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Exploring Digital Literacy Challenges and Strategies Among International Students Studying Abroad

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ABSTRACT: *This research explores how international students in Malaysian higher education develop digital literacy, the barriers that impede such development, and strategies that may enhance institutional support. To understand their experiences using digital tools within an academic context, semistructured interviews were conducted with international students in a qualitative design. The results showed that confidence develops through repeated use and structured support, and barriers include complexities of software applications, integration challenges across different platforms, and limited chances for hands-on training. Participants called for targeted workshops, peer mentorship, improved resource access, and early integration into the curriculum. This paper offers practical suggestions useful to universities seeking to foster international students' adjustment to digitally mediated learning environments.*

Keywords: Digital literacy, International Students, Digital literacy barriers, Digital literacy improvement, Studying abroad

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INTRODUCTION

In today's rapidly evolving digital landscape, the ability to use digital technologies is no longer optional but essential for success in higher education and beyond (Ittefaq et al., 2025). Universities play a critical role in preparing students to navigate this environment by integrating digital literacy into academic life, equipping future professionals with creativity, critical thinking, and technological competence (Gutierrez-Angel et al., 2022). However, disparities persist in the integration of digital competency across institutions, often linked to socioeconomic inequalities, differential access to technology, and variations in academic support services (Baharuddin et al., 2023).

International students represent a particularly vulnerable group within this context. Although digital literacy has been widely studied among domestic student populations, limited literature addresses the experiences of international students and the development of their digital competencies. International students frequently arrive with diverse educational backgrounds and varying levels of technological exposure. In addition to academic challenges, they must navigate linguistic, cultural, and emotional barriers when engaging with digital learning environments.

Accordingly, it is critical to develop a nuanced understanding not only of the technological demands placed upon these students but also of the cognitive, emotional, and social dimensions influencing their digital literacy development. Such understanding is necessary to enable an increasingly diverse student population to thrive academically and professionally.

Despite growing interest in digital literacy within higher education, research examining international students' experiences in non-Western host countries remains limited. Existing studies have often focused primarily on technological adoption and access, with insufficient attention to cognitive, technological, and socioemotional dimensions of digital literacy in foreign learning contexts. To address this gap, the present study adopts a student-centered approach to examine

international students' digital literacy experiences within Malaysian higher education institutions. This study is guided by the following objectives:

- a) To identify contributing factors that support effective digital literacy development in universities.
- b) To identify contributing factors that hinder effective digital literacy development.
- c) To recommend measures to strengthen digital literacy

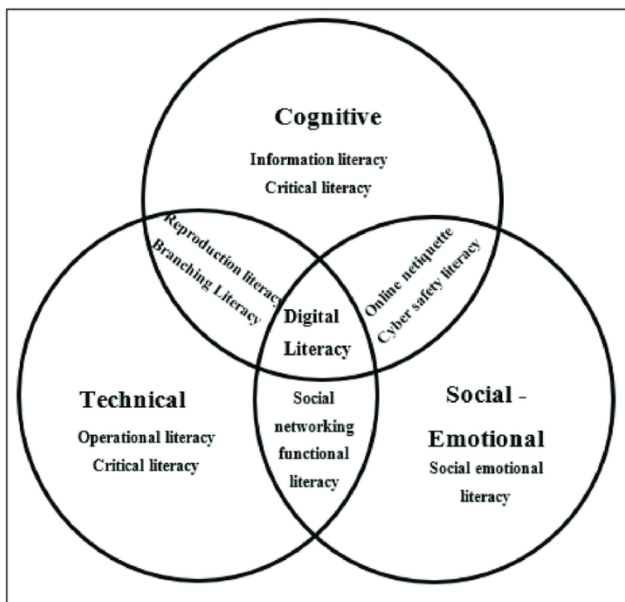
LITERATURE REVIEW

Digital Literacy and Model

Digital literacy refers to the ability to access, understand, manage, evaluate, create, and communicate information employing digital technologies (Falloon, 2020). Beyond technical skills, it is the gateway to how one uses the internet to source social capital, such as knowledge and career advancement, thereby leveling socioeconomic disparities (Chan, 2022). It also refers to the responsible and effective use of digital tools to meet information requirements daily (Baharuddin et al., 2023). The Ng (2012) three-dimensional model (Figure 1) offers a comprehensive digital literacy model of cognitive, technical, and social-emotional domains. These complementary fields are essential for academic development and personal enrichment among Malaysian university students. The cognitive domain is centered on critical thinking in finding, analyzing, and creating digital information. It requires an awareness about issues in ethics and the law. An example of this is the issue of plagiarism and copyright when working with diverse forms of electronic media, such as text, audio, video, and multimedia materials, as defined by Ng (2012). A major part of technical skill involves developing the necessary knowledge to use ICT properly. This may include hardware components such as devices for networking as well as data security and debugging.

There is the importance of critical literacy, which involves "reading" any given computer text to understand the values embedded in it, as explained by Ng (2012). The social-emotional part involves communication in the digital environment by abiding by the rules of "netiquette," maintaining online privacy, as well as useful collaborative work online. This is considered the most complex, as it involves grasping the unwritten rules of digital communication, including issues related to spam, information sharing, and online collaboration (Miglbauer; Ng, 2012; Eshet, 2004). These dimensions together form a general feeling of digital literacy that is critical to international students' success in digitally mediated learning environments, as shown in Figure 1.

Figure 1
Digital literacy model (Ng, 2012)



Contributing factors to the implementation of digital literacy

Student perception

Students who attach great significance to digital literacy and are more aware of its importance are more likely than other students to actively seek the skills they want to learn. The realization that digital literacy is applicable to both one’s career and personal life can be used to inform students’ attitudes toward the issue (Eshet, 2004). Furthermore, learners who possess an inner drive to learn and apply digital tools boost the attainment of their digital literacy skills. Motivation sources may include self-interest, perceptions of usefulness, or the desire to excel as digital literates (Balakrishnan, 2017). A fact that remains truly overlooked, especially among international students in Malaysia, is the essential role of digital literacy. This is especially true for those from distant corners, where the use of technology in such contexts tends to differ.

Research has thus suggested that despite a basic level of understanding in utilizing technology, international students do not seem to have the essential cognitive or even socioemotional abilities needed to effectively use technology in contexts such as academic institutions (Ali & Smith, 2023). The structural decisions regarding the set program need to ensure that, in addition to fine-tuning

the technical capacity of these technologically inclined learners, critical thinking abilities and effective digital communication skills are enhanced.

Personal factors

Demographic factors, including age, gender, and educational level, influence digital literacy. Other critical dimensions involve the use of the internet and smartphones. The other critical dimensions of digital literacy competency include technical skills, analytical understanding and communicative capability. Learning style, individual innovativeness, self-efficacy in using information and communication technology, motivation to learn about information at home, the presence of proper guidance, prior programming experience, and self-efficacy have also been found to significantly and positively influence digital literacy. The home environment factors in developing digital reading ability, such as an individual's perception of his or her ability to read, availability of learning resources at home, discussion of classroom readings at home, and availability of books at home, are significant. Generally, individual, demographic, and environmental factors all together influence one's level of digital literacy. The digital literacy determinants for an international student do not involve only access to technology. The cultural background, previous education and language proficiency of international students impact their ability to use digital resources effectively. Indeed, an international student might understand simple technology tools but may struggle to use them for complex tasks that require advanced technical skills, such as data analysis and research in academic settings, as noted by Lee (2020).

Institutional support

To realize digital literacy, higher institutions of learning must have reliable web access, updated computer devices, and up-to-date software. Infrastructure also acts as a significant determinant to ensure that both the students and lecturers have all the things they require for digital learning. Many disciplines should infuse digital literacy into their curriculum. Therefore, such integration acts to serve the purpose of enabling these learners to encounter many different situations with the advancement of their skills in technologies, making them a whole part of general education and not just one isolated skill (Hague & Payton, 2010). They highlighted the need for assessment to give constructive feedback and keep track of progress. There is the need for evaluations and response practices to monitor the progress of the students to ensure that learning outcomes are achieved. The partnership can create value by making resources available in the form of best practices or real-life examples where digital literacy can be practiced upon; an association with industry associations, other educational institutions, or technology providers can be helpful. Thus, this can facilitate practical experiences for learners to ease into the system that the business world has currently embraced. While industrial support is the backbone of the environment where digital literacy thrives, higher education institutions need to provide technological support and need to create a culture that encourages and prioritizes the development of digital skills. This needs to be accompanied by top management's commitment to

championing digitization initiatives, securing adequate funding for them, and creating strategic partnerships that enhance educational resources and opportunities.

Second, the administration should ensure that the digital literacy programs are relevant and effectively implemented in line with the institution's general academic objectives. This implies that clear guidelines must be set down and support offered to embed digital tools in teaching processes. In addition, institutions must actively encourage all departments to promote digital literacy, making it an important cross-cutting skill. In addition, institutional support involves training and professional development of students and faculty to keep abreast of changes facing technology. This ensures that everyone within the institution has up-to-date digital skills and knowledge, resulting in a digitally competent graduating class that meets the demands of the modern workforce.

Challenges in Fostering Digital Literacy

Technological Access and Infrastructure

Students may be prevented from engaging in digital learning due to limited access to reliable internet connections, computers, or other devices. In most schools, especially those in rural or interior parts of a country, students and teachers face significant barriers to learning due to inadequate access to reliable internet connectivity, modern computers, or other digital devices. The lack of language enhancement and the digital divide are two of the major concerns that prevent students from taking part in all digital learning activities. Thus, these can be identified as one of the reasons for educational inequity. The development of digital literacy is not possible without proper infrastructure and updated technology in the educational institute. Digital literacy cannot be achieved with outdated technological systems and poor infrastructure. Computers installed in the past might not support the most advanced software that is currently used to conduct digital literacy classes. Similarly, poor bandwidth will hinder online classes and create less access to educational resources. As such, the emergency remote teaching situation did not allow for the development of learners' digital competencies, therefore being an obstacle in promoting literacies within the digital space (Monteiro & Leite, 2021).

Resistance to Change

The students may not see the immediate advantages of these skills, thus the lack of motivation to take up digital literacy education (Monteiro & Leite, 2021). Information overload and distractions can also be tasks in themselves. One may be swamped by information overload on the internet yet be unable to distinguish credible sources of information. In addition, social media, gaming, or other forms of online entertainment act as distractions from educational tasks, thus affecting students' development in digital literacy (Kurelović et al., 2016). Additionally, students may miss technical literacy. The participation of 214 Ghanaian students shows that they cannot study effectively online due to a lack of technical literacy status. Learners lack relevant technological knowledge and skills, which contribute to difficulties in dealing with technology-enhanced learning (Owusu-

Fordjour et al., 2020; Reddy et al., 2023). For instance, students may lack the cognitive literacy needed to effectively use online resources and, at the same time, be able to examine information before using it (Cartile, 2020).

This cognitive flaw can leave learners unable to access or use digital tools and resources. Some students face challenges with ICT tool use and technophobia. For example, medical students from the College of Medicine of Alfaisal University in Saudi Arabia had difficulties with ICT tools and were found to have technophobia (Rajab et al., 2020). This was to do with their ability to incorporate digital literacy within their learning processes. In addition, there is an issue of concern in regard to how technology influences one's mental well-being. The student may feel mentally strained due to overuse of digital technology. This could be due to prolonged screen time, overload of information, or trying too hard when navigating various online platforms (Sing Yun, 2023).

The absence of faculty and student competence in using online technologies may also hinder the integration of digital literacy practices in higher education. A survey of faculty and student digital competence at a Spanish university identified significant gaps in development that could impede the effective integration of digital literacies into higher education pedagogy (Al-Balas et al., 2020; Sales et al., 2020). Different universities have different standards for what is considered a digitally literate student. International students often cannot understand how they feel about joining online training portals and using electronic gadgets due to alienation or objections to unfamiliar technologies. To do so, a clear roadmap needs to be provided for supporting these students who are on the verge of embracing new teaching methods through encouragement.

Lack of standardized Digital Literacy

In the absence of standardized frameworks, the definition of digital literacy varies across institutions and programs, resulting in inconsistent definitions. This could, in turn, result in various levels of proficiency because of the lack of standardization depending on the approach each facility takes in imparting digital literacy skills. This, in essence, means that every graduate from every institution could have their own level of expertise, depending on which skills the university emphasizes, be it technical skills as identified above, communication, or collaboration. For a standard test of digital literacy, there needs to be a standard first. Thus, there might be problems monitoring students' progress and guarantee that they achieve a particular level (Spante et al., 2018). For example, a university may use practical exams to assess digital literacy, while another university may use project-based assessments, thereby complicating the comparison of results across institutions.

Additionally, according to Walter (2024), the rapid adoption of AI across sectors necessitates incorporating AI elements into digital literacy practices. Students who are not familiar with this domain could be further marginalized, as AI learning has not been included in most digital literacy frameworks. Some schools may choose to include issues of artificial intelligence and machine learning in their curricula so that students can understand areas such as data analysis and decision making. However, on this matter others will probably not

give it much attention, which in the end would create a problem in which new graduates would have no idea about workplaces controlled by AI technologies. This difference could affect both learners' technical competence and critical understanding of artificial intelligence, as well as ethical considerations and practical use, among other things.

The quality of instruction can vary due to inconsistencies in standards for digital literacy. Some instructors can easily integrate digital literacy into their teaching, while others find it challenging, thereby creating inequality in the learning process for students (Wilson et al., 2015). This may lead to inequalities in the student body, with some students receiving excellent instruction in digital literacy while others do not, which may affect the student's overall academic performance and access to future possibilities.

Socioeconomic Disparities

The emergence of a “digital divide” among international students based on economic inequalities may restrict poor international students’ access to computer knowledge compared to their relatively richer peers and may prevent them from developing adequate proficiency in this skill (van Dijk et al., 2014; Suengkamolpisu et al., 2026). This may create differences in knowledge and proficiency with this skill among some international students compared to their peers, due to their relative economic status in society (Warschauer & Matuchniak, 2010). Coding club members or tech bands and tech internships may be restricted to members from certain socioeconomic statuses for international students who come from such economic statuses that may be considered relatively poor in society. Extracurricular activities provide the practical experience needed to acquire advanced digital skills, but poor children miss out on many of these opportunities. The long-term career prospects of students can be affected when disparities in digital literacy are driven by socioeconomic factors. People who lack digital literacy skills may face greater difficulty obtaining jobs than their counterparts who are competent in this field, a trend that is increasing (DiMaggio & Bonikowski, 2008). In several current professional areas, a person must be at least digitally literate, and failure to do so by students will make their job search difficult.

METHOD

Research design and sampling

This research employs interpretivism philosophical paradigms in place of the wide variety of research paradigms and philosophies that influence researchers and their work. The reason is that, with this paradigm, researchers can reconstruct the original intent of the content by examining, explaining, articulating, and attempting to place themselves in the participant's shoes (Pervin & Mokhtar, 2022). The qualitative method research design was employed in this research because, according to Jw (2009), the qualitative method is an interpretive and

exploratory research approach that researchers utilize to have lengthy discussions with respondents to gather feedback on issues that cannot be determined using technology.

The study focuses on improving digital literacy among international university students in Malaysia. A total of six undergraduate participants were chosen from Malaysian universities, consisting of internationals studying in Malaysia. Purposive sampling was utilized to gain participants to promote diversity in terms of their field of study as well as their respective study years, and the study ceased when thematic saturation was obtained in the sixth interview. Guest et al. (2006) found that data saturation often occurs within the first six interviews. Semistructured interviews were conducted to explore international students' experiences, perceptions and challenges related to digital literacy. Semistructured interviews are based on open-ended questions instead of closed-ended ones, even though the questions are prepared in advance (Magaldi & Berler, 2020).

Interviewee Characteristics

The interviewees were international students in Malaysia. Table 1 below shows the demographic profile of the interviewees.

Table 1
Interviewee Characteristics

No.	Intervie wee ID	Year of Study	Field of Study	Mode of Interview
1	I1	3 rd - (Final Year)	Information Technology	Google Meet
2	I2	2nd Year	International Business Management	Google Meet
3	I3	4 th - (Final Year)	Electrical Engineer	Google Meet
4	I4	2nd Year	Intelligent Robotics	Google Meet
5	I5	3rd Year	Accounting	Google Meet
6	I6	4 th - (Final Year)	Electrical Engineer	Google Meet

Data Collection

A semi structured interview was conducted with the interviewees during this stage, including international university students from Cyberjaya universities. All those who were asked for the interview accepted the interview offer, but the research needed reassurance that the data were saturated to determine whether the

data were reliable. Data saturation is important for qualitative research such as this one, as it ensures that the data collected are comprehensible and no newer information is being discovered; therefore, continuing to collect data beyond this point does not add any much more value to the research, therefore allowing researchers to go ahead and end their collection of data confidently (Fusch & Ness, 2015). Seven out of 7 interviewees accepted the researcher's invitation to participate, but sacrifices were made on both sides due to time constraints and unavoidable circumstances. In the analysis part of the research, the researcher compiled, recorded, and transcribed the responses. Therefore, in the context of this research, data saturation was achieved with the 6th interviewee, after which the 7th interviewee coincidentally repeated and gave similar points to the previous interviewees; this marked the data saturation point, and data collection stopped at the 6th interviewee.

Data Transcription

All interviews were conducted through the Google Meet platform. The transcription was performed using the Microsoft Word transcription feature, which separated and identified the 2 speakers' inputs and divided them into "Speaker 1" and "Speaker 2". Member checking was then used to further reassure the validity and accuracy of the input information from the recordings. The fixed transcriptions were then sent back to the interviewees to re-evaluate the findings and comment on their accuracy.

Thematic Analysis

Thematic analysis is a systematic approach to finding, organizing, and revealing patterns within a dataset. Using thematic analysis, the researcher can observe and comprehend shared experiences by emphasizing significance across a collection of data. During this phase, one should take notes on the material they read or hear. (Clarke & Braun, 2017). During this phase, the extensive analytical work required for thematic analysis is completed, along with molding the study into its precise specifics. Finally, the final report will be created. A claim that addresses the research question must be included alongside the description that follows, even when using descriptive thematic analysis (Clarke & Braun, 2017).

Reliability in Qualitative Study

To assess the reliability of the transcriptions, the researcher conducted a peer review of the data. Consequently, the reliability of the data was assessed using the Cohen kappa method (Viera & Garrett, 2005). This technique is used to assess interrater reliability when coding qualitative or categorical variables. The values of Kappa range from 0 to 1.00, with higher values indicating greater reliability. A Kappa > 0.70 is considered adequate. Separating the data transcriptions by question, each of which included several interviewees, was the researcher's first stage in the data analysis process. Subsequently, the data transcriptions were provided to two randomly selected raters, who were asked to read them and

identify several codes. Only Q1 is selected for this use. Table 2 lists the output that these two raters produced.

Table 2
Interrater Reliability Test

	I1	I2	I3	I4	I5	I6
Rater 1	3	2	2	2	4	4
Rater 2	2	2	2	2	3	3

Based on these findings, Cohen’s kappa value was 0.5, indicating that Rater One and Rater Two had moderate agreement with the researcher’s findings. This figure shows the validity of the study's data transcription. As stated by Rosato et al. (2024), achieving moderate agreement (values ranging from 0.4 to 0.6) is usually expected because of the subjective nature of qualitative coding. Finally, this research used two different strategies to enhance the validity of the findings. The two strategies included member checking as well as audit trials. The information obtained from the Google Meet transcription was further verified for accuracy through member verification, in which the data and interpretations were returned to the interviewees to validate the authenticity of the material. Interviewees were asked to reconsider the results and provide feedback on the precision of this procedure. (Lincoln & Guba, 1988) advise member checking because they argue that the validity of the content is a crucial element of correct statements or interpretations of occurrences (Birt et al., 2016).

RESULTS AND DISCUSSIONS

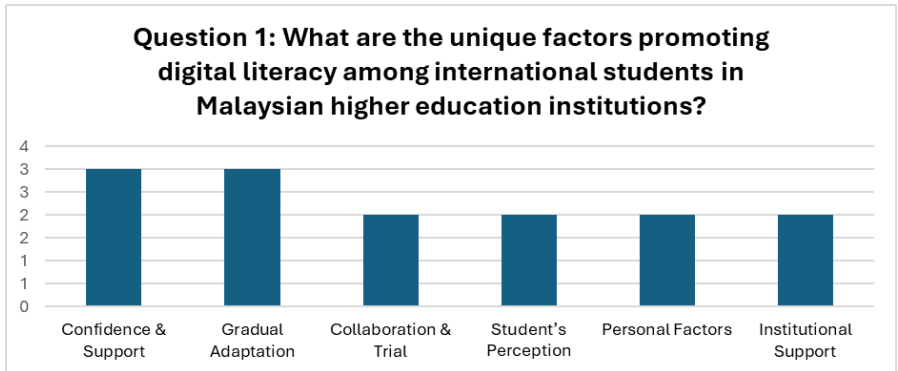
Findings for Research Objective 1

Table 3 below presents the final findings for research objective 1: to identify the contributing factors that promote effective digital literacy enhancement in higher education institutions. According to the literature, a variety of factors have been identified as promoting effective digital literacy adaptation among international students in higher education institutions (HEIs), as presented in Figure 2. The use of interviews helped in furthering the exploration to understand their impact. The first factor is Building Confidence through Repetition and Support. Earlier studies showed that confidence in using digital tools is important for students to find their way through academic challenges successfully (Ng, 2012).

Table 3
Final Findings for Research Objective 1

ID	Factors	Aspects
F1	Building Confidence through Repetition and Support	<ol style="list-style-type: none"> 1. Structured support structures, like workshops and peer collaboration, are important for building digital confidence. 2. Confidence in using digital tools is vital for students to adapt and find their way through academic challenges successfully.
F2	Gradual Adaptation through Experience and Academic Needs	<ol style="list-style-type: none"> 1. Continuously engaging with digital tools in academic settings is important for skill development. 2. Digital literacy skills change over time through sustained use in academic as well as professional contexts.
F3	Learning through Collaboration and Trial	<ol style="list-style-type: none"> 1. Digital literacy is enhanced through collaborative learning and hands-on experimentation. 2. Collaboration and trial-and-error learning are necessary for mastering complicated digital tools.
F4	Student's Perception	<ol style="list-style-type: none"> 1. Initial perceptions and attitudes toward digital tools influence the adaptation process. 2. Personal motivation and interest in digital literacy impacts the speed of acquiring the digital skills.
F5	Personal Factors	<ol style="list-style-type: none"> 1. Previous experience with digital tools in the home country affects adaptation to the new academic environment. 2. Personal background and initial perceptions can shape the learning curve and adaptation process.
F7	Institutional Support	<ol style="list-style-type: none"> 1. University resources, such as workshops and access to software, support learning. 2. Institutional support is crucial for integrating digital literacy into educational settings.

Figure 2
Findings for Research Objective 1



Interviewee 1 (I1) stated that, “When I first arrived, I found the digital tools overwhelming. Over time, with workshops and peer support, I’ve gotten more familiar with them.” This implies that support mechanisms, such as workshops and human interactions, play an essential role in developing students’ digital confidence. I2 further reported that “Initially, using business management software was challenging, but with the help of my classmates and attending university workshops, I gained confidence.” This implies that support mechanisms and repetition play a vital role in developing digital literacy among international students.

The second factor (Gradual Adaptation through Experience and Academic Needs) was mentioned previously in the literature, “as a slow but significant process for the development of skills for working with digital technology” (Bawden, 2008). I2 discussed: “Over time, I’ve become more comfortable using digital tools, particularly those we use for research and data analysis.” It is obvious how important it is to have their own experience and engagement with digital technology within an academic environment. Moreover, I3 mentioned, “Getting used to the engineering software took time, but constant use for projects helped me adapt.” As discussed previously, skills evolve over time and through experience within an academic context.

(Learning through Collaboration and Trial) is another key theme that emerged from the literature study. It is usually through collaborative learning and trial-and-error that a strong understanding of digital literacy is acquired (Eshet, 2004). As stated by I6, “I struggled with engineering software, but continuous practice and guidance from peers helped me feel more confident.” Additionally, another study by I3 stated that “Well, yeah, the professors encouraged us to explore different tools, but it was truly the group work that pushed me to get better at using the digital tools.” Initiating this study was motivated by our concern for relevance to real-life situations

Additionally, the literature indicates that (Student’s Perception), (Personal Factors), and (Institutional Support) are other important aspects in improving

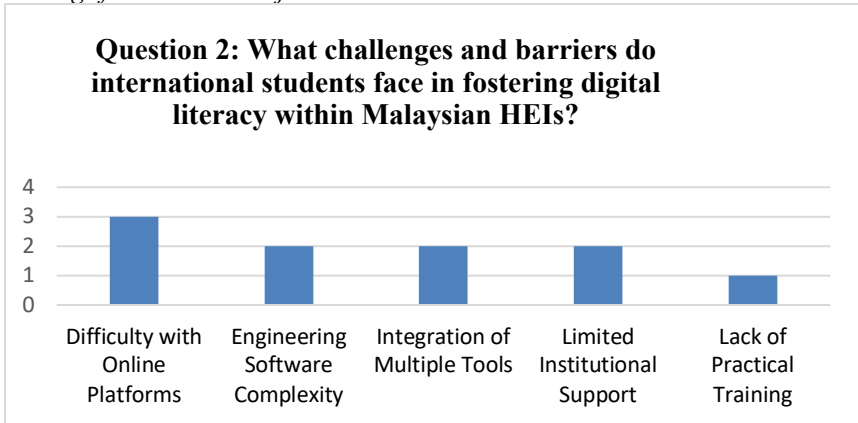
digital literacy skills (Mishra & Koehler, 2006; Redecker, 2017; Zhao & Bryant, 2006). In the interviews conducted in the case, the importance of student perceptions and the role of personal factors in shaping the digital literacy journey of the interviewees, I1 and I2: “Digital tools here are different from what I used in my home country. It took some time to adjust.” Last, Institutional Support) was a recurring theme. Interviewee I3 declared, “The university provides a lot of resources, like workshops and access to software, which helps us learn.” Therefore, this aligns well with Zhao & Bryant’s (2006) statement that institutional support is crucial for integrating digital literacy into educational settings.

Findings for Research Objective 2

The table shown below exhibits the final findings for research objective 2: To identify the contributing factors that cause poor digital literacy enhancement in higher educational institutions.

Table 4
Findings for Research Objective 2

ID	Factors	Aspects
F1	Difficulty with Online Platforms	1. Lack of familiarity with online learning platforms. 2. Insufficient support during the shift to remote learning.
F2	Engineering Software Complexity	1. Challenges in mastering specific software required for courses. 2. Frustration due to complexity and lack of experience.
F3	Integration of Multiple Tools	1. Difficulty in integrating various digital tools effectively. 2. Overwhelmed by managing multiple software and resources.
F4	Limited Institutional Support	1. Lack of hands-on workshops and access to resources. 2. Need for more structured support for specific digital tools.
F5	Lack of Practical Training	1. Insufficient practical experience with essential software. 2. Need for experience-based learning opportunities.

Figure 3*Findings for Research Objective 2*

The prior literature has identified multiple factors as barriers to effective digital literacy adaptation among international students in higher education institutions (HEIs). The use of interviews helped further explore these challenges and understand their impact, as shown in Figure 3. The first factor is difficulty with online platforms. Earlier studies have shown that international students often struggle with online learning platforms due to a lack of familiarity and support during the sudden shift to remote learning (Anderson Jr, 2022). Interviewee 1 (I1) mentioned, *“One of the biggest challenges was getting used to the online learning platforms, especially during the pandemic. “It took me a while to get through all the features and learn to use them effectively.”* This suggests that the sudden need to rely on digital platforms when guidance is inadequate poses a major obstacle for students. Interviewee 2 added, *“The online systems here are different from what I was used to.”* Hence, it can be established herein that poor orientation and support toward the use of online platforms negatively impacts the adaptation of digital literacy among international students.

The second factor is engineering software complexity, which has been identified in the literature as one of the common challenges among students in technical courses (Smith et al., 2020). It was specifically mentioned by I3, *“The biggest one for sure was getting used to the different types of engineering software because at first, I found everything complicated, and I was frustrated.”* This shows the difficulty experienced by students in mastering specific software required for the course.

The integration of multiple tools is another theme that was derived from literature. Digital literacy mainly focuses on the easy usage or integration of multiple digital tools (Bawden, 2008). Interviewee 5 (I5) claimed that *“Understanding how to integrate different software, like using Excel alongside more advanced financial tools, was very confusing at first.”* On the other hand, Interviewee 4 (I4) claimed that *“managing all the tools we use for coding and robotics was overwhelming.”* This situation indicates that students can experience

difficulty integrating multiple tools, which can affect the effectiveness of their digital literacy. In addition to the themes, the following themes were identified as crucial elements that can influence the process of digital literacy adaptation: language and cultural barriers, limited institutional support, and a lack of practical training (Mishra & Koehler, 2006; Redecker, 2017; Zhao & Bryant, 2006).

Limited institutional support was the other themes that continued to appear. Interviewee 4 (I4) mentioned, *“I think MMU could organize more hands-on coding and robotics workshops for beginners. Additionally, having more access to robotics hardware outside of class could help us practice more.”* This echoes the sentiments of Zhao and Byant (2006) that the support provided by the institutions in question is paramount and a major factor in enhancing the integration of digital literacy into educational institutions. Limited Institutional Support was also mentioned by Interviewee 2 (I2). The interviewee mentioned, *“One of the challenges was getting used to the specific business management software that we use in our courses. As I took my time to learn how to use them effectively, especially as I didn’t have much experience with them prior to that”.*

Findings for Research Objective 3

Table 5 below exhibits the final findings for research objective 3: To identify the recommendations to improve digital literacy practices in higher educational institutions.

Table 5
Findings for Research Objective 3

ID	Recommendation Theme	Aspects
R1	Targeted Workshops and Training	1. Focus on specific digital tools used in various academic disciplines. 2. Specialized training sessions for software used in coursework.
R2	Hands-on Practical Sessions	1. Provide practical, experience-based learning opportunities. 2. Increase access to relevant hardware and software for hands-on practice.
R3	Improved Access to Resources	1. Ensure availability of necessary digital tools and resources in labs. 2. Improve accessibility to academic resources outside of class hours.
R4	Buddy/Mentorship Programs	1. Implement peer mentorship programs where senior students guide new students. 2. Provide structured support systems for learning complex digital tools and software.

R5	Curriculum Integration	<ol style="list-style-type: none">1. Integrate digital literacy training into early stages of the curriculum.2. Develop a structured approach to teaching digital skills systematically throughout the degree.
R6	Personalized Support for Beginners	<ol style="list-style-type: none">1. Offer tailored resources that match the varying levels of students' digital skills.2. Provide individualized support and guidance for students with little experience in digital tools.

CONCLUSION

The research in this study focused on identifying factors that promote digital literacy, the major hurdles that impede its improvement, and recommendations to improve digital literacy among international university students in Malaysian HE institutions. By conducting literature reviews and semi-structured interviews, it has effectively pinpointed key areas of the topic, creating a better opportunity to contribute to improving digital literacy among international university students. The research findings revealed that it is essential to create a more encouraging digital learning environment that meets the needs of internal students in HE institutions to support digital learning improvement. Indeed, the research in this study made a significant contribution in that it has determined the major ways that contribute to digital literacy improvement, has identified the hurdles that impede the improvement process, and created significant recommendations regarding digital literacy improvement among international university students in Malaysian HE institutions. The research findings gained from the literature reviews are validated with the findings from the interviews that are conducted, which create a wider perspective regarding the issue in the study. The research is significant since it considers both enablers and hindrances of digital literacy development from the perspective of international students. Although the research offers specific suggestions, its aim is to improve the digital literacy system in Malaysian universities and other higher education institutions, thereby enhancing the academic and employment skills of international students. The findings can be instrumental in helping educational policymakers, administrators, and practitioners develop effective digital literacy programs.

Limitations and Future Work

The primary limitation of the research was the scarcity of literature on digital literacy among international students in Malaysia. Furthermore, due to the timeframe, sample accessibility, and the saturation point of the research, the research was conducted using results from a smaller sample. Although the limitations of the research may be addressed through future research, the scope can include teachers as well as administrative employees of the institute.

Potential future research could continue to build upon the current findings by examining digital literacy within other student demographics, namely, locals,

postgraduates and those in other fields of study. A mixed approach would most likely yield a greater overall level of knowledge on the issue. A longitudinal approach could also investigate students' development of digital literacy, yielding a richer overall understanding.

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- None
- Some sections, with minimal or no editing
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- Double check in-text and references here; there are a few extra
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