioural Control_2	0.725***			
	Perceived Behavioural Control_3	0.740***			
	Perceived Behavioural Control_4	0.730***			
Digital Competencies	Digital Competencies_1	0.712***	0.780	0.640	0.840
	Digital Competencies_2	0.729***			
	Digital Competencies_3	0.730***			
	Digital Competencies_4	0.740***			
Digital Business Performance	Performance_1	0.698***	0.814	0.702	0.830
	Performance_2	0.680***			
	Performance_3	0.779***			
	Performance_4	0.783***			
	Performance_5	0.776***			
	Performance_6	0.759***			

Discriminant Validity

Discriminant validity tests are performed to ensure that each construct differs from the others. For this test, the mean square value of the average extracted variance (AVE) is compared with the relationship between the constructs (Hair et al., 2010). Based on the results shown in Table 2, each item is interconnected between its respective constructs but different from other constructs.

Table 2: Discriminant Validity

No.	Variable	1	2	3	4	5
1	Attitude	0.825				
2	Subjective Norm	0.630**	0.837			
3	Perceived Behavioural Control	0.680**	0.600**	0.829		
4	Digital Competencies	0.790**	0.660**	0.650**	0.800	
5	Digital Business Performance	0.710**	0.780**	0.590**	0.700**	0.837

Note: Values in the diagonal show the square root of AVE



Hypothesis Testing

From Table 3, it can be concluded that attitude ($\beta=0.308^{***}$), subjective norm ($\beta =0.332^{***}$), perceived behavioral control ($\beta=0.260^{***}$), and digital competencies ($\beta=0.209^{***}$) have a significant influence on sustainable performance due to their probability value, which shows a value of 0.000 which means <0.05 . Thus, H1, H2, H3, and H4 were accepted. Then, the results also show that attitude ($\beta=0.670^{***}$), subjective norm ($\beta=0.520^{***}$), and perceived behavioral control ($\beta=0.480^{***}$) significantly influence digital competencies. Mediation analysis is discussed in Table 5. The results have proved that there are significant mediation effects of digital competencies towards the relationships between attitude ($\beta=0.140^{***}$), subjective norm ($\beta=0.109^{***}$), perceived behavioral control ($\beta=0.101^{***}$), and digital business performance. Lower-Level Confidence Intervals (LLCI) and Upper-Level Confidence Intervals (ULCI) values do not contain zero. Thus, H(a), H5(b), and H5(c) are accepted.

Table 3: Assessment of the Structural Model

Path	β	Bootstrap (95% CI)	
		Lower- Level Confidence Intervals (LLCI)	Upper- Level Confidence Intervals (ULCI)
Standardized Direct Effects			
Attitude → Digital Business Performance	0.308***		
Subjective Norm → Digital Business Performance	0.332***		
Perceived Behavioural Control → Digital Business Performance	0.260***		
Digital Competencies → Digital Business Performance	0.209***		
Attitude → Digital Competencies	0.670***		
Subjective Norm → Digital Competencies	0.520***		
Perceived Behavioural Control → Digital Competencies	0.480***		
Standardized Indirect Effects (Mediation Effect via Digital Competencies)			
Attitude → Digital Business Performance	0.140***	0.074	2.220
Subjective Norm → Digital Business Performance	0.109***	0.700	2.219
Perceived Behavioural Control → Digital Business Performance	0.101***	0.730	2.240
Standardized Total Effects (Direct Effect + Indirect Effect)			
Attitude → Digital Business Performance	0.448***		
Subjective Norm → Digital Business Performance	0.441***		
Perceived Behavioural Control → Digital Business Performance	0.361***		

Note: ***Paths are significant at the 1% level ($p < 0.01$). ***Indirect effects are significant at the 1% level with bootstrap at 5000 and bias-corrected percentile method

Discussion

Four variables, namely attitude, subjective norm, perceived behavioral control and digital competencies, were found to have positive and significant relationships with performance. Digital competencies were found to mediate the proposed relationships partially. The contribution of this study is that this study can contribute to the field of entrepreneurship in Malaysia. This is because the study focuses on attitude, subjective norms, and perceived behavioral control that can improve digital entrepreneurship performance. This study has also shown that digital competencies are critical in ensuring the survival and viability of businesses in the post-COVID-19 era. Thus, entrepreneurs need the knowledge and skills to use digital marketing mediums such as Search Engine Optimization (SEO) and e-commerce platforms



such as Lazada, Shopee, Zalora, and other social media applications (Garcez et al., 2022). It is a challenge for a business if the business owner does not have the skills even though they already have good infrastructure and facilities (d'Ignazio et al., 2025). Digitalization in business can further boost business marketing if they have the skills to market online (Ostrovskaya et al., 2021).

Suggestions that can be made to improve digital entrepreneurship are to increase advocacy and promotion programs, provide development training guidance, and provide loan assistance schemes for entrepreneurs (Lee et al., 2021). The development and provision of these programs must be monitored regularly so that the impact of entrepreneurship success is higher, and they can survive and be competitive in today's business market. Governments and agencies involved play a vital role in creating a digital environment so that online businesses can be supported and accessed by all communities in urban and rural areas. Government policies and regulations, copyright, consumer rights laws, and enforcement are said to encourage or hinder entrepreneurs' use of digital technology. The friendly and supportive environmental regulation in the use of digital technology is important because it can encourage its use by organizations (Malodia et al., 2023). The strategic approach also includes trust and confidence in e-commerce, improving the legal and regulatory framework, strengthening infrastructure and logistical support for e-commerce, and optimizing economic and social benefits (Fahmi & Savira, 2023). This study also recommends that entrepreneur development programs conducted by government and private agencies focus on the critical success factors. Entrepreneurs and potential entrepreneurs must also be given information and awareness to participate in entrepreneur development programs through various effective strategies and campaigns. This step is important to ensure an increase in new entrepreneurs, empower existing entrepreneurs, and reduce the number of entrepreneurs who experience bankruptcy and business failure. Proper advisory and training services can improve the knowledge and skills of digital entrepreneurs, thus making them more competitive in a challenging business environment (Garcez et al., 2022).

Conclusion

Through an e-commerce system, it can move a business forward even without having an extensive business premise or requiring many employees. By having perfect and suitable IT equipment such as computers, modems, Internet, and telephone lines, products and services can be advertised via the Internet online. This allows millions of users to browse advertisements placed online, and this allows them to make choices about the products or services needed. This research paper has provided a clear understanding of the role and influence of attitude, subjective norm, perceived behavioral control, and digital competencies on digital business performances in the Malaysian market. This study also explains the influence of digital competencies as a mediator. For future research suggestions, this study could extend the sample selection to other states or areas. In addition, it is also suggested that the study be conducted qualitatively with the involvement of respondents from more than one state. Suggestions for future research include in-depth interviews or focus groups with entrepreneurs to obtain their views, perceptions, and experiences using digital media and managing digital businesses.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Akpan, I. J., Udoh, E. A. P., & Adebisi, B. (2022). Small business awareness and adoption of state-of-the-art technologies in emerging and developing markets, and lessons from the COVID-19 pandemic. *Journal of Small Business & Entrepreneurship*, 34(2), 123-140.
- Al-Mamary, Y. H. S., & Alraja, M. M. (2022). Understanding entrepreneurship intention and behavior in the light of TPB model from the digital entrepreneurship perspective. *International Journal of Information Management Data Insights*, 2(2), 100106.
- Almunawar, M. N., & Anshari, M. (2022). Digital enabler and value integration: revealing the expansion engine of digital marketplace. *Technology Analysis & Strategic Management*, 34(7), 847-857.
- Amanda, S. (2025). *Contribution of e-commerce to the GDP of Malaysia 2015-2023*. Retrieved from <https://www.statista.com/statistics/956908/e-commerce-contribution-to-gdp-malaysia/>
- Arbuckle, J. L. (2014). *IBM SPSS Amos 23.0 user's guide*. AMOS Development Corporation.
- Bai, C., Quayson, M., & Sarkis, J. (2021). COVID-19 pandemic digitization lessons for sustainable development of micro-and small-enterprises. *Sustainable Production and Consumption*, 27, 1989-2001.
- Bartolomé, J., Garaizar, P., & Larrucea, X. (2022). A pragmatic approach for evaluating and accrediting digital competence of digital profiles: A case study of entrepreneurs and remote workers. *Technology, Knowledge and Learning*, 27(3), 843-878.
- Broekhuizen, T. L., Broekhuis, M., Gijzenberg, M. J., & Wieringa, J. E. (2021). Introduction to the special issue–Digital business models: A multi-disciplinary and multi-stakeholder perspective. *Journal of Business Research*, 122, 847-852.
- Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin*, 105(3), 456–466.
- Burns, P. (2022). *Entrepreneurship and small business*. Bloomsbury Publishing.
- d'Ignazio, A., Finaldi Russo, P., & Stacchini, M. (2025). Micro-entrepreneurs' financial and digital competencies during the pandemic in Italy. *Italian Economic Journal*, 1-37.
- Dolega, L., Rowe, F., & Branagan, E. (2021). Going digital? The impact of social media marketing on retail website traffic, orders, and sales. *Journal of Retailing and Consumer Services*, 60, 102501.
- Dwivedi, Y. K., Ismagilova, E., Rana, N. P., & Raman, R. (2023). Social media adoption, usage and impact in business-to-business (B2B) context: A state-of-the-art literature review. *Information Systems Frontiers*, 1–23.
- Elnadi, M., & Gheith, M. H. (2023). The role of individual characteristics in shaping digital entrepreneurial intention among university students: Evidence from Saudi Arabia. *Thinking Skills and Creativity*, 47, 101236.
- Fahmi, F. Z., & Savira, M. (2023). Digitalization and rural entrepreneurial attitude in Indonesia: a capability approach. *Journal of Enterprising Communities: People and Places in the Global Economy*, 17(2), 454-478.

- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research* (Vol. 6). Reading, MA: Addison-Wesley.
- Garcez, A., Franco, M., & Silva, R. (2022). The soft skills bases in digital academic entrepreneurship in relation to digital transformation. *Innovation & Management Review*, 20(4), 393-408.
- Hair, J. F. J., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis. A global perspective* (7th Ed.). USA: Prentice Hall.
- Hanim Mohamad Zailani, S., Eltayeb, T. K., Hsu, C. C., & Choon Tan, K. (2012). The impact of external institutional drivers and internal strategy on environmental performance. *International Journal of Operations & Production Management*, 32(6), 721-745.
- Jha, A., Sindhwani, R., Dwivedi, A., & Saddikuti, V. (2022). Sustainable recovery for digital entrepreneurs with shared resources: Enablers, challenges, and solutions. *Journal of Asia Business Studies*, 16(3), 515-537.
- Kline, R. B. (1998). *Principles and practice of structural equation modeling*. Guilford Press.
- Kobbeltvedt, T., & Wolff, K. (2009). The risk-as-feelings hypothesis in at Theory-of-planned-behavior perspective. *Judgment and Decision Making*, 4, 567-586.
- Kumar, V., Sindhwani, R., Behl, A., Kaur, A., & Pereira, V. (2024). Modelling and analysing the enablers of digital resilience for small and medium enterprises. *Journal of Enterprise Information Management*, 37(5), 1677-1708.
- Lazo-Amado, M., Cueva-Ruiz, L., & Andrade-Arenas, L. (2021). E-Business model to optimize sales through digital marketing in a Peruvian Company. *International Journal of Advanced Computer Science and Applications*, 12(11).
- Lee, Y. Y., Falahat, M., & Sia, B. K. (2021). Drivers of digital adoption: A multiple case analysis among low and high-tech industries in Malaysia. *Asia-Pacific Journal of Business Administration*, 13(1), 80-97.
- Lim, C. H., & Teoh, K. B. (2021). Factors influencing the SME business success in Malaysia. *Annals of Human Resource Management Research*, 1(1), 41-54.
- Liñán, F., & Chen, Y. (2009). Development and cross-cultural application of a specific instrument to measure entrepreneurial intentions. *Entrepreneurship Theory and Practice*, 33(3), 593-617.
- Lyu, C., Peng, C., Yang, H., Li, H., & Gu, X. (2022). Social capital and innovation performance of digital firms: Serial mediation effect of cross-border knowledge search and absorptive capacity. *Journal of Innovation & Knowledge*, 7(2), 100187.
- Malodia, S., Mishra, M., Fait, M., Papa, A., & Dezi, L. (2023). To digit or to head? Designing digital transformation journey of SMEs among digital self-efficacy and professional leadership. *Journal of Business Research*, 157, 113547.
- Minai, M. S., Raza, S., & Segaf, S. (2021). Post COVID-19: Strategic digital entrepreneurship in Malaysia. In *Modeling economic growth in contemporary Malaysia* (pp. 71-79). Emerald Publishing Limited.
- Mir, A. A., Hassan, S., & Khan, S. J. (2023). Understanding digital entrepreneurial intentions: A capital theory perspective. *International Journal of Emerging Markets*, 18(12), 6165-6191.

- Mitra, S., & Datta, P. P. (2014). Adoption of green supply chain management practices and their impact on performance: An exploratory study of Indian manufacturing firms. *International Journal of Production Research*, 52(7), 2085-2107.
- Mohd Noor, N. H., Mohamad Fuzi, A., & El Ashfahany, A. (2023). Institutional support and self-efficacy as catalysts for new venture performance: A study of iGen entrepreneurs. *Journal of Entrepreneurship and Public Policy*, 12(3/4), 173-196.
- Mohd Noor, N. H., Omar, N., Mohamad Fuzi, A., Md Zaini, S., & Mohd Beta, R. M. D. (2024). Advocating women entrepreneurs' success in a developing country: An explanatory analysis. *Journal of Emerging Economies & Islamic Research*, 12(1).
- Mohd Noor, N. H., Yaacob, M. A., & Omar, N. (2024). Do knowledge and personality traits influence women entrepreneurs' e-commerce venture? Testing on the multiple mediation model. *Journal of Entrepreneurship in Emerging Economies*, 16(1), 231-256.
- Nafees, L., Cook, C. M., Nikolov, A. N., & Stoddard, J. E. (2021). Can social media influencer (SMI) power influence consumer brand attitudes? The mediating role of perceived SMI credibility. *Digital Business*, 1(2), 100008.
- Noor, N. H. M. (2024). Mengejar makhluk mitos–Syarikat unicorn: mengenalpasti kejayaan perniagaan baru dalam dunia digital. *Journal of Entrepreneurship and Business*, 12(2), 1-19.
- Noor, N. H. M. (2025). An Investigation of Innovation Mindset, Entrepreneurial Knowledge, and Success of Small Businesswomen. In *The Future of Small Business in Industry 5.0* (pp. 57-84). IGI Global Scientific Publishing.
- Noor, N. H. M., & Omar, N. (2024). Menangani ketaksamaan gender dalam keusahawanan: Cabaran usahawan wanita dari kumpulan berpendapatan rendah (B40). *Sains Insani*, 9(1), 34-46.
- Olson, E. M., Olson, K. M., Czaplewski, A. J., & Key, T. M. (2021). Business strategy and the management of digital marketing. *Business Horizons*, 64(2), 285-293.
- Ostrovskaya, H., Tsikh, H., Strutynska, I., Kinash, I., Pietukhova, O., Golovnya, O., & Shehynska, N. (2021). Building an effective model of intelligent entrepreneurship development in digital economy. *Eastern-European Journal of Enterprise Technologies*, 6(13), 114.
- Palmié, M., Miché, L., Oghazi, P., Parida, V., & Wincent, J. (2022). The evolution of the digital service ecosystem and digital business model innovation in retail: The emergence of meta-ecosystems and the value of physical interactions. *Technological Forecasting and Social Change*, 177, 121496.
- Qasim, D., Shuhaiber, A., Bany Mohammed, A., & Valeri, M. (2024). E-entrepreneurial attitudes and behaviors in the United Arab Emirates: An empirical investigation in the digital transformation era. *European Journal of Innovation Management*, 27(8), 3014-3034.
- Rubach, C., & Lazarides, R. (2021). Addressing 21st-century digital skills in schools – Development and validation of an instrument to measure teachers' basic ICT competence beliefs. *Computers in Human Behavior*, 115, 106636.
- Sahut, J. M., Iandoli, L., & Teulon, F. (2021). The age of digital entrepreneurship. *Small Business Economics*, 56(3), 1159-1169.



- Santos, V., Augusto, T., Vieira, J., Bacalhau, L., Sousa, B. M., & Pontes, D. (2023). E-commerce: Issues, opportunities, challenges, and trends. Promoting organizational performance through 5G and agile marketing, 224-244.
- Setkute, J., & Dibb, S. (2022). "Old boys' club": Barriers to digital marketing in small B2B firms. *Industrial Marketing Management*, 102, 266-279.
- SME Annual Report (2022). *MSME Insights 2022/23 New Release*. Retrieved from https://smecorp.gov.my/images/Publication/MSME_Insights/2022_23/3Chapter%202_Performance%20of%20MSMEs%20in%20Malaysia.pdf
- Soluk, J., Miroshnychenko, I., Kammerlander, N., & De Massis, A. (2021). Family influence and digital business model innovation: The enabling role of dynamic capabilities. *Entrepreneurship Theory and Practice*, 45(4), 867-905.
- Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, 6(4), 144-176.
- Triyono, M. B., Mutohhar, F., Kholifah, N., Nurtanto, M., Subakti, H., & Prasetya, K. H. (2023). Examining the mediating-moderating role of entrepreneurial orientation and digital competence on entrepreneurial intention in vocational education. *Journal of Technical Education and Training*, 15(1), 116-127.
- Venkatesh, V., Morris, M. G., Davis, F. D., & Davis, G. B. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.
- Wardana, L. W., Indrawati, A., Maula, F. I., Mahendra, A. M., Fatihin, M. K., Rahma, A., ... & Narmaditya, B. S. (2023). Do digital literacy and business sustainability matter for creative economy? The role of entrepreneurial attitude. *Heliyon*, 9(1).
- Wielgos, D. M., Homburg, C., & Kuehnl, C. (2021). Digital business capability: Its impact on firm and customer performance. *Journal of the Academy of Marketing Science*, 49(4), 762-789.

E-WASTE RECYCLING BEHAVIOUR IN MALAYSIA: AN INTEGRATION OF THEORY OF PLANNED BEHAVIOUR

Nur Batrisyia Nordin ¹
Nurul Hidayana Mohd Noor²
Mahazril ‘Aini Yaacob³

¹Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM), Shah Alam, Selangor, Malaysia, (batrisyiaida@gmail.com)

²Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM), Seremban, Negeri Sembilan, Malaysia (hidayana@uitm.edu.my)

³Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA (UiTM), Seremban, Negeri Sembilan, Malaysia (mahazril@uitm.edu.my)

Abstract: *Technological advances are paving the way for more efficient recycling processes, from sophisticated sorting systems to breakthroughs in transforming complex materials into recyclable resources. One area of exciting development is in the field of e-waste recycling. Electronic waste management has become a significant concern with the rapid advancement of technology. This study aims to identify the determinants of e-waste recycling among the Malaysian public in Negeri Sembilan. The survey method used in this study involved 100 study respondents selected from two central districts in Negeri Sembilan, namely Seremban (n=150) and Port Dickson (n=150). The data were analyzed using bivariate correlation analysis. The results showed that policy and regulation, moral obligation, waste sorting knowledge, facility support, and subjective factors significantly influence e-waste recycling. On the other hand, attitude and time availability do not predict e-waste recycling. In conclusion, several suggestions have been put forward to help improve e-waste recycling practices in Malaysian society, and suggestions to help researchers who will conduct studies in the future are also provided.*

Keywords: *Determinant, E-Waste Recycling, Correlation Analysis, Malaysia Public*

Introduction

Recycling is the process of producing new goods from waste. Recycling is a key component in modern waste reduction, and the 3R practice is the third component of the waste hierarchy: "Reduce, Reuse, and Recycle." Recycling practices help to reduce waste, reduce the use of new raw materials, reduce energy consumption, reduce air pollution, and water pollution, and reduce greenhouse gas emissions compared to producing new goods from raw materials (Aboelmaged, 2021; Fawole et al., 2023). Various materials can be recycled, including most types of glass, paper, metal, plastic, textiles, electronic components, and others (Bhutto et al., 2023). In Malaysia, the government has established a special department to handle recycling activities, namely the National Solid Waste Management Department, a government agency under the Ministry of Local Government and Housing (Department of Environment, 2023). Electronic components such as batteries, calculators, mobile phones, electrical appliances, Kalimantan lamps, LED lamps, electric kettles, electric stoves, and so on can be recycled when their lifespan has expired (Andeobu et al., 2021).



In Malaysia, e-waste is categorized as scheduled waste with code SW110 under the First Schedule, Environmental Quality (Scheduled Waste) Regulations 2005, Environmental Quality Act 1974, which is enforced by the Department of Environment (Department of Environment, 2023). E-waste is listed as a scheduled waste in the First Schedule under Code SW110. However, this legislation only applies to managing industry-generated e-waste, not households. European countries have strictly prohibited manufacturers from using these six hazardous substances in electronics manufacturing by restricting certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) (Shittu et al., 2021). This is because e-waste that ends up in landfills will contaminate groundwater. Therefore, creating sustainable e-waste management at the household level is important.

E-waste generation is divided into two types of sources, namely, from the industrial sector and those produced by households (Herat, 2021). E-waste is electrical and electronic goods that are damaged, malfunctioning, or old/obsolete, such as mobile phones, computers, televisions, washing machines, refrigerators, and air conditioners (Dahan et al., 2024). Code SW110 is interpreted as waste from electrical and electronic installations that contain components such as accumulators, mercury switches, glass from cathode ray tubes and other activated glass or polychlorinated biphenyl capacitors, or that are contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese, or polychlorinated biphenyls (Fawole et al., 2023).

E-waste, including in Malaysia, has become a problem worldwide (Leoi, 2019). The more electrical and electronic goods that are produced, the more e-waste that needs to be disposed of/managed (Almulhim, 2022). Suppose e-waste is disposed of without using environmentally friendly methods such as throwing it into rivers, going to landfills, burning it at will, or giving it to inappropriate parties. In that case, this e-waste can endanger life, affect our health, and cause a deterioration in the quality of the environment (Ahirwar & Tripathi, 2021). Arsenic is used in the electronics industry, including the manufacture of transistors, semiconductors, glass, textiles, ceramics, glue, and explosives, causing metabolic disturbances in the body of humans and animals, resulting in poisoning and even death (Fawole et al., 2023). For a pregnant mother, exposure to toxic e-waste can affect the health and development of the fetus (Shittu et al., 2021). Other harmful effects on children's health-related to e-waste include impaired lung and respiratory function, DNA damage, thyroid dysfunction, as well as an increased risk of several chronic diseases later in life, such as cancer and cardiovascular disease (Dhir et al., 2021).

The increase in the amount of electronic waste in Malaysia is due to several factors, such as the lack of information about e-waste to the public, lack of public awareness in managing e-waste for household scale use (home appliances), the unavailability of accurate data on the amount of use of electronic goods in Malaysia, and the unavailability of other technical provisions, such as the age of items that can be recycled (Ismail, & Hanafiah, 2021; Shad et al., 2020). The recycling program held in Malaysia aims to achieve a one percent increase in the annual recycling program. However, today, Malaysians have not practiced recycling activities to manage daily waste (Ismail & Hanafiah, 2021; Noor & Nordin, 2023a). This is further exacerbated by the attitude of people who are less concerned and responsible for preserving the environment, which has hurt the natural environment and the quality of human life (Herat, 2021; Leoi, 2019). Thus, this study aims to identify the determinants of e-waste recycling among the Malaysian public in Negeri Sembilan.



Literature Review

Theory of Planned Behaviour

Ajzen (1991), a prominent social psychologist, developed a critical theory for understanding the relationships between attitude and behavior. The theory of Planned Behaviour (TPB) describes relationships between beliefs and behavior by identifying three main factors that affect behavioral intentions. These include attitudes, subjective norms, and perceived behavioral control. This theory has become an important foundation in behavioral and environmental research. TPB is an effective and straightforward theory in predicting and explaining behavior. TPB describes the concept of intention as the extent to which a person strives and expends effort to do something. Thus, the essence of TPB is that the predicted intention will be reflected in actual behavior unless there is a significant obstacle. TPB is an evolution from The Theory of Reasoned Action (TRA), which states that intentions are predicted through three main components: attitude, subjective norm, and perceived behavioral control. Attitude is the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question (Ajzen, 1991). If someone believes that doing something good for the environment, they have an attitude of love for the environment.

Subjective norms are the opinions of close people, important people, who influence individual behavioral decisions and encourage them to meet the expectations of others (Ajzen, 1991). These norms show that social influence can influence thoughts, feelings, and a person's behavior. Individuals form opinions and beliefs about what they should do and what the community will accept. This happens through interaction, observation, and the information they get. Perceived behavioral control increases the prediction of individual behavior by considering perceptions about the availability of resources and supporting opportunities (Ajzen, 1991). Perceived behavioral control in TPB shows the lowest level of internal will control. This is because individuals are often influenced by their level of self-confidence in the behavior they can do. A person's ability to evaluate resources and the opportunities that support their behavior affects their feelings of self-confidence.

E-Waste Recycling and Its Determinants

Now more than ever, we are all aware of our modern lifestyle's negative environmental impact. However, when it comes to recycling, most people think primarily of the paper and plastic bottles we put in the recycling bins. Little thought is given to recycling electronics; as a result, the rise of electronic waste (e-waste) has become a major global issue, and the need for e-recycling is growing exponentially (Dahan et al., 2024). E-waste refers to all electronic products that have reached the end of their useful life (Herat, 2021). Common examples of e-waste include mobile phones, computers, televisions, monitors, printers, and microwaves. While this technology provides undeniable benefits, including entertainment, convenience, and efficiency, the current rate and method of disposing of electronic goods is unsustainable (Shittu et al., 2021). Many electronic products include components that contain valuable resources, some of which are considered toxic and hazardous (Yadav et al., 2022). The process of e-recycling involves converting these e-waste products into reusable materials. By recovering many valuable components and removing potentially hazardous and toxic materials, e-waste recycling can prevent this pollution from ending up in landfills and hurting the environment (Vijayan et al., 2023).



Compliance with regulations or standards has been the focus of research by academics, professionals, and governments across various disciplines such as economics, accounting, business, psychology, and policy. Enforcement and monitoring activities drive compliance with environmental regulations to change the behavior of individuals or firms (Arya & Kumar, 2020). E-waste is an environmental issue that affects Malaysia in terms of environmental quality. Although the country has implemented various pollution policies and prevention regulations, this problem still cannot be solved, and the individuals and companies involved are still polluting the environment (Shad et al., 2020). Therefore, it is important to strengthen regulations to improve the situation (Noor & Nordin, 2023b). The industry's and households' compliance with environmental regulations is important to protect the environment and ecosystems, and it reflects the credibility of the regulations themselves and the enforcement agencies (Thakur & Kumar, 2022). Several countries can be used as models in implementing recycling practices. In Japan, for example, the law is enforced by imposing fines of more than 30,000 yen (RM970.57) on those who throw away household appliances without recycling. In Germany, the government requires companies and industries to separate and recycle at least 80 percent of the goods they produce. For example, companies producing boxed drinks are required to recycle used beverage boxes.

Next, everyone must be responsible for pollution and the environmental degradation it causes. Disposing of pollutants elsewhere is like poisoning the people where we dispose of the pollutants (Bhutto et al., 2023). Awareness of the need to preserve and conserve the environment to maintain the ecosystem balance could affect people's intentions and behavior toward e-waste recycling (Aboelimged, 2021; Michael et al., 2024). For example, the recycling process's effectiveness in Japan is partly due to the attitude of the Japanese themselves. In Japan, their culture favors the community more than the individual. Therefore, their attitude is more inclined to maintain harmony in social life and help each other to live in a better environment. They do not throw garbage everywhere to care for the environment, which is a common right. Japanese people usually carry plastic bags with them when they leave the house. These plastic bags will be used to store the garbage they produce while they are outside. This garbage will be taken home and thrown away when they get home or at work.

In addition, environmental attitudes play an important role in influencing and motivating human behavior towards the environment (Hamzah et al., 2020). Individuals with a positive attitude towards the environment will apply that attitude daily (Vijayan et al., 2023). Studies have supported this opinion. Noor et al. (2023c) found a significant relationship between attitude and e-waste recycling behavior. According to past studies, knowledge and education are key to increasing e-waste recycling rates (Noor et al., 2024; Yahya et al., 2022). Educational programs should be introduced in schools and through public campaigns to provide information on the methods and importance of e-waste recycling (Hamzah et al., 2020).

Moreover, governments and private organizations should provide appropriate facilities for collecting recyclable materials (Dutta & Goel, 2021; Tutton et al., 2022). This includes providing e-waste recycling bins in public places and setting up special collection facilities for specific items (Herat, 2021). Communities should be allowed to recycle e-waste without hassle (Yadav et al., 2022). The process of collecting and distributing recyclable materials should be simple and practical. Collaboration between various parties, including the government, the private sector, and local communities, is essential (Tutton et al., 2022). Initiatives such as recycling challenges and incentive programs can encourage more people to participate

(Esenduran et al., 2020). Moreover, individuals can set a good example by practicing recycling daily (Vijayan et al., 2023). By showing a positive attitude towards recycling, other communities will be inspired to do the same (Pham et al., 2023). Based on the above discussion, this study posited the following hypothesis:

- H1: Policy and regulation significantly determine e-waste recycling.
- H2: Moral obligation determines e-waste recycling.
- H3: Attitude determines e-waste recycling.
- H4: Waste sorting knowledge determines e-waste recycling.
- H5: Facility support determines e-waste recycling.
- H6: Time availability determines e-waste recycling.
- H7: Subjective norm determines e-waste recycling.

Figure 1 depicts the research model for this study.

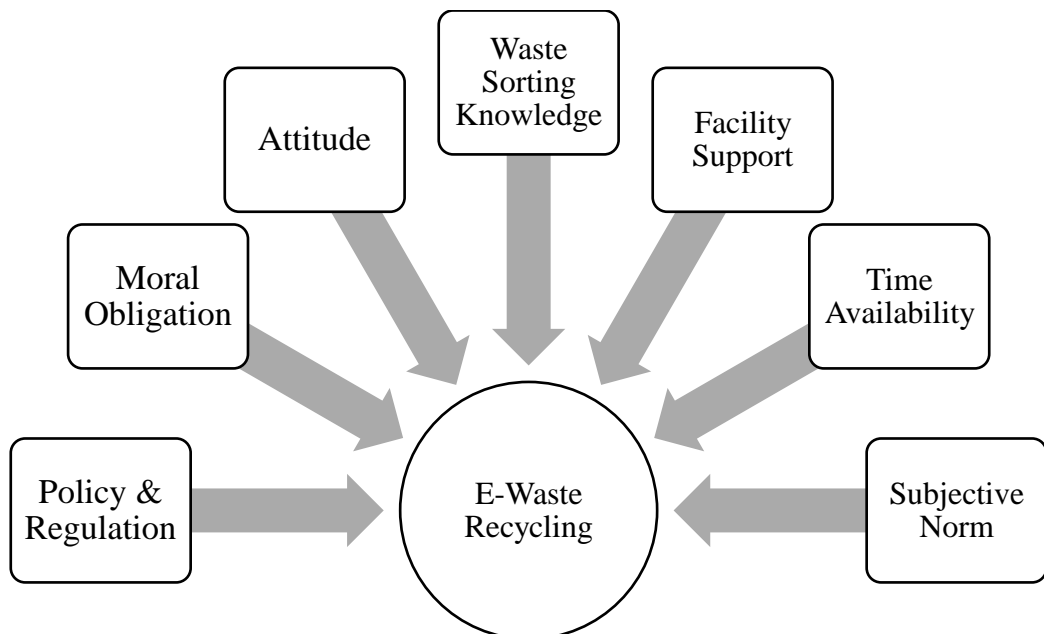


Figure 1: Research Model

Methodology

Questionnaires were developed to survey the community's behavior towards e-waste recycling programs in the study area. Determining the number of samples needed for the questionnaire survey refers to the theory of Roscoe (1975). According to Roscoe (1975), the eligible sample size in the research is 30 to 500. Thus, 300 respondents have been selected using multi-stage sampling. Three hundred respondents were selected through cluster sampling in urban and main town areas in Seremban (n=150) and Port Dickson (n=150), Negeri Sembilan. The sample was based on the population density in the identified areas. The use of questionnaires can help researchers obtain data quickly. It is also an efficient data collection tool because many data is collected. Therefore, the researcher used the questionnaire to obtain primary data for this study. The research tool for the variables is adapted from Rakhmawati et al. (2023). Data collections were analyzed using the SPSS software package. Bivariate correlation determines the strength

of the relationship between two variables and the direction of the relationship between two variables.

Findings

Demographic Profiles

Based on Table 1, most respondents are female, with 192 respondents (74.4%), and the rest are male, with 66 respondents (25.6%). For the age most of the respondents are between the age range of 21-25 years, with a total of 161 respondents (62.4%), followed by 18-20 years with a total of 95 respondents (36.8%), 26-30 years with a total of one respondent (0.4%), and one respondent aged between 41–45 years (0.4%). For the level of education, most of the respondents had obtained undergraduate qualifications, with 179 people (69.4%). This is followed by *Sijil Pelajaran Malaysia (SPM)* with 64 people (24.8%), *Sijil Tinggi Pelajaran Malaysia (STPM)* with nine respondents (3.5%), foundation with four respondents (1.6%), and secondary school level with two respondents (0.8%). For living areas, most of the respondents were from urban areas, with 115 respondents (44.6%), followed by semi-urban with 94 respondents (36.4%), and lastly, rural areas, with 49 respondents (19%).

Table 1: Demographic Profile

No.	Profile		Frequency (n)	Percentage (%)
1	Gender	Female	192	74.4
		Male	66	25.6
2	Age	18-20 years old	95	36.8
		21-25 years old	161	62.4
		26-30	1	0.4
		41-45	1	0.4
3	Level of Education	Secondary School	2	0.8
		SPM	64	24.8
		STPM	9	3.5
		Foundation	4	1.6
		Undergraduate	179	69.4
4	Living Area	Rural	49	19.0
		Semi-urban	94	36.4
		Urban	115	44.6

Normality and Reliability Tests

Table 2 shows the normality and reliability results for all variables. The Cronbach Alpha test is conducted to see if survey questions measured through the Likert scale are reliable. High reliability means that the items in the survey truly measure the variables, while low reliability means that they measure something other than the variables. The Cronbach Alpha (α) coefficient, developed by Lee Cronbach in 1951, measures reliability or internal consistency. In summary, all variables fulfill the goodness of measures. Based on the reliability results in Table 2, this study achieves reliability as Cronbach's Alpha value is more than 0.60 (Nunally & Bernstein, 1994). The data normality test is a statistical procedure used to assess whether data distribution in a dataset follows a normal distribution. This is important because many statistical analysis methods, especially parametric ones, assume the data is normally distributed to produce valid results. According to Kline (2005), skewness values must fall between -3 and

+3, and kurtosis values must fall between -10 and +10. Based on the normality results, the data is normally distributed.

Table 2: Normality & Reliability Results

Variable	Mean	SD	Skewness	Kurtosis	Cronbach's Alpha
E-Waste Recycling Behaviour	3.805	0.794	- 0.479	0.476	0.689
Policy and Regulation	3.792	0.754	-0.286	0.068	0.898
Moral Obligation	4.164	0.710	-0.821	0.635	0.892
Attitude	4.164	0.710	-0.821	0.635	0.896
Waste Sorting Knowledge	3.264	0.995	-0.289	-0.328	0.903
Facility Support	2.591	0.849	1.011	0.903	0.930
Time Availability	2.591	0.849	1.011	0.903	.669
Subjective Norm	2.988	0.935	-0.181	0.179	0.906

Pearson Correlation Analysis

Based on Table 3, the finding shows a positive correlation between policy and regulation and e-waste recycling behavior ($r=0.380, p=0.000, p<0.05$). Then, moral obligation to e-waste recycling behavior ($r=0.225, p=0.000, p<0.05$), waste sorting knowledge to e-waste recycling behavior ($r=0.346, p=0.000, p<0.05$), facility support to e-waste recycling behavior ($r=0.307, p=0.000, p<0.05$), and subjective norm to e-waste recycling behavior ($r=0.225, p=0.000, p<0.05$) also shows a positive correlation. While attitude towards e-waste recycling behavior ($r=0.116, p=0.062, p>0.05$) and time availability towards e-waste recycling behavior ($r=0.112, p=0.072, p>0.05$) show a negative correlation. Thus, it shows that the hypothesis for policy and regulation (H1), moral obligation (H2), waste sorting knowledge (H4), facility support (H5), and the subjective norm (H7) are accepted. On the other hand, attitude (H3) and time availability (H6) do not have a significant relationship with e-waste recycling behavior.

Table 3: Pearson Correlation

		E- Waste Recycling
Policy and Regulation	Pearson Correlation	0.380**
	Sig. (2-tailed)	0.000
	N	258
Moral Obligation	Pearson Correlation	0.225**
	Sig. (2-tailed)	0.000
	N	258
Attitude	Pearson Correlation	0.116
	Sig. (2-tailed)	0.062
	N	258
Waste Sorting Knowledge	Pearson Correlation	0.346**
	Sig. (2-tailed)	0.000
	N	258
Facility Support	Pearson Correlation	0.239**
	Sig. (2-tailed)	0.000
	N	258
Time Availability	Pearson Correlation	0.112
	Sig. (2-tailed)	0.072
	N	258
Subjective Norm	Pearson Correlation	0.307**
	Sig. (2-tailed)	0.000
	N	258

Discussion

The results have shown that policy and regulation, moral obligation, waste sorting knowledge, facility support, and subjective factors significantly influence e-waste recycling. On the other hand, attitude and time availability do not predict e-waste recycling. As an implication, the government needs to implement public awareness campaigns. Many in the community are unaware of the dangers e-waste can pose to the environment and human health (Shad et al., 2020). Awareness campaigns can be organized through social media, television, or posters in public places to provide information about the importance of proper e-waste management (Hamzah et al., 2020). For example, campaigns can emphasize the dangers of throwing electronic items in regular trash because chemicals in electronic devices can pollute soil and water. Most discarded electronic devices still have components that can be reused. Therefore, this recycling program can reduce the amount of electronic waste thrown away and save natural resources used to manufacture new devices. Through this education and awareness, the community will be more responsible in managing e-waste (Aboelmaged, 2021).

In addition to awareness, providing more accessible e-waste collection centers is also important (Tutton et al., 2022). Governments and local authorities can work together to increase the number of e-waste collection centers in urban and rural areas (Almulhim, 2022). For example, supermarkets or schools can be used as temporary collection centers to make it easier for people



to hand in their old electronic equipment. The government can provide the necessary policies and infrastructure, while the private sector can support it through innovation and implementation of recycling programs. Once collected, this e-waste can be sent to specialized recycling centers for processing. With such facilities, people will be more motivated to manage their e-waste correctly. At the same time, stricter enforcement of laws on e-waste management also needs to be implemented. Governments can introduce policies or laws that oblige electronics companies and consumers to manage their e-waste responsibly (Noor & Nordin, 2023b). For example, laws can oblige manufacturers to provide e-waste collection and recycling services. Companies that fail to comply with these regulations can be subject to heavy fines. Technology companies and electronic device manufacturers can play an important role by providing trade-in programs, where consumers can hand in their old electronic devices to get discounts on new products. If law enforcement is implemented more strictly, all parties will be serious about ensuring that e-waste is managed properly (Yadav et al., 2022).

Finally, using green technology to produce electronic devices can also help reduce the amount of e-waste (Rakhmawati et al., 2023). Manufacturers can prioritize environmentally friendly and recyclable materials when manufacturing their products. For example, environmentally friendly batteries that do not contain harmful chemicals can replace traditional batteries. In addition, the design of electronic devices that are modular and easy to repair can also help reduce the amount of equipment discarded. Innovation and adaptation of green technology in creating a device will reduce the negative impact of e-waste on the environment (Thakur & Kumar, 2022). Society also needs to play its role by adopting a more responsible lifestyle, such as not throwing away electronic equipment carelessly.

Conclusion

Recycling plays an important role in preserving the environment. However, sustainable e-waste management methods such as recycling and reuse are less practiced by households. This proves that households still have a low level of knowledge on managing e-waste sustainably. Unclear regulations and guidelines on household e-waste management are among the aspects that cause Malaysia to face the issue of unsustainable e-waste management still today. Therefore, a more systematic regulation or management guideline should be established as a proposal for sustainable e-waste management in the long term. Unsustainable e-waste management should be addressed as soon as possible to avoid more serious negative implications for the environment and humans. By understanding the meaning and importance of recycling, we can take more proactive steps to protect our earth. All Malaysians should strive to practice recycling and make it a culture in our daily lives for the well-being of the environment and future generations. Continuous campaigns can raise awareness that the environment is important for humans to achieve a prosperous life. Governments and NGOs need to carry out environmental campaigns more aggressively and systematically.

References

- Aboelmaged, M. (2021). E-waste recycling behavior: An integration of recycling habits into the theory of planned behavior. *Journal of Cleaner Production*, 278, 124182.
- Ahirwar, R., & Tripathi, A. K. (2021). E-waste management: A review of recycling process, environmental and occupational health hazards, and potential solutions. *Environmental*

- Nanotechnology, Monitoring & Management*, 15, 100409.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Almulhim, A. I. (2022). Household's awareness and participation in sustainable electronic waste management practices in Saudi Arabia. *Ain Shams Engineering Journal*, 13(4), 101729.
- Andeobu, L., Wibowo, S., & Grandhi, S. (2021). A systematic review of e-waste generation and environmental management of Asia Pacific countries. *International Journal of Environmental Research and Public Health*, 18(17), 9051.
- Arya, S., & Kumar, S. (2020). E-waste in India at a glance: Current trends, regulations, challenges, and management strategies. *Journal of Cleaner Production*, 271, 122707.
- Bhutto, M. Y., Rütelionė, A., Šeinauskienė, B., & Ertz, M. (2023). Exploring factors of e-waste recycling intention: The case of generation Y. *Plos One*, 18(10), e0287435.
- Dahan, S. M., Omar, W. A. H. W., & Taib, M. Y. (2024). *Disposal of e-waste: Government agencies' perspective*. In AIP Conference Proceedings (Vol. 3023, No. 1). AIP Publishing.
- Department of Environment (2023). *Bahagian bahan berbahaya, Jabatan Alam Sekitar*. Retrieved from <https://ewaste.doe.gov.my/index.php/ms/infografik/>
- Dhir, A., Koshta, N., Goyal, R. K., Sakashita, M., & Almotairi, M. (2021). Behavioral reasoning theory (BRT) perspectives on E-waste recycling and management. *Journal of Cleaner Production*, 280, 124269.
- Dutta, D., & Goel, S. (2021). Understanding the gap between formal and informal e-waste recycling facilities in India. *Waste Management*, 125, 163-171.
- Esenduran, G., Lin, Y. T., Xiao, W., & Jin, M. (2020). Choice of electronic waste recycling standard under recovery channel competition. *Manufacturing & Service Operations Management*, 22(3), 495–512.
- Fawole, A. A., Orikpete, O. F., Ehiobu, N. N., & Ewim, D. R. E. (2023). Climate change implications of electronic waste: Strategies for sustainable management. *Bulletin of the National Research Centre*, 47(1), 147.
- Hamzah, T. A. A. T., Yahya, A. S. M., & Shafie, A. (2020). Knowledge, attitude, and practices on E-waste recycling among public in Port Dickson. *Pertanika Journal of Social Sciences and Humanities*, 28(4), 2731-2748.
- Herat, S. (2021). E-waste management in Asia Pacific region: Review of issues, challenges and solutions. *Nature Environment and Pollution Technology*, 20(1), 45–53.
- Ismail, H., & Hanafiah, M. M. (2021). Evaluation of e-waste management systems in Malaysia using life cycle assessment and material flow analysis. *Journal of Cleaner Production*, 308, 127358.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd Ed.). New York, NY: Guilford Press.
- Leoi, S. L. (2019). *Malaysia is overflowing with waste, and we're running out of options*. Retrieved from <https://www.thestar.com.my/lifestyle/living/2019/07/16/plastic-waste-landfills>
- Michael, L. K., Hungund, S. S., & KV, S. (2024). Factors influencing the behavior in recycling of e-waste using integrated TPB and NAM model. *Cogent Business & Management*, 11(1), 2295605.
- Noor, N. H. M., & Nordin, N. B. (2023a). Reassuring pro-environmental behavior: A goal-framing theory perspective. *Bioresources and Environment*, 1(3), 14-26.
- Noor, N. H. M., & Nordin, N. B. (2023b). Environmental Law and policy on domestic waste

- segregation: Study on the indirect effect of community awareness. *Asian Journal Of Environment, History and Heritage*, 7(2).
- Noor, N. H. M., Soleman, N. A. F., & Azuan, A. S. K. (2023c). To recycle or not to recycle? Factors affecting Malaysian residents' intention for recycling e-waste. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, 8(2), e002102-e002102.
- Noor, N. H. M., Zaini, S. M., Pudir, S., & Sidek, M. S. J. (2024). Environmental sustainability: Mediating effect of environmental knowledge for pro-environmental behavior. *Indonesian Journal of Sustainability Accounting and Management*, 8(1), 230-248.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd Ed.). New York, NY: McGraw-Hill.
- Pham, T. T., Lam, T. P. M., Le Dang, H., & Pham, N. T. (2023). Consumers' willingness to pay an environmental fee for e-waste recycling in Vietnam: Integrating the theory of planned behavior and the norm activation model. *Journal of Material Cycles and Waste Management*, 25(5), 2900-2914.
- Rakhmawati, T., Damayanti, S., Jati, R. K., & Astrini, N. J. (2023). An extended TPB model of waste-sorting intention: A case study of Indonesia. *Management of Environmental Quality: An International Journal*, 34(5), 1248-1268.
- Roscoe, J. T. (1975). *Fundamental research statistics for the behavioral sciences* (2nd Ed.). New York, NY: Holt Rinehart & Winston.
- Shad, K. M., Ling, S. T. Y., & Karim, M. E. (2020). Comparative study on e-waste management and the role of the Basel convention in Malaysia, Singapore, and Indonesia: A Way Forward. *Indon. L. Rev.*, 10, 63.
- Shittu, O. S., Williams, I. D., & Shaw, P. J. (2021). Global E-waste management: Can WEEE make a difference? A review of e-waste trends, legislation, contemporary issues, and future challenges. *Waste Management*, 120, 549-563.
- Thakur, P., & Kumar, S. (2022). Evaluation of e-waste status, management strategies, and legislations. *International Journal of Environmental Science and Technology*, 19(7), 6957-6966.
- Tutton, C. G., Young, S. B., & Habib, K. (2022). Pre-processing of e-waste in Canada: Case of a facility responding to changing material composition. *Resources, Environment and Sustainability*, 9, 100069.
- Vijayan, R. V., Krishnan, M. M., Parayitam, S., Duraisami, S. P. A., & Saravanaselvan, N. R. (2023). Exploring e-waste recycling behavior intention among the households: Evidence from India. *Cleaner Materials*, 7, 100174.
- Yadav, R., Panda, D. K., & Kumar, S. (2022). Understanding the individuals' motivators and barriers of e-waste recycling: A mixed-method approach. *Journal of Environmental Management*, 324, 116303.
- Yahya, A. S. M., Hamzah, T. A. A. T., & Shafie, A. (2022). Knowledge of E-waste recycling among communities in Selangor, Malaysia. *Southeast Asia: A Multidisciplinary Journal*, 22(1), 5-22.



INNOVATING THE LEGAL AID SERVICES IN MALAYSIA USING AI-ENABLED SOLUTION

Ani Munirah Mohamad¹
Mohd Aamir Adeeb Abdul Rahim²

¹School of Law and Centre for Testing, Measurement and Appraisal (CeTMA), Universiti Utara Malaysia (UUM), Malaysia, (animunirah@uum.edu.my)

²School of Quantitative Sciences, Universiti Utara Malaysia (UUM), Malaysia, (aamir@uum.edu.my)

Abstract: *Legal aid services in Malaysia aim to provide under-privileged and marginalised individuals with access to justice through legal consultations, representation, and mediation. However, systemic problems such as resource restrictions, bureaucratic inefficiencies, and access barriers limit their effectiveness. This study investigates the potential of artificial intelligence (AI) to improve legal aid services in Malaysia. The study uses a literature-based methodology to explore AI applications in legal services, such as chatbots for legal awareness, virtual consultations, and AI-assisted document processing. The findings indicate that AI can improve accessibility, streamline service delivery, and reduce operational burdens. Despite its potential, issues including digital literacy gaps and affordability problems must be addressed. The report presents an AI-powered solution for legal aid services and makes policy recommendations for integration. The implications underscore AI's significance in improving justice delivery while emphasizing the importance of regulatory frameworks and digital infrastructure to support its adoption.*

Keywords: *Legal aid services, Innovation, Artificial intelligence, AI*

Introduction

Legal aid services in Malaysia provide those with limited resources access to justice. Providing legal consultations, representation, and mediation, these services address civil, criminal, and syariah cases. Among the advantages are lessening of financial obligations, support of fair trials, and defense of underprivileged groups. These services are offered by volunteer attorneys and legal assistance agents to improve legal availability.

Nevertheless, providing legal aid services also comes with its problems and challenges. Various organisations, both governmental and non-governmental, provide legal aid, but challenges such as limited resources and bureaucratic barriers often hinder access (Tasnim & Tania, 2024; Sobari, 2024). In addition, legal aid posts in courts facilitate access to legal information and support, yet issues like misallocation of resources can prevent those in genuine need from receiving assistance (Sobari, 2024). Within the broader context, legal aid not only addresses individual cases but also contributes to broader societal goals, such as promoting sustainable development and reducing structural inequalities within the justice system (Garahan, 2020). However, the effectiveness of legal aid services can be compromised by systemic issues, including digital divide and inadequate funding, which may limit their reach and impact (Tasnim & Tania, 2024).

The primary objective of this paper is to deliberate on the potential of innovating the legal aid services in Malaysia by incorporating elements of artificial intelligence (AI) into the legal aid systems. It is believed that AI could improve and enhance the delivery of legal aid services, thus improving the delivery of justice to the people.

The paper begins by providing an overview of the key concepts engaged in this study, followed by the methodology, and deliberation of the potential of incorporating AI system into the legal aid services in Malaysia. The paper concludes with a proposed model for the AI-enabled legal aid services in Malaysia, and some recommendations for the improvement of the system.

Literature Review

The Concept of Legal Aid Services

Legal aid services are essential mechanisms designed to provide legal assistance to individuals, particularly those who are financially disadvantaged or marginalised, as shown in **Figure 1**. These services aim to ensure access to justice by offering legal advice, representation, and education, thereby empowering individuals to navigate the legal system effectively. Legal aid is often state-funded and encompasses various forms of support, including legal consultations, document preparation, and advocacy for law reforms to promote social justice and equality before the law (Garahan, 2020). Legal aid services are intended to assist poor and indigent individuals who cannot afford legal representation, ensuring their rights are protected in legal proceedings (Tasnim & Tania, 2024). They serve as a platform for educating communities about their legal rights and available resources, particularly in remote areas where legal knowledge is limited (Susantyo et al., 2024).



Figure 1: Concept of Legal Aid Services

Legal Aid Services in Malaysia

In Malaysia, legal aid services are primarily provided by the Legal Aid Department or *Jabatan Bantuan Guaman* (JBG), National Legal Aid Foundation or Yayasan Bantuan Guaman Kebangsaan (YBGK), Legal Aid Centres (LAC) by Malaysian Bar (including community legal aid organisations). A summary of the legal aid services in Malaysia is produced in **Figure 2**. JBG, a department under the government of Malaysia, provides legal aid services to eligible individuals in accordance with the Legal Aid Act 1971. The government aims to provide legal

services to the public at a lower fee as an alternative to services offered by private lawyers (Website of JBG, 2025).

On the other hand, YBGK provides legal assistance in criminal matters including Syariah criminal matters to all Malaysian at the stage of arrest, remand and bail application. The means test will only be conducted for the purpose of determining who is eligible for legal representation at the trial stage. Offences that carry the death penalty will not be covered by the YBGK for the time being as the court already provides assigned counsel to persons charged for such offences (Website of YBGK, 2025).

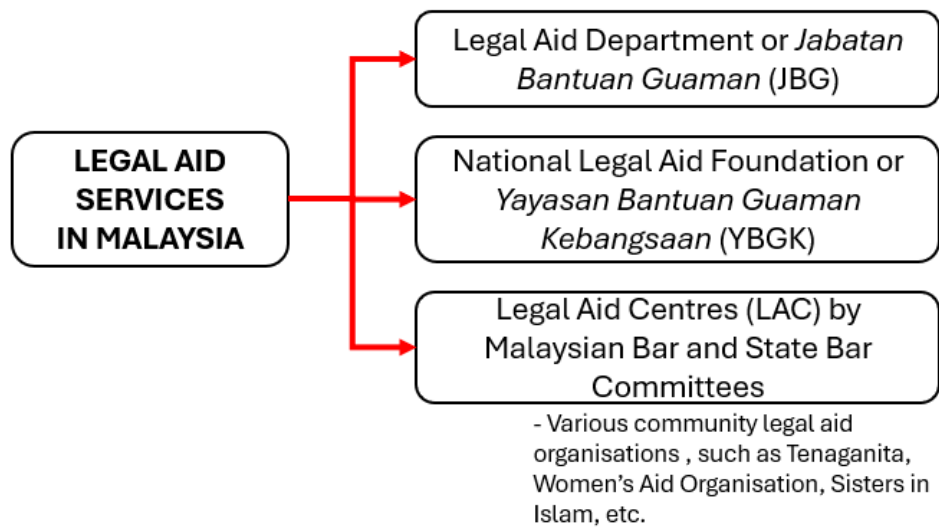


Figure 2: Legal Aid Services in Malaysia

Additionally, LAC of the Malaysian Bar and State Bar Committees coordinate various legal assistance initiatives throughout the nation, in which lawyers and pupils in chambers would be attached to various community legal aid organisations that are linked with the LACs. The services depend very much on the different means and objectives of the organisations, such as Tenaganita's cause for promoting and protecting the rights of women as well as migrant workers and refugees (Website of Tenaganita, 2025), Women's Aid Organisation (WAO) cause for the provision of free and confidential services to survivors of domestic violence, rape, and other forms of violence (Website of WAO, 2025), and also Sisters in Islam for the promotion of the rights of women in Malaysia. Its efforts to promote the rights of Muslim women are based on the principles of equality, justice and freedom enjoined by the Quran (Website of Sisters in Islam, 2025).

AI-Enabled Solution for Legal Aid Services

AI is a branch of computer science that aims to create machines capable of performing tasks typically requiring human intelligence (Morandín-Ahuerma, 2022; Nagendraswamy & Salis, 2021). AI systems utilise machine learning algorithms to develop cognitive abilities, enabling autonomous or semi-autonomous task execution (Morandín-Ahuerma, 2022). The use of AI in legal aid services is gaining attention for its potential to enhance accessibility and efficiency. Research suggests that AI can be instrumental in providing free legal assistance, particularly in handling large caseloads and improving public trust in legal services (Hakim et al., 2024).

The development of integrated legal decision-support systems, rather than standalone expert systems, is recommended for sustainable free legal advisory services (Greenleaf, Mowbray & Chung, 2018). Collaboration between LIIs and free legal advice providers is proposed as a promising approach to develop and sustain AI-powered legal assistance systems (Greenleaf, Mowbray & Chung, 2018; Mowbray, Chung & Greenleaf., 2019).

Based on the review of literature as presented above, it is apparent that AI holds strong promises towards improving the delivery of legal aid services in other countries. But it has not been the case for Malaysia, which is why this paper is proposing that the legal aid services in Malaysia also incorporate AI system into its process and implementation.

Methodology

This study engaged in paper analysis of the current and existing literature on the subject matter of AI in the context of legal aid services in Malaysia. The references are mainly from reputed academic textbook and articles, as well as reference to relevant websites involved in legal aid services in Malaysia. The purpose of referring to the websites is to get meaningful understanding of the services offered by these legal aid centres/organisations, to obtain updated information regarding their activities, and to understand better regarding the problems faced in delivering the legal aid services to the community.

AI-Enabled Solution for Innovating the Legal Aid Services in Malaysia

In general, legal aid services offer numerous benefits to individuals and society. They provide access to justice for those who cannot afford legal representation, particularly in civil cases involving basic human needs (Abel & Vignola, 2010). These services can help secure federal funding, benefits, and child support for clients. Additionally, legal aid can prevent harmful events, reduce domestic violence rates, keep families together, improve health outcomes, and lower law enforcement costs (Abel & Vignola, 2010). In Malaysia, free legal aid aims to assist poor and marginalised community in both civil and criminal matters (Jalil, 2015). However, challenges remain in calculating the benefits of legal aid services, and improved methods are needed to quantify their value (Prescott, 2010). While legal aid is intended to benefit patients, some argue that it diverts funds from patient care to lawyers (Gustaf, 2021). Overall, legal aid services play a crucial role in ensuring access to justice and providing various societal benefits.

Problems Encountered by Legal Aid Services in Malaysia

Numerous problems hinder the proper implementation of legal aid services in Malaysia, which could be summarised into four major aspects, such as the digital divide, lack of engagement between lawyers and the public, high internet costs, and transportation challenges as produced in **Figure 3**.

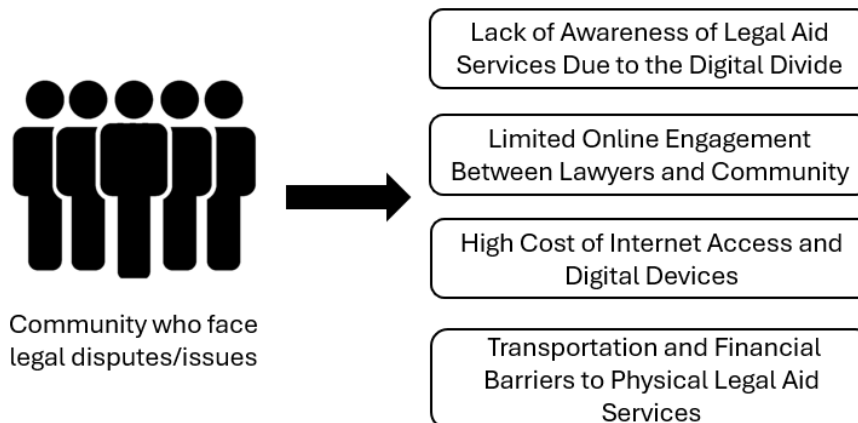


Figure 3: Problems of Legal Aid Services in Malaysia

For the issue of digital divide, even though access to legal aid is a basic right; nonetheless, some Malaysians remain oblivious to their eligibility for these services. This issue is especially prominent in marginalised communities, such as rural populations, the elderly, and low-income persons (Ajrun, 2023). A primary factor contributing to this is the digital divide. Despite Malaysia's advancements in digital transformation, a considerable segment of the population remains without internet connection or digital literacy (Ayob, Aziz & Ayob, 2022). Although information may be accessible, it is frequently articulated in intricate legal terminology, rendering comprehension challenging for the community at large who face the legal disputes or issues.

Moving on the issue of disconnection between legal practitioners and the communities that want assistance the most. Numerous law firms operate websites and social media profiles, although these platforms are frequently tailored for business clientele rather than the general populace (Hamin, Kamaruddin & Wan Rosli, 2018). Consequently, those lacking familiarity with legal procedures may experience uncertainty regarding how to obtain assistance. Moreover, digital legal aid systems in Malaysia remain inadequately developed, and current online clinics or helplines lack sufficient promotion (Siong, 2019). Language and cultural obstacles exacerbate this issue, as numerous Malaysians—particularly individuals from indigenous or non-Malay-speaking communities—encounter difficulties in accessing legal information in their native languages.

Another problem is the financial aspect of Internet connectivity. While internet coverage in Malaysia is very high, price remains an issue, particularly for low-income individuals. Many people cannot afford to purchase mobile phones, tablets, or computers, which are required for accessing online legal services (Shah, Ali & Iftikhar, 2023). Even if they own such gadgets, keeping an internet subscription can be pricey, particularly in rural areas where data prices are high. This disproportionately impacts vulnerable groups such as single moms, refugees, and daily wage workers, such as rubber tappers or paddy farmers, who prioritise necessities above digital access (GS & Ab Karim, 2024).

The final major problem affecting legal aid among the larger community is transportation. For people without internet access to legal services, visiting legal assistance offices personally is the substitute (Ladin, et al, 2014). But most of these facilities are in big cities, hence those living in far-off places find it challenging to get to them. This difficulty stems from time limits,

transit costs, and mobility problems (Chan, 2007). For example, someone from a Sabah or Sarawak could have to pay great transportation expenses by traveling several hours to the closest legal assistance office. Many low-income people cannot afford to pay for travel expenses or take time off from work to visit a lawyer. Online legal services theoretically could close this disparity, but has been already noted, digital hurdles may make this impractical.

How AI-Enabled Solution can Innovate the Legal Aid Services in Malaysia

According to Becher and Alarie (2025), AI-powered systems could change the way legal aid services work by making it easier for people to get justice, lowering bias, and increasing speed. These systems can leverage machine learning, natural language processing, and predictive analytics to automate legal research, improve litigation result predictions, and provide personalised legal services (Becher & Alarie, 2025; Ejjami, 2024). Hakim et al. (2024) say that AI can help lawyers handle a lot of cases and build trust with the public.

Within the context of Malaysia, there are various AI uses which are proposed to be useful for enhancing the effectiveness of the legal aid services, which are AI chatbots to increase awareness of legal aid eligibility, virtual legal consultations to bridge the lawyer-community gap, AI-powered legal document assistance to overcome digital and financial barriers and the introduction of mobile AI application to address transport and cost barriers. These AI uses within the context of legal aid services are as produced in **Figure 4**.

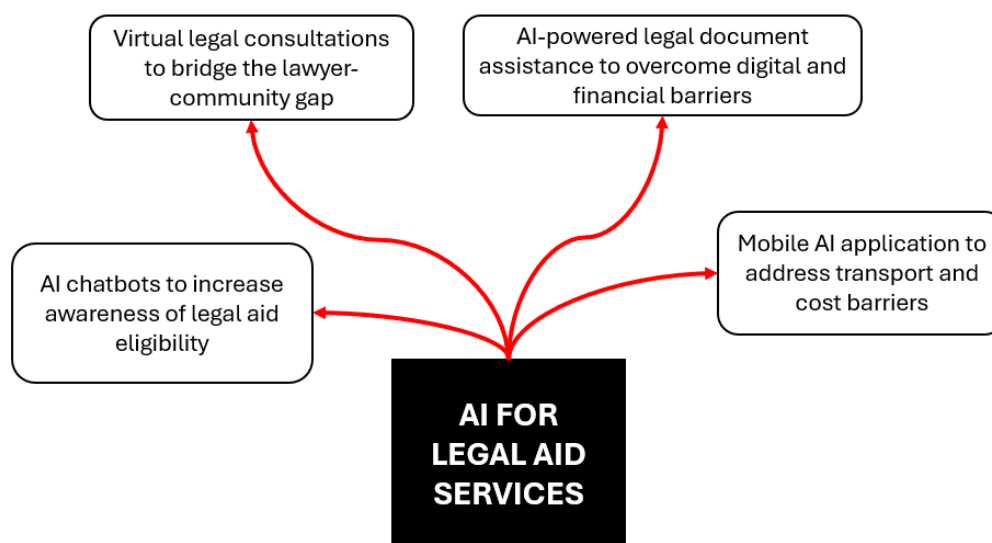


Figure 4: AI Uses for Legal Aid Services in Malaysia

First and foremost, AI chatbots would potentially increase the awareness of legal aid eligibility among the potential audience. On the outset, many people are unaware they qualify for legal aid since the material is not readily available or presented in convoluted legal jargon (Kamaruzzaman, 2020). AI-powered chatbots can guide users through eligibility tests and offer easy language answers to legal inquiries around-the-clock (Singh, 2023). By including these chatbots into websites, social media, and mobile application, more people—especially those from rural areas—know about their rights and the legal assistance resources accessible to them.



Another use of AI is the implementation of virtual legal consultations to bridge the lawyer-community gap. Lawyers and the community do not interact since many of them use venues inaccessible to the regular people (Singh, 2023). By means of virtual legal consultations—where people may interact with legal assistance lawyers via video calls, chat, or audio messages—AI can assist (Mohamad, et al, 2020). By matching people with the appropriate attorneys depending on their legal problems, geography, and preferred language, AI-driven platforms also guarantee more efficient and effective legal support.

Additionally, for the AI-powered legal document assistance is proposed to overcome digital and financial barriers among the community who are seeking the legal aid services (Kamaruzzaman, 2020). Lack of digital access or affordability causes many people—especially those from low-income backgrounds—to battle with legal documentation (Rajendra & Thuraisingam, 2022). By automating the drafting of legal documents, AI helps people to procure required documentation without consulting an attorney. Reducing reliance on costly legal services, AI-powered solutions can also produce legal forms depending on user input and offer step-by-step direction.

The final use of AI for the legal aid services is the introduction of mobile AI application to address transport and cost barriers (Baharum, et al, 2023). For those living in remote areas, traveling to legal aid centres is costly and time-consuming (Abd Ghadas, et al, 2022). AI-powered mobile application can bring legal aid directly to users, providing offline access to legal information, voice-to-text features for those with low literacy, and AI-driven navigation to help users find nearby legal aid services. These applications can also allow users to submit legal queries and receive AI-generated guidance, reducing the need for in-person visits.

Potential Implications of AI-Enabled Legal Aid Services in Malaysia

More Malaysians, particularly those in rural regions or with limited legal knowledge, will be able to check their eligibility using the AI chatbot and acquire the required support thanks to the planned AI connection with the legal aid services. Less people will thereby miss out on legal aid merely because they are unaware it exists. By connecting the community with the appropriate lawyers depending on their needs, AI-powered virtual consultations and case-matching tools can also help to alleviate the issue of disconnect between lawyers and the society. This guarantees quicker and more effective legal advice and helps to lower long waiting for in-person consultations.

Moreover, AI-powered systems can create legal documentation depending on user input, hence lowering the demand for costly attorney advice. For individuals unable of affording expert legal advice, this allows them to promptly and precisely complete necessary documentation. Finally, AI-enabled smartphone applications let people—especially those living in rural areas—access legal information, submit documentation, and even get advice from far away. This lessens their need for travel, so legal help is more easily available to people living in underprivileged or far-off places.

Conclusion

The possibilities of adding AI into Malaysia's legal aid system to improve its accessibility and efficiency have been investigated in this study. AI can significantly help to improve legal aid



delivery by tackling important issues such as lack of knowledge about legal aid eligibility, the gap between lawyers and the community, difficulties processing legal papers, and the financial load of obtaining legal services. Particularly for underprivileged and rural areas, AI-powered chatbots, virtual consultations, automated document assistance, and mobile applications provide creative ideas that can make legal aid services more efficient, affordable, and generally accessible.

Though AI offers great possibilities, its application must be carefully monitored to guarantee accuracy, fairness, and data security. Policymakers should concentrate on creating user-friendly, routinely updated, and compliant with Malaysia's legal system AI technologies if we are to maximise their possibilities in legal aid services. Ensuring AI-driven legal aid services are reliable and efficient depends on government, legal professional, and technological expert cooperation. Public awareness campaigns and digital literacy programs can also help people more effectively negotiate AI-powered legal assistance. These actions will help Malaysia towards a more creative and inclusive legal aid system, therefore enhancing access to justice for all.

References

- Abd Ghadas, Z. A., Asuhaimi, F. A., Hannan, M., & Shah, M. (2022). Lex Formulaic: Law Formula Mobile Apps. *Innovating Education For A Better Tomorrow*, 267.
- Abel, L. K., & Vignola, S. (2010). Economic and other benefits associated with the provision of civil legal aid. *Seattle J. Soc. Just.*, 9, 139.
- Ajrun, N. (2023). Bridging the digital divide affecting persons with disabilities in Malaysia. *International Journal of Disability, Development and Education*, 70(4), 562-574.
- Ayob, N. H., Aziz, M. A., & Ayob, N. A. (2022). Bridging the digital divide: Innovation policy and implementation in Malaysia. *International Journal of Academic Research in Business and Social Sciences*, 12(8), 1373-1389.
- Baharum, Z., Ahmad, F., Qureshi, M. I., Nasien, D., & Adiya, M. H. (2023). Mobile-Based applications: the legal challenges on data privacy. *International journal of online and biomedical engineering*, 19(9), 4-14.
- Becher, S., & Alarie, B. (2025). LexOptima: The promise of AI-enabled legal systems. *University of Toronto Law Journal*, 75(1), 73-121.
- Chan, G. K. (2007). The right of access to justice: Judicial discourse in Singapore and Malaysia. *Asian Journal of Comparative Law*, 2(1).
- Ejjami, R. (2024). AI-driven justice: Evaluating the impact of artificial intelligence on legal systems. *Int. J. Multidiscip. Res*, 6(3), 1-29.
- Garahan, S. (2021). Legal aid: promoting sustainable development through greater access to justice. In *Peace, Justice and Strong Institutions* (pp. 490-500). Cham: Springer International Publishing.
- Greenleaf, G., Mowbray, A., & Chung, P. (2018). Building sustainable free legal advisory systems: Experiences from the history of AI & law. *Computer Law & Security Review*, 34(2), 314-326.

- GS, J. K., & Ab Karim, H. S. (2024). Inclusive Digital World: Examining Access, Affordability and Ability in Malaysian Underserved Community. *Journal of Information and Knowledge Management*, 14(2), 12-24.
- Gustaf, M. A. M. (2021). Legal Aid in Indonesia: Problems and Challenges. *The Indonesian Journal of International Clinical Legal Education*, 3(2), 163-172.
- Hakim, H. A., Praja, C. B. E., Setyaningrum, W., & Setiawati, D. (2024). Smart legal: Proposing artificial intelligence application to provide free legal aid in Indonesia. In *E3S Web of Conferences* (Vol. 500, p. 05004). EDP Sciences.
- Hakim, H. A., Praja, C. B. E., Setyaningrum, W., & Setiawati, D. (2024). Smart legal: Proposing artificial intelligence application to provide free legal aid in Indonesia. In *E3S Web of Conferences* (Vol. 500, p. 05004). EDP Sciences.
- Hamin, Z., Kamaruddin, S., & Rosil, W. R. W. (2018). "Trust me; I'm your lawyer": Lawyers' Reporting Duty under AML/ATF Law in Malaysia. *Journal of ASIAN Behavioural Studies*, 3(10), 1-8.
- Jalil, F. (2015). Challenges and Prospects on Access to Justice in Malaysia. Available at SSRN 2746717.
- Kamaruzzaman, S. S. (2020). An Overview on The Usage of Artificial Intelligence (AI) In The Malaysian Legal Industry: Challenges And The Way Forward. *Law Majalla*, 7, 112-134.
- Ladin, M. A., Das, A. M., Najah, A., Ismail, A., & Rahmat, R. A. A. O. (2014). A review of strategies to implement sustainable urban transportation options in Malaysia. *Jurnal Teknologi (Sciences & Engineering)*, 69(2).
- Mohamad, A. M., Hamin, Z., Nor, M. Z. M., Kamaruddin, S., & Radzi, M. S. N. M. (2020). The Implications of Audio/Video Conference Systems on the Administration of Justice at the Malaysian Courts. *Webology*, 17(2).
- Morandín-Ahuerma, F. (2022). What is Artificial Intelligence? *Int. J. Res. Publ. Rev.*, 3(12), 1947-1951.
- Mowbray, A., Chung, P., & Greenleaf, G. (2019). Utilizing AI in the Legal Assistance Sector. In *LegalAIIA@ ICAIL* (pp. 12-18).
- Nagendraswamy C, & Salis A. (2021) A review article on artificial intelligence. *Ann Biomed Sci Eng*. 2021; 5: 013-014.
- Prescott, J. J. (2010). The challenges of calculating the benefits of providing access to legal services. *Fordham Urb. LJ*, 37, 303.
- Rajendra, J. B., & Thuraisingam, A. S. (2022). Artificial intelligence and its impact on the legal fraternity. *UUM Journal of Legal Studies*, 13(2), 129-161.
- Shah, R. W., Ali, A., & Iftikhar, K. (2023). The Impact of Internet Connectivity on Financial Inclusion: Comparative Analysis between Developed and Developing Countries. *South Asian Journal of Management*, 17(1), 82-103.
- Singh, J. K. S. (2023). The values of an AI ethical framework for a developing nation: considerations for Malaysia. In *Elgar Companion to Regulating AI and Big Data in Emerging Economies* (pp. 115-134). Edward Elgar Publishing.
- Siong, W. H. (2019). Lawyers as Meddlers in the Mediation Process-A Malaysian Perspective. *Global J. Bus. Soc. Sci. Review*, 7(1), 84-90.
- Sobari, A. (2024). Layanan pos bantuan hukum (posbakum) di pengadilan agama kota pangkalpinang kelas 1a. *Islamitsch Familierecht Journal*, 5(1), 35-50. <https://doi.org/10.32923/ifj.v5i1.4688>



- Susantyo, H. P., Syahbana, A. N., Haji, M. S., Azzuhdi, I. M., & Afandi, A. (2024). Membangun kesadaran hukum masyarakat melalui layanan bantuan hukum bagi masyarakat miskin di desa batur kabupaten probolinggo. *Jurnal Abdi Panca Marga*, 5(2), 215–222. <https://doi.org/10.51747/abdipancamarga.v5i2.2166>
- Tasnim, K. S., & Bint-E-Basar, K. T. (2024). Legal aid for poor and indigent litigant in bangladesh. *Journal of Asian and African Social Science and Humanities*, 10(3), 23–32. <https://doi.org/10.55327/jaash.v10i3.341>
- Website of JBG - Jabatan Bantuan Guaman (2025), online at <http://jbg.gov.my/> accessed 14 March 2025.
- Website of Sisters in Islam (2025), online at <https://sistersinislam.org/> accessed 14 March 2025.
- Website of Tenaganita (2025), online at <https://tenaganita.net/> accessed 14 March 2025.
- Website of WAO – Women’s Aid Organisation (2025), online at <https://wao.org.my/> accessed 14 March 2025.
- Website of YBGK - Yayasan Bantuan Kebangsaan Malaysia (2025), online at <https://www.ybgk.org.my/> accessed 14 March 2025.

CHATGPT-4O VS. DEEPSEEK-V3: A PROMPT-ENGINEERED COMPARATIVE ANALYSIS OF AI PERFORMANCE IN INTEGRATED MARKETING COMMUNICATION (IMC)

Fahri Ahmed¹
Hasrina Mustafa²

¹School of Communication, University Sains Malaysia (USM), Malaysia, (fahri@usm.my)

¹School of Communication, University Sains Malaysia (USM), Malaysia, (hasrina@usm.my)

Abstract: *This conceptual paper presents a prompt-engineered comparative analysis of ChatGPT-4o and DeepSeek V3, focusing on their potential effectiveness in Integrated Marketing Communication (IMC). As AI-driven tools increasingly influence branding, content strategy, and digital marketing, understanding their capabilities, limitations, and strategic fit is crucial for businesses. This study proposes a structured methodology to evaluate both platforms across eight key marketing categories—market analysis, branding and audience targeting, communication mix, pay per click (PPC) campaigns, public relations (PR) and email, social media ideation, ad copy and messaging, and search engine optimisation (SEO) blogging—using a refined framework grounded in Natural Language Generation (NLG) theory and marketing principles. For research objective 1 (RO1), the study employs keyword trend analysis and Principal Component Analysis (PCA) to assess the surge in DeepSeek V3’s industry interest following its release, compared to ChatGPT. RO2 examines the functionalities of both AI models, identifying their comparative strengths and suitability for IMC tasks. RO3 evaluates which platform excels by conducting a rubric-based survey with twenty subject matter experts with at least three years of experience. Participants assess AI-generated outputs on the eight categories mentioned above for each platform and provide additional comments to reason their scores. The data will be analysed using descriptive statistics—mean score per category, median and mode, standard deviation, and histogram distribution analysis—to track trends, response consistency, and overall performance. Given the small sample size, the study will employ the Wilcoxon rank test to analyse category-wise performance correlations, while intra-class correlation (ICC) ensures evaluator agreement. To complement numerical scoring, decision tree analysis will determine which IMC category contributes most to AI effectiveness. Currently in the analysis phase, this study aims to bridge theoretical and practical applications, providing a structured foundation for future empirical research on AI’s role in marketing communication.*

Keywords: *DeepSeek V3, ChatGPT-4o, AI-marketing tools, Integrated Marketing Communication (IMC), prompt-engineered AI results, Artificial Intelligence effectiveness.*

Introduction

In 2024, AI isn't just transforming content marketing—it's dominating it. Businesses are pouring billions into AI-driven tools, making automation a necessity, not a trend. Global spending on AI-powered marketing tech is set to explode from \$15.8 billion in 2021 to \$107.5 billion by 2028 (Statista, 2023). AI-generated content now fuels social media, email marketing,



and brand storytelling at an unprecedented scale. At the forefront stands OpenAI's ChatGPT, the undisputed leader in conversational AI, boasting 180 million active users as of April 2024 (OpenAI, 2024). With 67% of marketers leveraging ChatGPT for content creation, cutting production time by 40% (McKinsey, 2023), it has revolutionised marketing. Yet, its weaknesses—logic-based reasoning, structured content, and precision—leave room for disruption. Enter DeepSeek—the AI model making waves and challenging ChatGPT's supremacy. Launched in December 2024, DeepSeek promises superior logical structuring, precision-driven reasoning, and a lower-cost alternative to existing AI giants. With 98.7% accuracy in Python code generation, outperforming GPT-4's 89.3% benchmark (DeepSeek, 2024), it's engineered for fact-based problem-solving rather than pure creative fluency. The industry is taking notice. DeepSeek's efficiency claims have triggered a \$593 billion sell-off in Nvidia's stock, the largest single-day loss in Wall Street history, as investors brace for a potential AI hardware disruption. Within 24 hours of its launch, DeepSeek's app surpassed ChatGPT in downloads from Apple's App Store.

The conceptual paper explores that in the midst of this hype, is DeepSeek R1 truly an industry-shaking revolution, or just another overhyped AI challenger? For marketers and brand strategists relying on AI, the answer could redefine the future of content creation.

Literature Review

The proliferation of artificial intelligence (AI) in marketing has led to a highly saturated landscape, with tools designed to assist users across a spectrum of tasks, ranging from basic data entry to complex decision-making. Specialised platforms such as Copy.AI focus on content generation, while Perplexity AI is tailored for research-based applications. Additionally, general-purpose AI assistants such as Microsoft's Copilot, which integrates with Microsoft products, and Google's Gemini, designed for broader knowledge retrieval and creative tasks, have further diversified the AI ecosystem. Scholars and industry experts posit that AI will soon be a fundamental component of marketing strategy. However, while AI presents notable advantages—including enhanced personalisation, superior customer experiences, and greater efficiency in campaign management—its adoption is not without challenges. The high costs of development and the need for specialised expertise serve as barriers to implementation (Rane et al., 2024). Furthermore, despite the availability of free versions of many AI tools, full functionality is often locked behind substantial subscription fees. ChatGPT, for instance, has gained widespread adoption, yet its optimal performance is largely contingent upon access to its premium features. Additionally, AI-driven marketing strategies are inherently dependent on high-quality datasets, as flawed or biased data may result in inaccurate outputs and misinformed decision-making (Bahrini et al., 2023).

The Evolution of AI in Integrated Marketing Communication: ChatGPT and DeepSeek

Since its introduction in 2022, ChatGPT has established itself as one of the most widely utilised AI models for content generation. Developed by OpenAI, it has gained prominence due to its linguistic fluency and adaptability, making it particularly effective for advertising copy, brand engagement, and creative content production. Unlike niche AI tools that focus on specific functionalities, ChatGPT offers a broad range of applications within marketing workflows. However, despite its versatility, ChatGPT has demonstrated limitations in structured reasoning, fact-based problem-solving, and precision-driven tasks, thereby creating a gap for alternative



AI models. In contrast, DeepSeek, developed in China and first introduced in November 2023, has rapidly gained industry attention with the launch of DeepSeek V3 in December 2024. Unlike ChatGPT's focus on linguistic fluency, DeepSeek has been engineered for logical structuring, strategic content planning, and data-driven decision-making (Arora, 2025). With its claimed superiority in structured reasoning and efficiency, DeepSeek is increasingly considered a viable alternative for marketing professionals seeking AI tools capable of campaign optimisation, predictive analytics, and structured content generation.

Research Objectives

Given the rapid advancements in AI-driven marketing, this study seeks to empirically compare ChatGPT and DeepSeek's performance in integrated marketing communication (IMC) by assessing their capabilities across eight key criteria. Specifically, the research aims to:

RO1: Examine the surge in industry interest towards DeepSeek V3 following its release, relative to ChatGPT.

RO2: Evaluate the functionalities of both AI models to identify their comparative strengths and suitability for IMC tasks.

RO3: Assess which AI model demonstrates greater efficacy in executing integrated marketing communication strategies.

Through this comparative analysis, the study will provide marketers, brand strategists, and AI developers with data-driven insights into the practical implications of ChatGPT and DeepSeek in the marketing ecosystem. By critically evaluating their capabilities, limitations, and strategic applications, this research will contribute to the broader discourse on AI's evolving role in shaping the future of integrated marketing communication.

Theoretical Framework

This study applies the Natural Language Generation (NLG) evaluation framework established by Reiter and Dale (2000), which identifies fluency, coherence, relevance, accuracy, and completeness as essential measures of text quality. These criteria have been extensively used across disciplines, including marketing, and remain critical for assessing large language models (LLMs) like ChatGPT-4o and DeepSeek-V3. Their relevance extends beyond conventional text generation; for example, Bang et al. (2023) employed them to evaluate LLM performance in code generation, underscoring their adaptability. By integrating these criteria into the eight key dimensions of marketing and branding, this research ensures a systematic and rigorous assessment of AI's effectiveness in marketing communication.

Methodology

To assess the effectiveness of ChatGPT-4o and DeepSeek V3 in marketing and branding, this study applies an eight-category framework adapted from Murar and Kubovics (2023), who analysed over 2,500 marketing workflows to identify AI's core functions. The selected categories—market analysis, branding and audience targeting, communication mix, PPC strategy, PR and email marketing, social media ideation, ad copy and messaging, and SEO blog



generation—reflect essential marketing activities that drive brand success. Each category addresses a fundamental aspect of marketing strategy, from data-driven decision-making in market analysis to precision targeting in PPC campaigns and engagement-driven content creation for social media (Hicham et. al, 2023). While ChatGPT excels in creative fluency and engagement, DeepSeek’s strength lies in structured reasoning and data-driven insights (Portakal, 2025). ChatGPT-4o and DeepSeek V3 were selected due to their frequent comparisons in AI performance discussions (DataCamp, 2024). By systematically comparing both models across these functions, this research provides a practical, performance-based evaluation of AI’s role in marketing communication, enabling brands to optimise strategy, efficiency, and impact.

To achieve the first objective, relevant keywords related to both platforms are collected and will be analysed to evaluate engagement levels and leading discussion topics using secondary data. To achieve RO2, the study collects secondary data sourced from official AI platform websites, past literature, and authoritative sources to assess the functionalities of ChatGPT-4o and DeepSeek V3, highlighting their suitability for integrated marketing communication. To achieve RO3, the study integrates prompt engineering (Rayhan, 2023) to refine AI-generated responses, ensuring alignment with specific marketing objectives. Purposive sampling selects subject matter experts with at least three years of marketing experience and familiarity with AI-driven marketing tasks so that it is ensured that those who are assessing the marketing tool’s prompt results have sufficient understanding and knowledge on the criteria. To ensure consistency and comparability, both AI tools operate under identical conditions, eliminating external biases from brand differences. Each AI-generated response is assessed on a 5-point scale (1-5), with 1 being poor, 3 being average, and 5 being excellent. The evaluation follows the NLG evaluation theory, assessing fluency, coherence, relevance, accuracy, and completeness while ensuring alignment with marketing principles to ensure the correctness and quality of the solutions (Mashagbeh et al., 2024). Additionally, the rubric includes a comments section for each category, allowing participants to provide qualitative insights on what influenced their rating. This ensures a more comprehensive evaluation, capturing both quantitative scoring and subjective feedback for deeper analysis.

To evaluate RO1, the study will employ the Principal Composite Index (PCI) to systematically identify engagement trends and dominant discussion topics surrounding DeepSeek V3 and ChatGPT-4o. To analyse RO2, a comparative document analysis approach will be used to systematically assess the functionalities of ChatGPT-4o and DeepSeek V3, identifying similarities, differences, and relative advantages in their marketing capabilities. To evaluate which platform excels in generating the marketing content as per RO3, this study will apply a combination of statistical and qualitative analysis methods, ensuring structured assessment with a minor participant pool (n=5).

The paper is now in data analysis process and seeks to reveal valuable insights for marketers and businesses as a whole to understand the topics around the hype of DeepSeek, where ChatGPT-4o and DeepSeek V3 stands in terms of their marketing functionalities and which platform is outperforming in integrated marketing tasks, in what category they best excel. This will give a comprehensive practical view of how best to leverage these tools to achieve effective benefits from their capabilities to execute diverse marketing communication tasks successfully.

References

- Arora, S. (2025). ChatGPT vs. DeepSeek: A Detailed Comparison. <https://currentaffairs.adda247.com/chatgpt-vs-deepseek-a-detailed-comparison/>
- Bahrini, A., Khamoshifar, M., Abbasimehr, H., Riggs, R. J., Esmaili, M., Majdabadkohne, R. M. & Pasehvar, M. (2023). ChatGPT: Applications, Opportunities, and Threats. In arXiv (Cornell University). Cornell University. <https://doi.org/10.48550/arXiv.2304>.
- Bang, Y., Cahyawijaya, S., Lee, N., Dai, W., Su, D., Wilie, B., ... & Fung, P. (2023). A multitask, multilingual, multimodal evaluation of ChatGPT on reasoning, hallucination, and interactivity. *arXiv preprint arXiv:2302.04023*.
- DataCamp. (2024). DeepSeek R1 vs V3: Comparing AI capabilities and applications. Retrieved from <https://www.datacamp.com/blog/deepseek-r1-vs-v3>
- DeepSeek. (n.d.). In *Wikipedia*. Retrieved February 12, 2025, from <https://en.wikipedia.org/wiki/DeepSeek>
- Hicham, N., Nassera, H. & Karim, S. (2023). Strategic Framework for Leveraging Artificial Intelligence in Future Marketing Decision-Making. In *Journal of Intelligent Management Decision* (Vol. 2, Issue 3, p. 139). <https://doi.org/10.56578/jimd020304>
- Mashagbeh, M., Al-Hadhaifeh, A., & Al-Hawary, S. (2024). Evaluating the effectiveness of AI-driven marketing tools: A benchmarking approach. *Journal of Marketing Technology*, 13(2), 78-95.
- McKinsey & Company. (2023). The impact of AI on marketing and sales. *McKinsey Insights*.
- Murar, M., & Kubovics, M. (2023). Using AI to create content designed for marketing communications. *Journal of Marketing Technology*, 12(3), 45-60.
- OpenAI. (2024). ChatGPT active users. *OpenAI*. Retrieved from <https://openai.com/blog/chatgpt/>
- Portakal, E. (2025, January 26). DeepSeek v3 Review: Performance in Benchmarks & Evals. *TextCortex*. Retrieved from <https://textcortex.com/post/deepseek-v3-review>
- Rane, N., Choudhary, S. & Rane, J. (2024). Artificial intelligence and machine learning in business-to-business (B2B) sales and marketing: a review [Review of Artificial intelligence and machine learning in business-to-business (B2B) sales and marketing: a review]. SSRN Electronic Journal. RELX Group (Netherlands). <https://doi.org/10.2139/ssrn.4842575>
- Rayhan, A. (2023). *Mastering prompt engineering: Techniques for creating powerful and effective AI language models*. Independently Published.
- Reiter, E., & Dale, R. (2000). *Building natural language generation systems*. Cambridge University Press.
- Statista. (2023). Artificial intelligence (AI) use in marketing - statistics & facts. *Statista*. Retrieved from <https://www.statista.com/topics/5017/ai-use-in-marketing/>



Appendix 1:

Survey: Scan QR or click this link:<https://forms.gle/5M3NfdoEtMfVPXZY6>



A COMPARATIVE REVIEW OF IONIC FRAMEWORK AS PROGRESSIVE WEB APPLICATION (PWA) FOR MOBILE APPLICATION DEVELOPMENT IN TVET

Nuraiman Abd Rahman¹
Nuzul Ardzan Mokhtar²
Muhammad Shafiq Abd Rahman³

¹Department of Petrochemical Engineering, Politeknik Kuching Sarawak, Malaysia, (nuraiman@poliku.edu.my)

²Department of Petrochemical Engineering, Politeknik Kuching Sarawak, Malaysia, (nuzul@poliku.edu.my)

³Department of Technology, Abata Commerce Sdn Bhd, Malaysia (shafiq@abatacommerce.com)

Abstract: *In Malaysia's Technical and Vocational Education and Training (TVET) programs, students focusing on software development need exposure to modern, industry-relevant technologies. Traditional mobile app development using native applications requires platform-specific coding, increasing development time, cost, and complexity. This limits students' ability to build scalable, cross-platform solutions efficiently. Ionic frameworks, when used as Progressive Web Applications (PWA), enhance this approach by providing a native-like experience while leveraging web technologies such as HTML, CSS, and JavaScript. This study presents a comparative ease of development, user interface (UI) differences and publishing challenges between PWA and native mobile application. PWA developers uses common web technologies that provide native like responsive user interface and easiest deployment with no app store restrictions. This review should assist educators, developers, and decision-makers in selecting the most suitable platform for TVET mobile application development.*

Keywords: *PWA; Ionic; Native; HTML; UI.*

Introduction

Mobile application development can be divided into two main categories, Native Mobile Applications and Progressive Web Applications (PWA)[1]. Native apps are platform-specific, built using programming languages such as Java for Android and Swift for iOS, and require installation from app stores[2]. In contrast, PWAs are web-based applications developed using HTML, CSS, and JavaScript, offering a native-like experience directly through a web browser[3].

In the context of Technical and Vocational Education and Training (TVET) at Politeknik Malaysia, students are introduced to C++ for fundamentals, Java for web development, and Android Studio for mobile applications[4]. However, learning native mobile app development can be challenging for students as one of the biggest technical obstacles for developers is the fragmentation of mobile platforms[5]. PWAs provide an alternative approach by leveraging familiar web technologies, potentially shorten the learning curve[6].

This study aims to compare the complexity, user interface, and deployment challenges of PWA and native mobile applications to determine their suitability for mobile development in TVET.

Progressive Web Application (PWA)

The emergence of Progressive Web Applications (PWA), a new approach for developing web-based mobile applications, is an outcome of the rapid growth of web technologies. The best components from native mobile apps and standard web applications are combined in PWAs, which provide a dependable, quick, and engaging user experience without require to install from an app store[7]. PWAs make use of common web technologies like HTML, CSS, and JavaScript, keeping them compatible with a wide range of devices and operating systems, in contrast to native apps, which are platform specific[6].

PWA is sometime mistaken with Responsive Web Apps (RWA) as both are browser-based access and enhance the user experience across devices. Table1 shows how PWA and RWA compare[8]:

Table 1: Comparison between PWA and RWA

Field	PWA	RWA
Push Notifications	Push notification for specific user	No push notification available
Loading Speed	Faster with the usage of usage of 'App Shell'	Slower without 'App Shell'
Add To Home Screen	Launch immediately with display icon on home screen	Launch from browser with the absent of home screen icon







PWA delivers better features and performance with the push notification, home screen icon and faster loading speed using the 'App Shell' compared to RWA.

Native Mobile Application

A native mobile application is made especially for a specific operating system and device, for example iOS for iPhone or Android for Samsung. In contrast to web-based apps, native apps can't be used unless they've been downloaded and installed from an official store, either the Apple App Store for iOS or the Google Play Store for Android[9].

Platform-specific programming languages are used to create native apps, which guarantee optimal performance, a seamless user experience, and close integration with the hardware and software capabilities of the device[10]. Table 2 displays the differences between Android and iOS native mobile applications.

Table 2: Comparison between Android and iOS

Operating System	 Android	 iOS
Device	Samsung and others	iPhone
Development Environment	 Android Studio	 Xcode
Programming Language	Java	Swift
Store	 Play Store	 App Store

Ionic Framework

Ionic is an open-source software development kit (SDK) for creating cross-platform, high-performance online and mobile applications that integrate with web-based technologies such as HTML, CSS, and JavaScript to responsively adjust to different screen sizes and devices. The development process is further improved by the integration with AngularJS, a complex JavaScript framework, which provides best practices for JavaScript development and the establishment of a stable working environment[11], [12].

Ionic enables web developers to build apps for all major app stores and the mobile web from a single codebase as Ionic can act as PWA or Hybrid Mobile Application. The differences of Hybrid app consist of customizable plug-ins with more native features components but need to be updated through stores[2].

Literature Review

The increasing demand for cross-platform mobile applications has led to the adoption of various development approaches, including Progressive Web Applications (PWA), Responsive Web Application (RWA), Ionic-based hybrid applications and native applications. Every approach has unique benefits and drawbacks, especially when it comes to development complexity, performance, and user experience. The main conclusions from earlier studies are highlighted in this overview of the literature, which also looks at the methodological techniques taken to develop applications leveraging each of these technologies.

According to earlier research, RWA is a comprehensive strategy for providing a more responsive user interface for customers across a range of devices. PWA is a better method for creating apps with native-like functionality because it can provide extra features like push notifications, offline service, and GPS[8].

Past research on the use of native capabilities like GPS location, PWA location tracking is significantly less precise than native apps. This finding supported the hypothesis that mobile web apps could not function and perform as well as native apps since they did not have direct access to the device hardware[9].

Past study also shows that, there is not a noticeable distinction in the user interfaces of Android, iOS, and mobile web apps when comparing Ionic-based hybrid to Ionic PWA for mobile geographical maps. Since it eliminates the need to publish the apps on the store, the PWA approach is therefore a preferable option for mobile apps that focus more on mobile geographical map functionalities[13].

The comparison between Progressive Web Applications (PWA), Ionic-based hybrid applications, and native applications highlights the strengths and limitations of each approach. PWAs offer a compelling solution for cross-platform development, enabling offline functionality, push notifications, and improved user experience without requiring app store distribution. However, their limitations in accessing native device features, such as GPS precision, restrict their use in applications requiring high-performance hardware integration.

Methodology

Table 3 lists the comparison in ease of development, user interface (UI) differences, publishing challenges, and between progressive web applications and hybrid mobile applications as methods for this study.

Table 3: Comparison between PWA and hybrid mobile applications

Ease of development	UI differences	Publishing challenges
Development Platform	Responsiveness	Updating Apps
Accessibility	User experience	Cost of publishing

The two main areas of ease of development are development platform and accessibility can be used to evaluate how easy it is to develop Progressive Web Applications (PWA) versus Hybrid Mobile Applications. The tools, frameworks, and programming languages needed to construct these applications are included in the Development Platform, and accessibility looks at how easily developers can design, test, and launch apps on various platforms.

User experience (UX) and responsiveness are the two main characteristics that may be used to evaluate UI differences. The ability of an application to adjust to multiple screen sizes, resolutions, and orientations on a variety of devices while maintaining a fluid visual presentation is measured by responsiveness. UX is the sum of an application's overall feel, functionality, and interactivity. It determines how easily and effectively users may interact with its features.

Publishing challenges between PWA and Hybrid Mobile Applications can be assessed through two key categories that are updating apps and cost of publishing. Updating apps examines how efficiently developers can implement and distribute new versions, ensuring users receive the latest features, improvements, and security updates with minimal delays. Cost of Publishing encompasses the expenses involved in launching and maintaining an application across different platforms focusing on app store fees.

Results on Ease of Development

According to the study findings, Ionic Progressive Web Applications (PWAs) are easier for students to use because they make use of well-known web development tools like HTML, CSS, and JavaScript. With this method, developers may produce apps that are deployable using Cordova and can be tailored for various operating systems, such as Windows, iOS, or Android [3][14]. On the other hand, native apps need platform-specific coding such as Java and Swift that must be created independently for the iOS and Android platforms[15]. Students have difficulties because of the increased complexity and development time[9].

Ionic PWA simplify development and testing procedures by running on any device with a web browser using a single codebase. Native apps, on the other hand, are limited to platforms and gadgets for example, an iOS app may only be downloaded and utilized on an iPhone, which restricts accessibility[9], [12], [15].

Results on User Interface Differences

Because of their architecture, Progressive Web Applications (PWA) provide significant performance benefits. By caching necessary interface elements, the App Shell model's implementation enables quicker load speeds and dependable user experiences even in less-than-ideal network circumstances. UI of PWA is designed to provide a responsive UI on a range of devices, guaranteeing consistent operation and natively look like a hybrid mobile application that can be compare on Spotify in Figure 1 [8], [16].

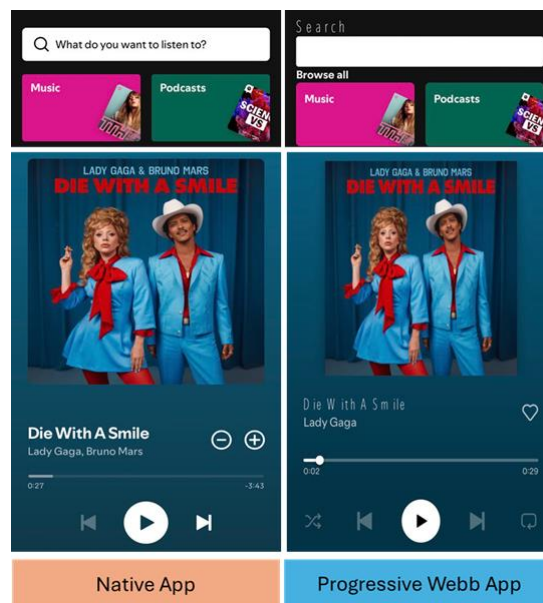


Figure 1: The comparison of UI responsiveness similarities between Spotify Native App and PWA

The coherence of the user interface, especially the appearance and feel of applications, is a critical component of the mobile user experience (UX). Native platforms offer design standards to guarantee uniformity among apps, resulting in a more cohesive and intuitive user experience that can be compare on Figure 2 as native platform can display better thumbnails and video to enhance the user experience. Web apps, on the other hand, are not bound by platform-specific

guidelines, which occasionally leads to a less user-friendly experience. Web apps, on the other hand, can be made to resemble native designs, providing a recognizable experience while preserving the benefit of a single, uniform appearance across many devices[17][18].

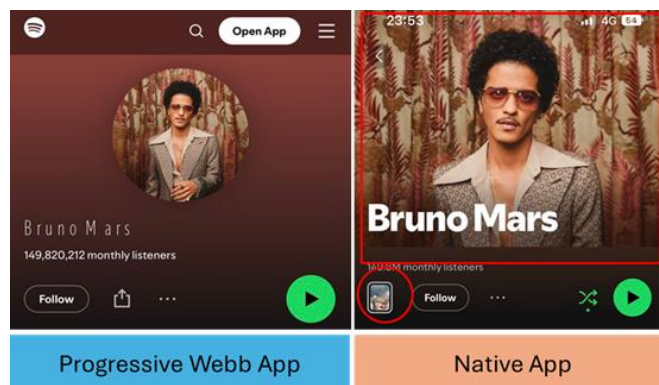


Figure 1: The comparison of UX between Spotify Native App and PWA

Results on Publishing challenges

Publishing challenges are the subject of the last comparison. Ionic PWAs have a big edge in this area since, unlike native apps, they don't need to be approved or reviewed before being launched[18]. iOS apps are approved in 1-2 days, however Android apps usually go through a review process that lasts 3-7 days. Students may find this review procedure especially difficult because they must follow strict rules. The waiting period for resubmission and approval may increase if an application is denied, causing additional delays[19][19].

Ionic PWA is the most cost-effective choice because it is entirely free to publish. However, iOS developers must pay a \$99.00 annual cost, while Android developers must pay a \$25 one-time fee. Because of this, Ionic PWA is a more affordable option, particularly for students and independent developers[19].

Conclusion

In the context of mobile development for TVET students at Politeknik Malaysia, this study explored at the ease of development, user interface differences and publishing challenges, between Progressive Web Applications (PWA) and native mobile applications. According to the results, PWAs are a good substitute for native apps, especially for students who require a more approachable, economical, and successful method of creating mobile apps.

By utilizing popular web technologies like HTML, CSS, and JavaScript, PWAs make development easier and allow developers to create cross-platform apps using a single source of code. On the other hand, platform-specific coding is necessary for native apps, which raises the complexity, expense, and time. While native apps offer a more refined and optimized UX by utilizing platform-specific UI elements, PWA offer a responsive and native-like experience from the standpoint of the user interface. Native apps improve user interaction by better integrating with device hardware, whereas PWAs guarantee consistency across devices.

Regarding publishing challenges, PWAs hold a significant advantage as they do not require app store approval and allow for instant updates. This eliminates delays associated with the review and approval process in app stores, making PWAs more convenient for students and independent developers. Additionally, PWAs have no publishing fees, whereas Android and iOS applications require one-time or annual costs.

Overall, the study concludes that PWA provide an effective solution for TVET students by reducing development complexity, improving accessibility, and eliminating publishing restrictions. However, the decision between PWA and native applications ultimately depends on project requirements, with native applications being more suitable for high-performance, hardware-intensive applications. Future research could explore hybrid solutions that combine the strengths of both approaches, ensuring an optimal balance between accessibility, performance, and cost-effectiveness in mobile application development.

References

- [1] A. Souha, L. Benaddi, C. Ouaddi, and A. Jakimi, "Comparative analysis of mobile application Frameworks: A developer's guide for choosing the right tool," in *Procedia Computer Science*, Elsevier B.V., 2024, pp. 597–604. doi: 10.1016/j.procs.2024.05.071.
- [2] P. Gunawardhana, L. K. Pulasthi, and D. Gunawardhana, "Native or Web or Hybrid which is better for Mobile Application," *Turkish Journal of Computer and Mathematics Education 4643 Research Article*, vol. 12, no. 6, pp. 4643–4649, 2021, doi: 10.16949/TURKBILMAT.56034.
- [3] S. Garad and S. Bendale, "PROGRESSIVE WEB APPS: A SEAMLESS USER INTERFACE," *www.irjmets.com @International Research Journal of Modernization in Engineering*, no. 523, [Online]. Available: www.irjmets.com
- [4] DR. CHEN MEI CHING, NEELAM AMELIA BINTI MOHAMAD REJENI, and NORFAZILAH BINTI MOHAMAD PON, *JTMK Student Handbook 2024 DIT Version 2*, 2nd ed. Malaysia, 2024.
- [5] V. Yberg, "Native-like Performance and User Experience with Progressive Web Apps," 2018.
- [6] M. Blessing, "Progressive Web Apps (PWAs) and Their Impact on User Experience Author: Moses Blessing," 2024. [Online]. Available: <https://www.researchgate.net/publication/383661054>
- [7] M. Shankar Srinivas Lingolu and M. Kumar Dobbala, "A Comprehensive Review of Progressive Web Apps: Bridging the Gap Between Web and Native Experiences," *International Journal of Science and Research (IJSR)*, vol. 11, no. 2, pp. 1326–1334, Feb. 2022, doi: 10.21275/sr24517172948.
- [8] Mr. Rohit Chandrakant Chavan, Mr. Shubham Deepak Bhatkar, and Dr. Kirti Muley, "Progressive Web Apps vs Responsive Web Apps," *International Journal of Advanced Research in Science, Communication and Technology*, pp. 211–214, Jul. 2022, doi: 10.48175/ijarsct-5668.
- [9] W. Jobe, "Native Apps Vs. Mobile Web Apps," *International Journal of Interactive Mobile Technologies (iJIM)*, vol. 7, no. 4, p. 27, Oct. 2013, doi: 10.3991/ijim.v7i4.3226.
- [10] C. T. PHAN, "Developing a hybrid mobile application with Ionic," Lahti University of Applied Sciences, 2018.

- [11] V. K. Kotaru, *Material design implementation with angularJS: UI component framework, first edition*. Apress Media LLC, 2016. doi: 10.1007/978-1-4842-2190-7.
- [12] Serhii Holivets, “Pros and Cons of Ionic Framework for App Development.”
- [13] B. Dunka, E. A. Emmanuel, Y. Oyerinde, B. D. Dunka, and D. O. Oyeyinka, “HYBRID MOBILE APPLICATION BASED ON IONIC FRAMEWORK TECHNOLOGIES,” 2017. [Online]. Available: <https://www.researchgate.net/publication/322397904>
- [14] Apeksha Mehta, “What Makes Ionic Framework Great For PWA Development?,” https://appinventiv.com/blog/ionic-frameworks-for-pwa-development/?utm_source=chatgpt.com.
- [15] O. Adetunji, C. Ajaegbu, N. Otuneme, and O. J. Omotosho, “Dawning of Progressive Web Applications (PWA): Edging Out the Pitfalls of Traditional Mobile Development,” *Technology, and Sciences (ASRJETS) American Scientific Research Journal for Engineering*, vol. 68, no. 1, pp. 85–99, 2020, [Online]. Available: <http://asrjetsjournal.org/>
- [16] V. Panwar, “Leveraging Progressive Web Apps (PWAs) for Enhanced User Experience and Performance: A Comprehensive Analysis,” 2024. [Online]. Available: <http://www.ijmra.us>,
- [17] I. Samsyudin, “Native Apps vs. Progressive Web Apps: A Comparative Analysis of User Experience and Development Costs.”
- [18] A. Holzer and J. Ondrus, “MOBILE APP DEVELOPMENT: NATIVE OR WEB?”
- [19] Bhaval Patel, “How Much Does It Cost to Put an App on the App Store?,” https://www.spaceotechnologies.com/blog/cost-to-put-app-on-app-store/?utm_source=chatgpt.com.

KAJIAN LEPAS BERKAITAN FILEM *BUYA HAMKA* BERDASARKAN TEORI TAKMILAH

Wan Amirah Najihah Wan Amir Nudin¹
Mohd Adi Amzar Muhammad Nawawi²

¹Fakulti Pengajian Bahasa Utama, Universiti Sains Islam Malaysia (USIM),
(wanamirah.wanurdin@raudah.usim.edu.my)

²Fakulti Pengajian Bahasa Utama, Universiti Sains Islam Malaysia (USIM), (adiamzar@usim.edu.my)

Abstract: *Filem Buya Hamka (2023) arahan Fajar Bustomi merupakan sebuah filem biografi yang mengisahkan kehidupan dan kegigihan seorang ulama dan penulis terkenal Indonesia iaitu Buya Hamka dalam perjuangannya mendukung Islam dan menyebarkan ilmu agama kepada masyarakat Indonesia. Pada ketika itu, keadaan menjadi lebih sukar apabila beliau terpaksa berhadapan dengan tentangan hebat daripada bangsa penjajah namun, semangat beliau sangat utuh untuk mengangkat martabat Islam dalam kalangan masyarakat Indonesia ke peringkat yang lebih tinggi. Filem ini telah ditonton lebih daripada satu juta penonton dalam masa dua minggu tayangannya di pawagam kerana ia mengangkat nilai sejarah, keagamaan dan budaya yang tinggi. Penghasilan filem ini diteliti secara mendalam yang merangkumi tiga aspek penting iaitu karya, pengkarya dan khalayak yang bertepatan dengan Teori Takmilah janaan Shafie Abu Bakar berdasarkan kepada tujuh prinsip utama dalam teori tersebut. Oleh itu, makalah ini akan menyoroti kajian-kajian lepas terhadap nilai-nilai Islam, kerangka teori Sastera Islam, pemikiran Buya Hamka dalam sastera dan filem serta pengaplikasian Teori Takmilah secara langsung dalam karya. Tuntasnya, terdapat pelbagai kajian lepas yang mengkaji berkenaan novel atau filem serta aplikasi Teori Takmilah yang menunjukkan kerelevanan bahan analisis tersebut.*

Keywords: *Filem Buya Hamka, Teori Takmilah, Sastera Islam*

Pendahuluan

Kajian ini berfokus kepada satu tinjauan literatur berdasarkan kajian-kajian lepas yang berkaitan dengan kajian lanjutan bagi menganalisis perkaitan babak-babak penting dalam filem *Buya Hamka* bersandarkan kepada tujuh prinsip utama dalam Teori Takmilah oleh Shafie Abu Bakar. Hal ini penting bagi meneliti sejauh mana isi kandungan filem ini menepati prinsip-prinsip yang digariskan dalam teori sastera Islam tersebut. Dewasa ini, genre filem sudah tidak asing lagi dalam bidang kesenian sastera moden yang menjadi aspek perbincangan baru dan menarik dalam kalangan ahli akademik samada daripada bidang kajian agama mahupun kajian filem. Perkembangan ini mempunyai kesan tersendiri terhadap bidang kajian filem kerana sebelum ini kajian berkaitan filem dan agama Islam tidak mendapat perhatian besar berbanding kajian filem berkaitan agama lain seperti Kristian, Hindu, dan Buddha (Mohd Helmi Yusoh et.al, 2018).

Menurut Naim Ahmad (2011), sebuah filem dianggap Islamik jika ia mematuhi semua piawai yang digariskan oleh Islam secara keseluruhan bermula daripada penghasilan skrip sehingga kepada khalayak filem di pawagam manakala filem berunsur Islam hanya mengandungi elemen keislaman dalam mana-mana bahagian filem (Mohd Helmi Yusoh et.al, 2018). Tidak dapat dinafikan bahawa kemunculan nilai Islam dalam filem adalah penting

kerana agama Islam merupakan cara hidup yang merangkumi seluruh aspek kehidupan termasuk isu dan masalah sosial. Namun begitu, masyarakat kini sering dilonggokkan dengan pelbagai genre filem negatif yang mampu merosakkan pemikiran luhur mereka terhadap kehidupan beragama yang jitu. Oleh itu, filem-filem yang mempunyai tema Islam perlu dimartabatkan agar dapat memberi manfaat dan pengajaran kepada masyarakat.

Antaranya, filem *Buya Hamka* yang mengisahkan jerih perih kehidupan sebenar seorang ulama Indonesia dalam usaha dakwah dan pengorbanan beliau untuk menuntut kemerdekaan dan memartabatkan Islam dalam kalangan masyarakat tanah air. Beliau juga merupakan seorang wartawan, penulis, guru dan ahli politik yang terkenal dan wajar dijadikan teladan dalam meniti arus kehidupan yang penuh cabaran ini (Muhammad Khalis Irfan et.al, 2023). Di samping itu, Teori Takmilah menjadi paksi utama bagi keseluruhan analisis agar kajian dapat diteliti secara kolektif daripada pelbagai sudut kerana teori ini dianggap sebagai satu-satunya teori kesusasteraan Islam yang syumul di Malaysia yang menekankan analisis dan kritikan yang berasaskan secara langsung kepada konsep tauhid (Zaidi Ahmad et.al, 2022).

Tambahan lagi, para ahli akademik yang menerapkan Teori Takmilah dalam teks-teks sastera moden membawa kepada anugerah sastera, antaranya Samsina Abdul Rahman yang memenangi anugerah sastera Malaysia yang pertama pada tahun 2000/2001 melalui penulisannya yang bertajuk "*Teori Takmilah dalam Puisi-Puisi Malaysia*" (Kamariah Kamarudin, 2011). Kesimpulannya, objektif kajian ini adalah untuk mengkaji dan menganalisis kajian lepas yang berkaitan supaya kajian lanjutan tentang filem *Buya Hamka* berdasarkan Teori Takmilah dapat dilaksanakan dengan baik. Seterusnya, perbahasan akan disusuli secara ringkas berkaitan analisis kritis dan diakhiri dengan kesimpulan keseluruhan kajian lepas.

Kajian Lepas

Asasnya, kajian ini telah memperincikan beberapa kajian lepas yang berkaitan dengan filem dan novel. Terdapat sebahagian kajian lepas yang menggunakan kerangka nilai-nilai Islam secara am di samping kecenderungan penggunaan kerangka teori sastera Islam pilihan pengkaji bagi melihat daripada pelbagai sudut yang berkait rapat dengan isu kajian secara mendalam. Seterusnya, kajian lepas juga membahas berkenaan pemikiran Buya Hamka dalam sastera dan filem serta pengaplikasian Teori Takmilah secara langsung dalam karya. Oleh yang demikian, pemanfaatan kajian lepas ini dapat membantu untuk memahami pengaplikasian teori sastera Islam dalam menganalisis babak-babak dalam filem atau novel.

Kajian Lepas Berkenaan Aplikasi Nilai-Nilai Islam dalam Novel atau Filem

Beberapa kajian terdahulu membincangkan tentang penerapan nilai-nilai Islam dalam novel sastera atau filem antaranya, kajian daripada Muhammad Khalis Irfan et al. (2023) yang bertajuk "*Representasi Metode Dakwah Islam: Analisis Semiotika pada Film Buya Hamka*". Kajian ini telah membincangkan kaedah dakwah yang digunakan oleh Buya Hamka ketika berdakwah kepada masyarakat melalui filem tersebut dengan menganalisis adegan dalam treler rasmi filem Buya Hamka (2023). Oleh itu, dapat dilihat bahawa pendekatan dakwah Buya Hamka adalah berteraskan Islam menerusi pengaplikasiannya terhadap Surah An-Nahl, ayat 125 iaitu kebijaksanaan, nasihat yang baik, dan perdebatan yang baik dalam dakwah. Oleh itu,

para pendakwah harus mencontohi dan mengikuti uslub dakwah Buya Hamka agar dakwah dapat disampaikan dengan lebih berkesan.

Seterusnya, kajian yang bertajuk “*Nilai-Nilai Religius dalam Novel Buya Hamka*” oleh Ahmad Fuadi yang dikaji oleh Alfiah et al. (2023) telah menjelaskan pelbagai aspek nilai keagamaan yang terdapat dalam novel *Buya Hamka*. Antaranya ialah nilai keimanan iaitu beriman kepada Allah, beriman kepada nabi dan beriman kepada qada dan qadar. Kemudian, terdapat juga nilai ibadah seperti solat, puasa, haji, berdoa, berzikir, dan membaca Al-Quran. Selain itu, nilai penghayatan turut diketengahkan, seperti memperoleh pertolongan Allah, khushyuk ketika berdoa, bertawakal, dan bersyukur. Sementara itu, wujud nilai pengetahuan mengenai rukun Islam dan hukum Islam. Akhir sekali, nilai pengamalan seperti suka menolong, bersedekah, pemaaf dan bersabar. Hal ini menunjukkan bahawa nilai-nilai agama ini sangat berkait rapat dalam kehidupan Buya Hamka sejak kecil hingga akhir hayatnya.

Di samping itu, kajian oleh Deby Rodearni et al. (2022) yang bertajuk “*Analisis Nilai-nilai Religius, Moral, dan Budaya pada Novel Tenggelamnya Kapal Van Der Wijck karya Hamka serta Relevansinya sebagai Bahan Ajar Sekolah Menengah Atas*” menjelaskan nilai keagamaan, nilai moral dan budaya berdasarkan novel tersebut. Pembaca boleh mengambil pengajaran daripada intipati novel *Tenggelamnya Kapal Van Der Wijck* iaitu tidak melakukan diskriminasi terhadap perbezaan suku dan budaya, berpegang teguh kepada ajaran Islam, serta menerima takdir Allah dengan penuh keikhlasan. Oleh itu, para pendidik wajar menerapkan nilai-nilai ini dalam pengajaran karya sastera di sekolah melalui karya ini.

Selain itu, kajian bertajuk “*Representasi Nilai Pendidikan Islam dalam Roman Tenggelamnya Kapal Van Der Wijck Karya Hamka*” oleh Arna Ayu Parman et al. (2021) membawa konsep nilai pendidikan Islam yang membimbing manusia menuju pengabdian kepada Allah. Novel tersebut dianalisis bagi membuktikan kewujudan nilai-nilai pendidikan Islam di dalamnya melalui tiga prinsip utama. Hasilnya, wujud nilai keimanan seperti tawakal, percaya kepada Allah dan keikhlasan dalam menerima qada dan qadar. Seterusnya, nilai akhlak seperti rendah hati, kesabaran, ikhlas dalam melakukan kebaikan, musyawarah, toleransi, dan kejujuran. Akhir sekali, nilai syariat seperti ketaatan, hukum pewarisan, perkahwinan, sedekah, dan taubat. Ini membuktikan bahawa novel ini mengandungi banyak nilai pendidikan Islam yang dapat membimbing pembaca menjadi insan yang lebih baik.

Akhir sekali, dalam kajian bertajuk “*Pesan Dakwah tentang Adab dalam Novel Angkatan Baru karya Buya Hamka*” oleh Hilmi Afa (2020) telah menganalisis mesej dakwah berkaitan nilai akhlak yang terdapat dalam novel ini melalui watak utama iaitu Syamsiar dalam menyampaikan pesan dakwah. Hasil kajian menunjukkan beberapa aspek utama iaitu akhlak seorang penuntut ilmu, akhlak seorang Muslim terhadap ibu bapanya, akhlak seorang Muslim terhadap keluarganya dan akhlak seorang Muslim terhadap dirinya sendiri. Tambahan pula, novel ini mampu dijadikan sebagai medium dakwah kerana penggunaan bahasanya yang mudah difahami dan mudah diterima oleh masyarakat.

Kajian Lepas Berkenaan Aplikasi Teori Sastera Islam dalam Novel atau Filem

Beberapa kajian terdahulu membincangkan mengenai penerapan teori atau konsep sastera Islam dalam novel dan filem. Antaranya ialah artikel bertajuk “*Aplikasi Teori Pengkaedahan Melayu dalam Filem Mat Kilau (2022) Menerusi Pendekatan Dakwah*” oleh Azean Idruwani

Idrus & Iffah Sakinah Othman (2023) yang menganalisis filem *Mat Kilau* untuk mengenal pasti perkembangan Islam juga sebagai medium memperkukuh budaya Melayu. Kajian ini menggunakan Teori Pengkaedahan Melayu yang terbahagi kepada dua pengkaedahan, iaitu pengkaedahan alamiah dan pengkaedahan keagamaan. Namun, kajian ini hanya memberi tumpuan khusus kepada pendekatan dakwah yang merupakan cabang dalam pengkaedahan keagamaan bagi menganalisis peristiwa-peristiwa penting dalam filem ini. Sebagai kesimpulan, pengkaji mendapati bahawa elemen dakwah dapat dilihat melalui beberapa aspek dalam filem ini seperti kepentingan masa, membantu orang yang dizalimi, sifat dengki dan pemimpin ummah. Ini menunjukkan bahawa filem *Mat Kilau* berjaya menyerlahkan nilai-nilai Islam dan keistimewaannya melalui pendekatan dakwah.

Seterusnya, dalam kajian bertajuk “*Analisis Teks Novel Mata Pelajaran Kesusasteraan Melayu Dari Lembah ke Puncak berdasarkan Gagasan Persuratan Baru*” oleh Muhammad Zarif et al. (2022) telah menjelaskan kedudukan ilmu dalam novel tersebut berdasarkan Gagasan Persuratan Baru. Kajian ini menggunakan alat analisis Persuratan Baru, iaitu paksi naratif, isian wacana, dan kandungan cerita untuk mencapai objektif kajian. Hasil kajian mendapati bahawa aspek ruang naratif dalam novel ini dipenuhi dengan kandungan cerita, bukannya kandungan wacana kerana tidak terdapat hujah yang kukuh dan bersifat ilmiah daripada penulis. Oleh itu, novel ini lebih berfungsi sebagai sebuah cerita semata-mata, bukan sebagai medium penyampaian ilmu. Selain itu, teori ini juga boleh diterapkan pada teks kesusasteraan lain untuk menentukan serta menjelaskan kedudukan ilmu dalam sesebuah karya sastra.

Di samping itu, artikel yang ditulis oleh Fauzi Hasan et al. (2018) bertajuk “*Individualisme Faisal Tehrani Dalam Kepengarangan Berdasarkan Novel-novel Terpilih*” melihat pembinaan identiti pengarang dalam lima novel terpilih iaitu *Perempuan Politikus Melayu*, *1515*, *1511H [Kombat]*, *Surat-surat Perempuan Johors*, *Tunggu Teduh Dulu* dan *Bahlut*. Walaupun Teori Teksdealisme menjadi sandaran kajian, namun hanya berfokus kepada prinsip keperibadian yang terdiri daripada empat kriteria untuk mengenal pasti pembinaan individualisme seseorang pengarang : stail individu, reka cipta individu, kedirian individu dan tindakan individu. Kajian mendapati bahawa Faisal Al-Tahrani cuba membina identiti dan keperibadiannya sendiri dalam novel-novel ini melalui gaya penulisan, idea-idea, dan teknik penulisan yang terkenal dalam kalangan pembaca.

Akhir sekali, Ayu Haswida Abu Bakar (2015) telah menulis artikel berjudul “*Konsep Tema Islamik Dalam Filem Islamik Syurga Cinta (2009)*” yang membincangkan kedudukan filem ini melalui konsep tema Islamik dalam filem tersebut. Teori Taabudiyah dan konsep estetika dalam Teori Takmilah akan digunakan dalam kajian ini. Oleh itu, ia menumpukan pada konsep tema penghayatan Islam yang merangkumi isu-isu dalam aspek kehidupan umat Islam samada permasalahan lama atau kontemporari. Hasilnya, peristiwa-peristiwa dalam filem ini tidak menyokong sepenuhnya konsep ibadah kepada Allah untuk menjadikannya tema cinta Islamik kerana ia menafikan watak Islam mengikut definisi Islam oleh Abdul Rahman. Oleh itu, filem *Syurga Cinta (2009)* bukanlah filem Islamik tetapi hanya mempunyai elemen Islam.

Kajian Lepas Berkenaan Buya Hamka dalam Lapangan Sastera dan Filem

Haji Abdul Karim Amrullah adalah nama asal Hamka. Hamka sangat meminati bidang ilmu dengan mula membaca buku-buku agama, sejarah, politik, sosial dan romantik. Pada usia 13-

14 tahun, beliau juga membaca karya pemikiran daripada Jamaluddin al-Afgani, Muhammad Abduh, Joko Krominoto, Mas Mansur dan lain-lain. Hasilnya, beliau telah dikenali sebagai seorang ahli akademik dan sasterawan yang terkenal dengan penulisan dan karya-karya sasteranya yang berkualiti tinggi (Rahmi Nur Fitri, 2020). Oleh itu, bidang penulisan merupakan salah satu sumbangan utama Buya Hamka kerana beliau telah menghasilkan 79 karya yang terdiri daripada pelbagai jenis genre (Nurshuhadah Zuhaidi & Firus Lubis Akhtar, 2021). Pemikirannya meliputi pelbagai bidang ilmu termasuk tasawuf, falsafah, pendidikan Islam, sejarah Islam, fiqh, sastera, dan tafsir. Antara karyanya ialah Falsafah Hidup (1950), Tasawuf Moden (1983), Lembaga Budi (1983), Tafsir Al Azhar (1962) dan lain-lain (Slamet Faozi et.al, 2021).

Penulisan dan karya sastera Hamka sangat terkenal dan memberi inspirasi kepada masyarakat sehingga diadaptasikan sebagai filem pada hari ini seperti *Di Bawah Lindungan Kaabah* (1977, 2011) dan *Tenggelamnya Kapal Van Der Wijck* (2013). Kedua-dua filem ini adalah kritikan beliau terhadap diskriminasi sosial yang wujud dalam realiti masyarakat (Haslina Ibrahim, 2022). Terdapat banyak juga mesej Islam dan Indonesia yang disampaikan dalam novel Hamka dan corak pemikirannya digambarkan dalam karyanya (Yusuf Afandi & Syukrina Damayanti, 2020). Selain itu, Hamka mengetahui tentang masalah adat Minangkabau daripada Datuk Singo Mangkuto (Rahmi Nur Fitri, 2020). Oleh yang demikian, karya-karya Hamka mencerminkan kehidupan masyarakat dan budaya pada zamannya yang masih relevan hingga hari ini kerana beliau sering menggunakan latar belakang kehidupan sosial yang realistik dalam penulisannya.

Antaranya, dalam kajian yang ditulis oleh Erik Tauvani Somae (2022) yang bertajuk "*Nilai-Nilai Hukum Keluarga Islam dalam Novel Merantau ke Deli Karya Hamka*" telah mengemukakan kritikan terhadap adat kekeluargaan Minang yang mengamalkan sistem nasab ibu (memberikan keistimewaan lebih kepada wanita) yang dikenali sebagai Adat Perpatih kerana umumnya Islam bergantung kepada nasab bapa. Hamka berusaha untuk menyampaikan pesan-pesan berkaitan Indonesia, nilai undang-undang keluarga Islam dan kritikan sosial terhadap adat Minangkabau dalam novelnya, *Merantau ke Deli*. Selepas itu, kajian bertajuk "*Hamka's Dakwah Reform: Islamisation of Self, Education, and Institution*" oleh Haslina Ibrahim (2022) menegaskan bahawa walaupun Hamka dilahirkan dan dibesarkan dalam keluarga Minangkabau, namun beliau tidak bersetuju dengan Adat Perpatih kerana ia bertentangan dengan syariat Islam.

Tambahan pula, Hamka juga muncul sebagai pengkritik dalam beberapa novelnya iaitu *Si Sabariah* (1928), *Di Bawah Lindungan Kaabah* (1938) dan *Tenggelamnya Kapal Van Der Wijck* (1938) yang membahaskan perbezaan antara dua darjat, orang kaya dan orang miskin. Selain itu, dua novel lain iaitu *Merantau Ke Deli* dan *Dijemput Mamak* mengkritik adat Minangkabau yang menceritakan kisah kegagalan perkahwinan yang disebabkan oleh mentaliti etnik orang Minangkabau (Haslina Ibrahim, 2022). Akhir sekali, kajian yang ditulis oleh Yusuf Afandi dan Syukrina Damayanti (2020) bertajuk "*Pesan Dakwah dalam Novel Terusir Buya Hamka*" menunjukkan bahawa Buya Hamka tidak hanya memasukkan nilai-nilai Islam dalam karyanya, tetapi juga mempunyai elemen emosi tentang cinta, kehilangan, kebijaksanaan, dan kasih sayang serta memaparkan konflik-konflik dalam kehidupan sosial untuk memberikan kesan mendalam kepada pembaca.



Kajian Lepas Berkenaan Pengaplikasian Teori Takmilah Janaan Shafie Abu Bakar

Teori Takmilah telah diperhalusi oleh Shafie Abu Bakar pada tahun 1996 dengan mengemukakan tujuh prinsip utama yang terdiri daripada : Prinsip Ketuhanan yang bersifat Kamal, Prinsip Kerasulan sebagai insan Kamil, Prinsip keislaman yang bersifat Akmal, Prinsip ilmu dengan sastera yang bersifat Takamul, Prinsip Sastera sendiri yang berciri estetik dan bersifat Takmilah, Prinsip pada pengkarya yang seharusnya mengistimakan diri dan Prinsip khalayak bertujuan memujuk mereka ke arah insan Kamil (Shafie Abu Bakar, 1996).

Antara kajian lepas yang menggunakan Teori Takmilah sebagai sandaran kajian adalah artikel yang ditulis oleh Mohd Shukery Ahmad dan Nadiatul Shakinah Abdul Rahman (2024) menerusi tajuk "*Insan Kamil dalam Novel Ceritera Hati Ana Karya Nur Shamsiah On*" membincangkan aspek insan kamil yang terdapat dalam novel tersebut berdasarkan Teori Takmilah. Kajian ini hanya menumpukan kepada prinsip kedua, iaitu Prinsip Kerasulan sebagai insan Kamil dengan menggabungkan konsep insan khalifah dan insan rabbani untuk mengetahui peranan watak utama, Ana yang bertepatan dengan sifat Rasulullah. Hasilnya, lahir sifat-sifat insan kamil dalam watak Ana seperti menunaikan ibadah, bertanggungjawab untuk memimpin adik-adiknya ke arah ketaatan kepada Allah, sentiasa bersyukur dan memberi nasihat yang baik kepada orang lain. Oleh yang demikian, ini jelas menunjukkan bahawa gabungan perilaku insan Rabbani dan insan Khalifah dalam watak Ana menjadikan dirinya sebagai insan Kamil sebagaimana keperibadian dan akhlak Rasulullah SAW.

Kemudian, kajian yang bertajuk "*Pemaparan Jenis Akhlak Menerusi Kumpulan Puisi As-Salam Karya Suhaimi Haji Muhammad Berdasarkan Teori Takmilah*" oleh Siti Nur Anis Muhammad Apandi et al. (2022) menerangkan nilai-nilai moral yang terkandung dalam kumpulan puisi Suhaimi Haji Muhammad melalui penerapan Teori Takmilah. Namun, pengkaji hanya berfokuskan kepada prinsip keempat, Prinsip ilmu dengan sastera yang bersifat Takamul dalam menganalisis puisi ini untuk menghasilkan karya yang berimpak tinggi. Hasilnya, puisi ini dilihat mengandungi unsur-unsur akhlak mahmudah seperti ikhlas dan amanah, serta unsur-unsur akhlak mazmumah seperti mengumpat dan takbur (sombong). Oleh itu, hal tersebut mampu untuk dijadikan panduan kepada masyarakat bagi membezakan perkara hak dan batil dalam kehidupan mereka.

Di samping itu, dalam kajian lain oleh Firuz Akhtar Lubis dan Nurul Farahana Azman (2021) bertajuk "*Aspek Akhlak Berdasarkan Konsep Pembangunan Insan Dalam Travelog Pelukis Jalanan dan Arkitek Jalanan Karya Teme Abdullah*" telah mengkaji peristiwa yang terdapat dalam kedua-dua novel tersebut untuk membincangkan konsep pembangunan manusia yang berasaskan moral. Oleh itu, fokus penyelidikan ini adalah pada prinsip keenam dalam Teori Takmilah iaitu Prinsip Pengkarya mengistimakan diri dan seterusnya mengaitkannya dengan konsep pembangunan insan melalui aspek akhlak. Hasil dapatan menunjukkan wujud konsep syukur, tawakal, sabar, rendah diri, muhasabah diri dan usaha penyebaran akhlak mulia dalam novel-novel tersebut. Oleh itu, dapat disimpulkan bahawa terdapat hubungan langsung antara prinsip keenam Teori Takmilah dengan konsep pembangunan insan seperti yang diterapkan dalam karya Teme Abdullah.

Akhir sekali, kajian berjudul "*Penerapan Sifat Kamalullah Dalam Puisi Sufistik Taman Taqwa*" oleh Abu Hassan Abdul et.al (2018) membahas konsep Kamalullah dalam puisi Suhaimi Haji Muhammad berdasarkan prinsip pertama, Prinsip Ketuhanan yang bersifat

Kamal dalam Teori Takmilah. Fokus analisis puisi ini melibatkan 79 judul berkaitan ketuhanan melalui sifat-sifat kesempurnaan Allah yang terdiri daripada dua puluh sifat. Sifat-sifat ini pula terbahagi kepada empat kategori : sifat ma'ani, sifat maknawi, sifat nafsiah dan sifat salbiah. Oleh itu, kajian ini telah menemukan 504 perkataan berkaitan sifat Kamalullah yang didahului oleh sifat Qudrah, Iradah, Qaunuhu Sami'an, Sama' dan Mukhalafatuhu lil Hawadith. Ini jelas menunjukkan bahawa pendekatan ma'ani lebih diberi penekanan berbanding pendekatan maknawi dalam menyampaikan sifat-sifat Kamalullah kepada para pembaca menerusi puisi ini.

Analisis Kritis

Berdasarkan kepada keseluruhan kajian lepas yang telah disoroti dan diperbahaskan pada bahagian sebelum ini, telah wujud banyak kajian yang membincangkan mengenai aplikasi nilai-nilai Islam dalam novel atau filem, kajian aplikasi teori sastera Islam dalam novel atau filem, kajian berkenaan Buya Hamka dalam lapangan sastera dan filem serta kajian terhadap pengaplikasian Teori Takmilah. Kebanyakan dapatan kajian lepas mengemukakan nilai-nilai Islam yang terdapat dalam karya sastera yang boleh dirangkumkan dalam 3 elemen utama iaitu akidah, ibadah dan akhlak sebagai landasan dalam membentuk pemikiran, jati diri dan sahsiah masyarakat.

Elemen akidah menekankan keimanan kepada Allah dan konsep ketuhanan seperti dalam kajian bertajuk "*Nilai-Nilai Religius dalam Novel Buya Hamka*" yang menampilkan nilai keimanan seperti beriman kepada Allah, beriman kepada nabi dan beriman kepada qada dan qadar dalam novel yang dikaji. Selain itu, intipati novel *Tenggelamnya Kapal Van Der Wijck* dalam kajian lain iaitu "*Analisis Nilai-nilai Religius, Moral, dan Budaya pada Novel Tenggelamnya Kapal Van Der Wijck karya Hamka serta Relevansinya sebagai Bahan Ajar Sekolah Menengah Atas*" juga mengajak pembaca agar berpegang teguh kepada ajaran Islam dan diperkukuhkan lagi dengan satu kajian lain dengan bahan kajian yang sama bertajuk "*Representasi Nilai Pendidikan Islam dalam Roman Tenggelamnya Kapal Van Der Wijck Karya Hamka*". Hasil dapatan menunjukkan wujud nilai keimanan seperti tawakal, percaya kepada Allah dan keikhlasan dalam menerima qada dan qadar dalam novel ini.

Seterusnya, elemen ibadah pula mencerminkan kepatuhan kepada syariat Islam dalam amalan harian seperti yang ditunjukkan dalam kajian novel *Buya Hamka* yang mengemukakan nilai ibadah seperti solat, puasa, haji, berdoa, berzikir, dan membaca Al-Quran. Kemudian, nilai syariat seperti ketaatan, hukum pewarisan, perkahwinan, sedekah, dan taubat juga diteliti dalam kajian *Roman Tenggelamnya Kapal Van Der Wijck Karya Hamka*. Akhir sekali, elemen akhlak menampilkan nilai-nilai yang menjadi panduan dalam kehidupan bermasyarakat seperti dalam kajian "*Representasi Metode Dakwah Islam: Analisis Semiotika pada Film Buya Hamka*" yang menonjolkan pendekatan dakwah Buya Hamka berteraskan Surah An-Nahl, ayat 125 iaitu kebijaksanaan, nasihat yang baik dan perdebatan yang baik dalam dakwah. Kajian bertajuk "*Pesan Dakwah tentang Adab dalam Novel Angkatan Baru karya Buya Hamka*" juga menjelaskan secara terperinci aspek akhlak dalam novel tersebut terhadap diri sendiri, keluarga dan ilmu. Oleh yang demikian, ketiga-tiga elemen ini dapat disampaikan secara halus dan memberikan kesan mendalam kepada pembaca agar memahami dan menghayati ajaran Islam.

Di samping itu, wujud pula kajian lepas yang mengaplikasikan pelbagai jenis teori sastera Islam dalam novel atau filem bagi mendapatkan hasil kajian yang konkrit. Teori sastera Islam

yang dipilih kebiasaannya berdasarkan kecenderungan pengkaji mengikut output yang diinginkan pada akhir kajian. Sebagai contoh, artikel bertajuk “*Aplikasi Teori Pengkaedahan Melayu dalam Filem Mat Kilau (2022) Menerusi Pendekatan Dakwah*” menganalisis filem Mat Kilau untuk mengenal pasti perkembangan Islam dan sebagai medium memperkukuh budaya Melayu melalui pendekatan dakwah dalam pengkaedahan keagamaan yang merupakan cabang kepada Teori Pengkaedahan Melayu. Selain itu, status ilmu dalam novel *Dari Lembah ke Puncak* telah dianalisis berdasarkan Gagasan Persuratan Baru menerusi kajian berjudul “*Analisis Teks Novel Mata Pelajaran Kesusasteraan Melayu Dari Lembah ke Puncak berdasarkan Gagasan Persuratan Baru*”.

Dalam kajian lain pula yang bertajuk “*Individualisme Faisal Tehrani Dalam Kepengarangan Berdasarkan Novel-novel Terpilih*” telah melihat pembinaan identiti pengarang dalam lima novel terpilih melalui prinsip keperibadian dalam Teori Teksdealisme. Akhir sekali, kajian yang menggabungkan dua teori sastera Islam, Teori Taabudiyah dan konsep estetika dalam Teori Takmilah telah membincangkan konsep tema Islamik bagi menentukan kedudukan filem tersebut dalam kajian bertajuk “*Konsep Tema Islamik Dalam Filem Islamik Syurga Cinta (2009)*”. Hal ini jelas menunjukkan bahawa pengaplikasian teori sastera Islam dalam karya sastera mampu memandu ke arah matlamat kajian yang lebih jelas dan tepat.

Selain itu, kajian lepas berkenaan Buya Hamka dalam lapangan sastera dan filem menjelaskan gaya pemikiran beliau dalam karyanya terhadap Islam dan adat serta budaya Minangkabau. Sebagai contoh, Buya Hamka telah mengkritik sistem Adat Perpatih yang bertentangan dengan ajaran Islam dalam Novel Merantau ke Deli menerusi kajian bertajuk “*Nilai-Nilai Hukum Keluarga Islam dalam Novel Merantau ke Deli Karya Hamka*”. Kemudian, kajian bertajuk “*Hamka’s Dakwah Reform: Islamisation of Self, Education, and Institution*” menjelaskan ketegasan Buya Hamka dalam menolak Adat Perpatih. Karya-karya sastera Buya Hamka bukan sahaja sarat dengan nilai pengajaran, bahkan penuh dengan nilai keislaman dan elemen emosi agar mudah diterima oleh masyarakat seperti yang dibahaskan dalam kajian bertajuk “*Pesan Dakwah dalam Novel Terusir Buya Hamka*”. Oleh itu, karya beliau tidak lapuk dek zaman kerana mengandungi nilai yang dekat dengan kehidupan khalayak.

Akhir sekali, kajian lepas juga banyak mengaplikasikan Teori Takmilah dalam karya sastera dengan menerapkan salah satu daripada tujuh prinsip utama dalam teori tersebut. Antaranya, kajian bertajuk “*Insan Kamil dalam Novel Ceritera Hati Ana Karya Nur Shamsiah On*” memfokuskan prinsip kedua, Prinsip Kerasulan sebagai insan Kamil dalam menganalisis aspek insan kamil yang terdapat dalam novel tersebut. Sementara itu, dalam kajian lain menggunakan prinsip keempat, Prinsip ilmu dengan sastera yang bersifat Takamul dalam menghuraikan nilai-nilai moral yang terkandung dalam kumpulan puisi Suhaimi Haji Muhammad menerusi kajian “*Pemaparan Jenis Akhlak Menerusi Kumpulan Puisi As-Salam Karya Suhaimi Haji Muhammad Berdasarkan Teori Takmilah*”.

Dalam kajian bertajuk “*Aspek Akhlak Berdasarkan Konsep Pembangunan Insan Dalam Travelog Pelukis Jalanan dan Arkitek Jalanan Karya Teme Abdullah*” mengaplikasikan prinsip keenam, Prinsip Pengkarya mengistimakan diri dalam mengkaji babak-babak yang terdapat dalam kedua-dua novel tersebut. Akhir sekali, prinsip pertama, Prinsip Ketuhanan yang bersifat Kamal telah dimanfaatkan dalam kajian berjudul “*Penerapan Sifat Kamalullah Dalam Puisi Sufistik Taman Taqwa*” untuk menerangkan konsep Kamalullah dalam puisi tersebut yang melibatkan 79 judul berkaitan ketuhanan. Oleh yang demikian, setiap kajian

menghasilkan dapatan yang pelbagai berpandukan kepada prinsip-prinsip yang digunakan dalam Teori Takmilah untuk mencapai objektif kajian yang dikehendaki.

Tuntasnya, berdasarkan perbincangan kajian lepas menunjukkan bahawa kajian terhadap babak-babak dalam novel atau filem sangat berkait rapat dengan teori sastera Islam yang banyak digunakan sebagai analisis filem. Namun begitu, aspek Teori Takmilah terutamanya dalam genre filem masih belum dikaji secara menyeluruh oleh para pengkaji. Oleh itu, sebuah kajian filem bersandarkan kepada ketujuh-tujuh prinsip dalam Teori Takmilah akan dilaksanakan bagi memberikan nilai tambah kepada kajian ilmiah terhadap karya sastera Islam.

Kesimpulan

Berdasarkan tinjauan dan ulasan yang telah dilakukan terhadap literatur-literatur lepas yang berkaitan dengan kajian ini, dapat disimpulkan bahawa kajian terhadap babak-babak dalam karya sastera sangat popular untuk dikaji dengan menggunakan metodologi kajian melalui teori sastera Islam. Umumnya, kajian aplikasi sebelum ini biasanya menumpukan kepada genre novel atau puisi dengan menganalisis kandungan karya tersebut berdasarkan sebahagian prinsip kritikan sastera yang berteraskan Islam yang menyebabkan dapatan kajian lebih bersifat permukaan kerana tidak digali secara menyeluruh. Hal ini telah mencetuskan keperluan untuk menghasilkan pengaplikasian Teori Takmilah secara berfokus pada babak-babak penting dalam genre filem khususnya dalam filem *Buya Hamka*. Justeru, dapatan yang akan diperolehi kelak bakal menyaksikan sejauh mana intipati dalam filem tersebut menepati kehendak prinsip Teori Takmilah.

Rujukan

- Abu Hassan Abdul, Azman Bado, A. Halim Ali & Wahibah Twahir@H Tahir. (2018). Penerapan Sifat Kamalullah Dalam Puisi Sufistik Taman Taqwa. *Sains Humanika*, 10(3-4), 121-128.
- Alfiyah, Linggua Sanjaya Usop, Misnawati, Alifiah Nurachmana & Paul Diman. (2023). Nilai-nilai Religious Dalam Novel Buya Hamka Karya Ahmad Fuadi. *Atmosfer : Jurnal Pendidikan, Bahasa, Sastra, Seni, Budaya dan Sosial Humaniora*, 1(1), 184-200.
- Arna Ayu Parman, Sukirman Nurdjan & Firman Patawari. (2021). Representasi Nilai Pendidikan Islam Dalam Roman Tenggelamnya Kapal Van Der Wijck Karya Hamka. *Jurnal Konsepsi*, 10(3), 196-206.
- Ayu Haswida Abu Bakar. (2015). Konsep Tema Islamik Dalam Filem Islamik Syurga Cinta (2009). *Jurnal Pengajian Melayu*, 26, 167-185.
- Azean Idruwani Idrus & Iffah Sakinah Othman. (2023). Aplikasi Teori Pengkaedahan Melayu Dalam Filem Mat Kilau (2022) Menerusi Pendekatan Dakwah. *e-Jurnal Bahasa dan Linguistik*, 5(2), 88-100.
- Deby Rodearni Simbolon, Esra Perangin-angin & Suasti Murni Nduru. (2022). Analisis Nilai – Nilai Religius, Moral, dan Budaya pada Novel Tenggelamnya Kapal Van Der Wick Karya Hamka Serta Relevansinya Sebagai Bahan Ajar Sekolah Menengah Atas. *Jurnal Basataka Universitas Balikpapan*, 5(1), 50-61.
- Erik Tauvani Somae. (2022). Nilai-Nilai Hukum Keluarga Islam Dalam Novel Merantau Ke Deli Karya Hamka. *Journal Commicast*, 3(1), 140-152.

- Fauzi Hasan, Tengku Intan Marlina Mohd. Ali & Madiawati Mamat@Mustaffa. (2018). Individualisme Faisal Tehrani Dalam Kepengarangan Berdasarkan Novel-Novel Terpilih. *Jurnal Antarabangsa Persuratan Melayu (RUMPUN)*, 6, 31-60.
- Firuz Akhtar Lubis & Nurul Farahana Azman. (2021). Aspek Akhlak Berdasarkan Konsep Pembangunan Insan dalam Travelog Pelukis Jalanan dan Arkitek Jalanan Karya Teme Abdullah. *Malay Literature*, 34(2), 281-314.
- Haslina Ibrahim. (2022). Hamkas's Da'wah Reform: Islamition of Self, Education and Institution. *AL ITQAN: Journal of Islamic Sciences and Comparative Studies*, 6(4), 24-46.
- Hilmi Aufa. (2020). Pesan Dakwah Tentang Adab Dalam Novel Angkatan Baru Karya Buya Hamka. *Syntax Fusion: Jurnal Nasional Indonesia*, 1(1), 8-20.
- Kamariah Kamarudin. (2011). *Takmilah dalam Novel Melayu*. Dewan Bahasa dan Pustaka.
- Mohd Helmi Yusoh, Jamaluddin Aziz & Abdul Latiff Ahmad. (2018). Pendefinisian Filem Berunsurkan Islam dan Pemerksaan Watak Wanita dalam Filem Perempuan Berkalung Sorban. *Jurnal Komunikasi*, 34(4), 2-4.
- Mohd Shukery Ahmad & Nadiatul Shakinah Abdul Rahman. (2024). Insan Kamil dalam Novel Ceritera Hati Ana Karya Nur Shamsiah On. *International Journal of Civilizational Studies and Human Sciences (BITARA)*, 7(1), 147-155.
- Muhammad Khalis Irfan, Fahriyan Awaluddin, Firman Fadilla & Salwa Ashfiya Angriani. (2023). Representasi Metode Dakwah Islam (Analisis Semiotika Pada Film Buya Hamka). *Nubuwwah: Journal of Communication and Islamic Broadcasting*. 1(2), 60-78.
- Muhammad Zarif Hassan@Zulkifli, Mohd Zariat Abdul Rani, Salmah Jan Noor Muhammad & Ab. Halim Mohamad. (2022). Analisis Teks Novel Mata Pelajaran Kesusasteraan Melayu Dari Lembah Ke Puncak berdasarkan Gagasan Persuratan Baru. *International Journal of Education and Training*, 8(2), 1-13.
- Nurshuhadah Zuhaidi & Firuz Akhtar Lubis. (2021). Hamka: Tokoh Ulama Nusantara. *Jurnal Islam dan Masyarakat Kontemporari*, 22(1), 74-82.
- Rahmi Nur Fitri. (2020). Hamka Sebagai Sejarahwan: Kajian Metodologi Sejarah Terhadap Karya Hamka. *FUADUNA: Jurnal Kajian Keagamaan dan Kemasyarakatan*, 4(1), 42-53.
- Shafie Abu Bakar. (1996). *Takmilah: Teori, Falsafah dan Prinsip*. Dewan Sastera, 25-33.
- Siti Nur Anis Muhammad Apandi, Rohayati Junaidi, Zainoren Zul, Eizah Mat Hussin, Farrah Atikah Saari, Nordiana Ab. Jabar, Sudirman Kiffli, Suraya Sukri, Mohd Firdaus Che Yaacob & Nurulahda Sulaiman. (2022). Pemaparan Jenis Akhlak Menerusi Kumpulan Puisi As-Salam Karya Suhaimi Haji Muhammad Berdasarkan Teori Takmilah. *Journal of Malay Language, Education and Literature (PENDETA)*, 13(1), 47-57.
- Slamet Faozi, Rahmat Iqbal & Rifky Yulian Syah Bagus Baskoro. (2021). Negarawan Sejati Menurut Pandangan Hamka. *An Naba: Jurnal Pemikiran dan Penelitian Pendidikan Islam*, 4(1), 14-24.
- Yusuf Afandi & Syukrina Damayanti. (2020). Pesan Dakwah Dalam Novel Terusir Karya Buya Hamka. *Al Hikmah: Jurnal Dakwah dan Ilmu Komunikasi*, 7(2), 105-121.
- Zaidi Ahmad, Azhar Abdul Wahid & Abdul Halim Ali. (2022). Prinsip Kerasulan Sebagai Insan Kamil Membentuk Modal Insan Dalam Novel Mereka Yang Tertewas. *Rumpun Jurnal Persuratan Melayu*, 10(2), 15-34.



AUTHOR INDEX

A

Abdullah Ehlid Al Walid Luli, 36
Aloja Simpoda, 6
Amirah Mohamad Fuzi, 51
Anding Nyuak, 21
Ani Munirah Mohamad, 78

D

Deborah Lumecio, 6

F

Fahri Ahmed, 88

H

Harlida Abdul Wahab, 44
Hasrina Mustafa, 88
Hazlin Jamari, 1

J

Jennifer Mario, 6
Johari Ahmad Ghazali, 21

M

Mahazril 'Aini Yaacob, 67
Marites Choycawen, 6
Mohamad Sharin L Bari, 21
Mohd Aamir Adeeb Abdul Rahim, 78
Mohd Adi Amzar Muhammad Nawawi,
102

Muhammad Shafiq Abd Rahman, 94

N

Nazrina Bakar, 21
Nur Batrisyia Nordin, 67
Nuraiman Abd Rahman, 94
Nurul Hidayana Mohd Noor, 51, 67
Nurzawani Mohamad Zani, 21
Nuzul Ardzan Mokhtar, 94

P

Paloma Pallaya, 6
Peter Paul Canuto, 6

R

Rohana Abdul Rahman, 44

S

Siti Zubaidah Othman, 44

V

Victory Waclin, 6

W

Wan Amirah Najihah Wan Amir
Nudin, 102
Wu Jia Wang, 21

Y

Yuvimin Lumidao, 6

GAE

GLOBAL ACADEMIC EXCELLENCE

"KNOWLEDGE FOR FUTURE"



@GAExcellence



_GAExcellence



Global Academic
Excellence GAE



@gaesbofficial



@global.academic.e



admin@egax.org



www.egax.org



+60139338546

+60108428094

