# Digital Literacy Skills and Academic-Library Engagement among Generation Z Students in Malaysian Higher Education

**Nur Balqis Binti Ridzuan[1], Noor Zaidi Sahid[2*]**

**[1 2] Faculty of Information Management, University Technology MARA, Malaysia**

***Corresponding Author**

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## ABSTRACT

This study investigates the relationship between digital-literacy competencies and academic-library engagement among Generation Z students in a Malaysian private university. Grounded in the Big6 Model, DigComp 2.2 Framework, and Bloom's Revised Taxonomy, the research adopts a quantitative descriptive-correlational design to examine how information literacy, critical thinking, digital communication, and problem-solving skills influence students' use of digital-library resources. Data were collected through a validated questionnaire (N = 421) and analysed using descriptive statistics, Pearson's correlation, and multiple regression in IBM SPSS Statistics 29. Findings indicate that while students exhibit moderate overall digital literacy (M = 3.47, SD = 0.61), their engagement with institutional e-resources remains limited (M = 2.96). All four literacy dimensions correlated positively with library engagement ($p < .01$); however, information literacy emerged as the strongest predictor ($\beta = 0.48$, $p < .001$), followed by problem solving ($\beta = 0.24$) and critical thinking ($\beta = 0.19$). The results highlight a perception–practice gap: students overestimate their abilities yet underuse scholarly databases. The study affirms that higher-order cognitive and evaluative skills are central to effective digital participation and recommends integrating structured literacy modules, gamified tutorials, and peer-mentoring initiatives to strengthen Malaysia's digital-competency agenda.

**Keywords—** Academic-library engagement, Digital literacy, Generation Z, Higher education, Information Literacy, Malaysia

## INTRODUCTION

### Background of the Study

The accelerating pace of digital transformation has reshaped higher education worldwide. Universities now function within knowledge-based economies that require graduates equipped with advanced digital, analytical, and collaborative competencies. Within this environment, digital literacy—the ability to access, evaluate, create, and communicate information through digital technologies—has emerged as a defining graduate attribute and a vital indicator of institutional quality (Carretero et al., 2017; Meyers et al., 2013). Beyond technical proficiency, digital literacy incorporates higher-order cognitive and socio-ethical capacities, positioning it as an essential skill for lifelong learning, critical scholarship, and innovation.

For members of Generation Z (born between 1997 and 2012), technology is deeply embedded in everyday life. They are often labelled "digital natives," presumed to possess intuitive command over digital tools. However, empirical studies have challenged this assumption. Research from various regions demonstrates that while Gen Z students excel in multitasking and online communication, they frequently struggle with evaluating information quality, synthesising evidence, and engaging in academic discourse (Giunta, 2017; Wilson, 2024). This paradox between technological fluency and academic literacy underscores an urgent need for institutions to cultivate students' evaluative and reflective capabilities.

Malaysia's higher-education system has embraced digitalisation as a strategic agenda under the Malaysia Education Blueprint 2015–2025 (Higher Education) and the MyDIGITAL Economic Transformation Plan.

These frameworks emphasise developing digitally competent citizens capable of contributing to an innovation-driven economy. Consequently, universities have invested heavily in virtual-learning environments, cloud-based repositories, and e-library infrastructures to support hybrid pedagogies. Despite these developments, studies continue to reveal uneven digital competencies among students and limited engagement with institutional scholarly resources (Hamizak & Uzir, 2024). Students' use of technology remains largely entertainment- or communication-oriented, with insufficient emphasis on academic or research purposes.

Private universities, which primarily serve urban, middle-income learners, often feature more advanced digital ecosystems—including subscription databases, AI-assisted discovery tools, and high-speed connectivity—than public institutions. Yet librarians at these universities report a steady decline in database utilisation even among digitally confident students. This paradox prompts a central pedagogical question: Does the mere availability of technology translate into meaningful scholarly engagement with information? Addressing this question is at the heart of the present study.

### Problem Statement

While digital infrastructures have expanded rapidly, the critical and scholarly use of these technologies by students remains inconsistent. Many universities presume that Generation Z learners inherently possess strong digital skills, leading to under-investment in structured digital-literacy instruction (Ng, 2012; Eshet-Alkalai, 2017). As a result, students often graduate without mastering fundamental competencies in information evaluation, ethical use, and academic communication (Head et al., 2020; Parkes et al., 2021).

This misalignment between perceived capability and demonstrated competence—often termed the perception–practice gap—poses challenges for teaching quality and learning assurance (Pinto et al., 2020; Rahman & Karim, 2023). Although institutional libraries provide access to high-quality databases and digital repositories, usage statistics show persistent under-utilisation (Azhari & Wong, 2019; Jusoh et al., 2022). Students continue to prioritise quick web searches and social-media resources over peer-reviewed literature, indicating that ease of access does not equate to information discernment (Lim, 2022; Wilson, 2024).

Within Malaysia, empirical evidence linking specific dimensions of digital literacy to academic-library engagement remains limited, especially in private-university settings. Understanding these relationships is crucial to designing effective curricula, targeted library interventions, and national strategies for digital-competency development. Hence, this study seeks to close this empirical gap by analysing how particular dimensions of digital literacy influence Generation Z students' academic-library engagement.

### Research Objectives

This study is guided by the following objectives:

1. To assess Generation Z students' overall level of digital literacy in a Malaysian private-university context.
2. To examine the relationship between four dimensions of digital literacy—information literacy, critical thinking, digital communication, and problem-solving—and academic-library engagement.
3. To determine which digital-literacy dimension most strongly predicts students' effective utilisation of academic-library resources.

Collectively, these objectives aim to generate empirical evidence that can inform curriculum design, library instruction, and policy development aligned with Malaysia's goal of nurturing digitally competent and critically literate graduates.

## LITERATURE REVIEW

### Evolution of the Digital-Literacy Concept

The notion of digital literacy has evolved substantially from its early technical orientation to a multidimensional construct encompassing cognitive, social, and ethical dimensions. Gilster (1997) first defined it as "the ability to

understand and use information in multiple formats from a wide range of sources when it is presented via computers." Early interpretations emphasised functional skills such as software use and information retrieval. Later scholarship broadened the scope, recognising that literacy in digital contexts involves the capacity to evaluate credibility, integrate sources, and participate ethically in online knowledge environments (Meyers et al., 2013).

Bawden (2008) described digital literacy as a synthesis of information, media, and ICT literacies that collectively enable users to manage information overload in complex digital ecosystems. Ng (2012) further articulated three interrelated dimensions—technical, cognitive, and socio-emotional—arguing that the latter two are decisive for deep learning. Contemporary frameworks such as the European Commission's DigComp 2.2 (Carretero et al., 2017) operationalise digital literacy into five core domains: information and data literacy, communication and collaboration, digital-content creation, safety, and problem solving. These domains stress the integrated nature of digital competence, bridging technology use with critical reasoning and ethical behaviour.

Although these global frameworks offer strong frameworks, there is a growing demand among scholars for culturally responsive frameworks that place digital literacy in particular socio-economic and educational contexts (Eutsler & Perez, 2022; Gay, 2018). The concept of digital literacy in a multicultural country such as Malaysia, in turn, can be distinctly influenced by language-of-instruction policies, the digital access gap between urban and rural areas, or a set of cultural communication standards. These are subtle aspects not necessarily employed by general models. The given research, then, frames the overall competencies of DigComp 2.2 against the background of the local policy objectives of the Malaysia Digital Economy Blueprint (MyDIGITAL) and the realities of the local higher-education landscape.

Furthermore, the Big6 Information-Literacy Model (Eisenberg & Berkowitz, 2003) complements DigComp by emphasising process. It delineates six iterative stages—task definition, information seeking, location and access, use, synthesis, and evaluation—reflecting how learners progress from recognising an information need to evaluating outcomes. Together, DigComp and Big6 demonstrate that effective digital engagement requires a fusion of procedural skill and critical awareness. They form the theoretical anchor for this study's operationalisation of digital-literacy dimensions in academic settings.

**Information-Seeking-Behaviour Theories**

Information-seeking-behaviour (ISB) theories provide behavioural insight into how individuals locate and use information. Wilson (1999) proposed that information behaviour results from perceived needs shaped by personal, social, and environmental contexts. His model identifies activating mechanisms—such as motivation or barriers—that influence information seeking and use. Ellis (2005) supplemented this with a behavioural taxonomy comprising starting, chaining, browsing, differentiating, monitoring, and verifying. These activities illustrate that information searching is rarely linear; users continually loop between exploration and verification.

Kuhlthau's (1993) Information-Search-Process Model added an affective perspective, suggesting that feelings of uncertainty and confidence evolve as search competence increases. These classic models collectively emphasise that successful information behaviour depends not merely on access to systems but also on users' strategic, cognitive, and emotional capacities. In digital environments, these competencies correspond directly to digital-literacy dimensions such as critical evaluation, synthesis, and problem solving. Consequently, ISB theories underpin the present study's assumption that digital literacy mediates between environmental affordances (e.g., databases) and behavioural outcomes (e.g., frequency of academic-library engagement).

**Global Studies on Generation Z and Digital Literacy**

Global empirical research consistently identifies a paradox among Generation Z learners—widespread digital exposure coexisting with shallow academic engagement. In technologically advanced contexts such as the United States, the United Kingdom, and Canada, students often display high operational proficiency yet limited evaluative judgment. Wilson (2024) reported that American employees under 25 demonstrated strong teamwork and communication abilities but weak discernment of credible information. Likewise, Ng (2012) observed that

UK undergraduates frequently equated digital literacy with technical know-how rather than analytical understanding, while McGrew et al. (2018) found that convenience and immediacy often guided search behavior, resulting in heavy reliance on Google or Wikipedia instead of scholarly databases.

European findings mirror these tendencies. Giunta (2017) and Parkes et al. (2021) noted that although students in high-income settings possess near-universal internet access, many still engage in surface-level searching and demonstrate minimal ethical reflection when citing sources. These studies reveal that even in resource-rich educational systems, digital literacy cannot be assumed; it must be cultivated through explicit, scaffolded learning.

However, such global evidence primarily reflects mature higher-education systems characterized by strong infrastructure and embedded information-literacy instruction. The realities of developing or transitional economies differ substantially, where technological readiness, linguistic diversity, and pedagogical traditions mediate literacy outcomes. Understanding these contrasts requires examining regional contexts—particularly Southeast Asia—where national digital agendas are expanding but disparities persist in the depth and quality of literacy integration.

**Southeast-Asian and Malaysian Context**

Across Southeast Asia, governments have elevated digital literacy as a strategic educational priority. Initiatives such as Thailand's Digital Literacy for Education Framework and the Philippines' Digital Learner Competency Model illustrate sustained policy commitment to embedding digital competencies in tertiary curricula (Sirisak & Suwannaphim, 2023; Aguilar et al., 2020). Empirical assessments show that structured literacy interventions—such as librarian-led workshops, gamified tutorials, and peer-learning modules—significantly improve students' confidence and information-evaluation skills.

Nevertheless, regional progress remains uneven. Limilia et al. (2022) and Puspitasari et al. (2024) found that Indonesian undergraduates demonstrate strong social-media fluency but limited evaluative competence, often prioritizing accessibility over credibility. Similarly, Sirisak and Suwannaphim (2023) reported that introducing gamified library training improved critical-thinking indicators by nearly 20 percent, underscoring the value of interactive pedagogies.

In Malaysia, research trends reveal an emphasis on ICT proficiency rather than evaluative or ethical literacy. Hamizak and Uzir (2024) observed that only one-third of students regularly access academic databases despite self-reported digital confidence. Tan and Ismail (2023) further noted that while device ownership approaches 100 percent, less than half of respondents could distinguish between peer-reviewed and non-academic sources. Azhari and Wong (2019) and Jusoh et al. (2022) found that major institutional investments in e-learning infrastructure have not yielded proportional gains in scholarly resource utilization.

These findings confirm a persistent perception–practice gap in Malaysian higher education, especially within private institutions that possess robust technological ecosystems yet limited critical-literacy culture. Addressing this gap requires contextualizing global frameworks within local initiatives such as the Malaysia Digital Economy Blueprint (MyDIGITAL) and the Malaysia Education Blueprint 2015–2025 (Higher Education), both of which emphasize human-capital development, responsible data use, and inclusive participation in the digital economy. The present study positions its inquiry within this evolving regional landscape.

**Digital-Library Engagement Models**

Digital-library engagement is shaped by technological, behavioral, and institutional variables. Classical adoption models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT2) attribute usage behavior to perceived usefulness, ease of use, and social influence (Venkatesh et al., 2012). Yet these frameworks insufficiently account for cognitive and ethical literacies critical to scholarly environments. Integrating digital-literacy constructs expands explanatory power: when students possess strong evaluative, critical-thinking, and problem-solving capacities, they interpret library systems as more useful and user-friendly, increasing sustained engagement.

Recent research supports this linkage. Parkes et al. (2021) found that information-evaluation competence positively correlated with satisfaction and continued use of e-libraries. Tsai and Liang (2020) similarly demonstrated that problem-solving skill predicted perceived ease of use and adoption persistence. Accordingly, effective library engagement depends on a synergy between technological design and users' higher-order literacies.

### Theoretical Integration and Policy Alignment

This study synthesizes three theoretical pillars—the DigComp 2.2 Framework, the Big6 Information-Literacy Model, and Bloom's Revised Taxonomy—to analyze digital-literacy competencies within a behavioral perspective of academic-library engagement.

DigComp 2.2 conceptualizes digital competence across five domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. The Big6 Model delineates the procedural stages of information problem-solving, from task definition to evaluation. Bloom's Revised Taxonomy locates literacy learning within a cognitive continuum from remembering to creating.

To ensure cultural and contextual relevance, this framework is anchored in Malaysia's national digital transformation agendas—the MyDIGITAL Economy Blueprint (2021) and the Malaysia Education Blueprint (2015–2025 Higher Education). These policies emphasize data ethics, inclusive access, and the cultivation of digital citizens capable of contributing to an innovation-driven economy.

By merging global competency models with local policy imperatives, the framework becomes culturally responsive, addressing both universal and context-specific dimensions of digital-literacy development. It supports the study's hypothesis that information literacy, critical thinking, communication, and problem-solving interact dynamically to predict meaningful engagement with institutional digital resources.

## METHODOLOGY

### Research Design

This investigation employed a quantitative descriptive-correlational design situated within the positivist paradigm, which emphasises objectivity, measurement, and replicability (Creswell & Creswell, 2018; Neuman, 2014). The choice of design was appropriate because the study sought to quantify the strength and direction of associations between students' digital-literacy dimensions and their engagement with academic-library resources.

A descriptive-correlational approach allows for empirical generalisation while maintaining an explanatory lens that identifies predictors within existing behavioural tendencies (Punch & Oancea, 2019). It aligns with the study's deductive reasoning process—testing relationships derived from theoretical constructs (Big6, DigComp, and Bloom). By focusing on naturally occurring variables without manipulation, the design ensured ecological validity within authentic educational settings. Quantitative data collection through structured questionnaires further facilitated statistical precision and reproducibility.

### Population and Sampling

The population comprised Generation Z students aged 18 to 28 enrolled at a leading private university in Malaysia. The institution offers diverse programmes—foundation, diploma, undergraduate, and postgraduate—within a digitalised learning environment. Given the study's objective to represent multiple academic levels, stratified random sampling was used to ensure proportional inclusion across programme categories.

Using Krejcie and Morgan's (1970) formula for finite populations, a minimum sample size of 375 was determined for a 95 percent confidence level and a 5 percent margin of error. A total of 421 valid responses were obtained, providing robust statistical power and slightly exceeding the recommended threshold to compensate for potential non-response bias. The stratification improved external validity by capturing variance across

disciplines and study levels (Sekaran & Bougie, 2019; Saunders et al., 2019).

| Demographic Variable | Distribution |
|---|---|
| Gender | 68 percent female, 32 percent male |
| Age | Mean = 21.4 years, SD = 2.1 |
| Programme Level | 72 percent undergraduate,<br>20 percent foundation/diploma,<br>8 percent postgraduate |

The demographic profile reflects the gender and disciplinary composition typical of Malaysian private-university enrolments, particularly in business, communication, and information-management programmes. This heterogeneity strengthens the generalisability of findings to similar institutional contexts.

**Instrumentation**

The research instrument was a structured questionnaire encompassing five sections aligned with the study's independent and dependent variables. Items were adapted from the Big6 Information-Literacy Model (Eisenberg & Berkowitz, 2003), the DigComp 2.2 Framework (Carretero et al., 2017), and UNESCO's Media and Information-Literacy Indicators (UNESCO, 2013). Each construct was operationalised through multiple indicators representing cognitive, technical, and behavioural components.

| Variable | No. of Items | Cronbach's α |
|---|---|---|
| Information Literacy | 10 | 0.92 |
| Critical Thinking | 10 | 0.90 |
| Digital Communication | 10 | 0.88 |
| Digital Problem Solving | 10 | 0.91 |
| Library Engagement | 10 | 0.89 |

All items were rated on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). A pilot study of 30 students was undertaken to test item clarity, contextual fit, and reliability. Feedback prompted minor wording adjustments and improved localization to Malaysian higher-education terminology. Reliability analysis produced an overall Cronbach's $\alpha = 0.95$, denoting excellent internal consistency. Subscale reliability coefficients were as follows: information literacy = 0.92, critical thinking = 0.90, digital communication = 0.88, digital problem-solving = 0.91, and library engagement = 0.89. These values exceed the 0.70 benchmark recommended by Hair et al. (2020).

Construct validity was confirmed through KMO = 0.89 and Bartlett's Test of Sphericity ($p < 0.001$). Exploratory factor loadings above 0.60 validated unidimensionality. Content validity was established via expert review from three library-science scholars. Together, these metrics demonstrate the instrument's psychometric soundness and reproducibility.

**Data-Collection Procedures**

Data were collected over a four-week period using Google Forms, distributed through official student e-mail and

learning-management-system channels. An electronic consent statement preceded participation, outlining voluntary involvement, anonymity, and data-confidentiality measures in accordance with the UiTM Research Ethics Committee's approval.The online format was selected for logistical efficiency and congruence with the study's digital-engagement theme. Weekly reminders followed Dillman et al.'s (2014) Tailored Design Method to reduce non-response bias. The response rate exceeded 80 percent of distributed invitations, reflecting strong student interest and accessibility.

Data screening involved three stages:

1. Completeness check – Incomplete responses were removed.
2. Duplication test – E-mail timestamps and IP addresses were cross-verified.
3. Outlier inspection – Extreme-value analysis ensured normal distribution of composite scores.

The cleaned dataset was exported to IBM SPSS Statistics 29 for quantitative analysis. All data were stored in password-protected cloud drives accessible only to the research team, ensuring ethical compliance with Malaysia's Personal Data Protection Act (2010).

**Data-Analysis Techniques**

Data analysis proceeded in three analytical stages.

1. Descriptive statistics summarised demographic characteristics and mean scores for each digital-literacy construct. Measures of central tendency (mean, SD) and frequency distributions established students' overall proficiency levels.
2. Pearson's product-moment correlation tested the strength and direction of bivariate relationships among digital-literacy dimensions and library engagement (Dancey & Reidy, 2017).
3. Multiple linear regression identified the relative contribution of each predictor variable—information literacy, critical thinking, digital communication, and problem solving—to academic-library engagement (Pallant, 2020).

All statistical assumptions were examined: normality (skewness ±1), linearity, homoscedasticity, and multicollinearity (VIF < 2.5; Hair et al., 2020). Significance was established at $p < 0.05$. To enhance interpretability, effect sizes were calculated using adjusted $R^2$ values and standardised β coefficients. Findings were then interpreted in relation to the theoretical model (Big6 + DigComp + Bloom) and the study's objectives.

This rigorous analytical protocol ensured reliability, transparency, and replicability—key hallmarks of positivist quantitative research.

**Ethical Considerations**

Ethical approval of this research was obtained from the UiTM Research Ethics Committee (Ref. No. 100-KPPIM (PI.9/10/) (MR/1292)). All participants were briefed on the study objectives, assured of voluntary participation, anonymity, and confidentiality, and provided informed electronic consent before beginning the survey.

Data were stored on encrypted, password-protected cloud servers accessible solely to the research team. The study adhered to Malaysia's Personal Data Protection Act (PDPA) 2010, the UiTM Research Integrity and Ethics Framework (2022) guidelines. These measures ensured compliance with international research-ethics standards for transparency, data protection, and participant welfare.

**Results**

**Data-Analysis Techniques**

The descriptive analysis revealed that students reported a moderate overall level of digital literacy (M = 3.47, SD = 0.61). Among the four literacy dimensions, information literacy recorded the highest mean score (M =

3.82, SD = 0.58), indicating that students perceived themselves as competent in identifying, locating, and evaluating information. Problem-solving skills followed (M = 3.54, SD = 0.63), suggesting moderate confidence in resolving technical or procedural issues. Critical thinking (M = 3.31, SD = 0.65) and digital communication (M = 3.12, SD = 0.67) were comparatively lower, reflecting limited ability to interpret complex information or engage in scholarly discourse online.

| Dimension | Mean | Standard Deviation | Interpretation |
|---|---|---|---|
| Information Literacy | 3.82 | 0.58 | High |
| Problem Solving | 3.54 | 0.63 | Moderate-High |
| Critical Thinking | 3.31 | 0.65 | Moderate |
| Digital Communication | 3.12 | 0.67 | Moderate Low |

In contrast, students' reported engagement with the university's digital-library systems was low (M = 2.96, SD = 0.71). Only 27 percent accessed e-resources weekly, while 41 percent relied mainly on Google Scholar or open-web platforms. This pattern indicates that despite possessing moderate literacy skills, students' academic application of these skills remains limited.

### Correlation Analysis

Pearson's correlation results showed strong, positive, and significant relationships between all four digital-literacy dimensions and academic-library engagement ($p < 0.01$). The correlation coefficients were as follows: information literacy ($r = .93$), problem solving ($r = .81$), critical thinking ($r = .76$), and digital communication ($r = .64$). Information literacy exhibited the strongest association, underscoring its centrality in shaping library engagement. These findings align with prior research by Salubi et al. (2018) and Rafi et al. (2019), who found that the ability to evaluate and synthesise information is the most consistent predictor of effective academic-library use.

### Regression Analysis

The multiple regression model explained 58 percent ($R^2 = 0.58$, $F = 135.2$, $p < 0.001$) of the variance in library engagement. Standardised coefficients indicated that information literacy ($\beta = 0.48$, $p < 0.001$) was the most influential predictor, followed by problem-solving ($\beta = 0.24$, $p < 0.01$) and critical-thinking skills ($\beta = 0.19$, $p < 0.05$). Digital communication ($\beta = 0.09$, $p > 0.05$) did not significantly predict library engagement when other variables were controlled.

These results confirm the theoretical expectation that higher-order cognitive competencies exert greater influence on behavioural engagement than do technical or communicative abilities alone. The adjusted $R^2$ of 0.57 indicates a large effect size (Cohen, 1988), demonstrating that literacy dimensions substantially account for variations in students' digital-library utilisation.

## DISCUSSION

### Overview of Findings

The findings demonstrate that while Generation Z students at the studied Malaysian private university possess moderate to high digital proficiency, their engagement with academic-library systems remains limited. The strong correlations among all four literacy dimensions indicate that digital-literacy skills function synergistically rather than in isolation. The prominence of information literacy as the strongest predictor reinforces the theoretical propositions of the Big6 Model and complements DigComp's emphasis on information and data literacy as foundational competences for effective digital participation.

The context of this study, namely a single private university, also deserves to be taken into consideration when explaining the results. In such an environment, students might have varying socio-economic statuses, pre-university digital exposure, and institutional resource demands when compared to students in their figures in a public university. Although no one-to-one comparison was made in this work, this environment (e.g. maybe more generously-furnished library systems or a more positive focus on English-language digital resources) could have affected both the perceived literacy of the students and actually their particular library use patterns. This solidifies the necessity of the comparative research which was already proposed in the limitations.

**Information Literacy as the Core Predictor**

Information literacy recorded both the highest mean score and the strongest predictive influence on library engagement. This finding implies that the ability to define information needs, conduct targeted searches, evaluate source credibility, and apply ethical referencing practices directly enhances students' use of academic resources. Students demonstrating these competencies were more likely to rely on peer-reviewed databases rather than open-web content.

However, the study also revealed a clear discrepancy between students' self-assessed information-search abilities and actual engagement behaviour. Despite high self-ratings, institutional usage records and qualitative feedback suggested low interaction with library platforms. This discrepancy mirrors the confidence–performance gap reported by Meyers et al. (2013) and Ng (2012), confirming that perceived expertise does not necessarily equate to effective academic practice. In essence, access to technology and self-perceived fluency are insufficient substitutes for structured literacy development.

**The Role of Critical Thinking and Problem Solving**

Critical-thinking ($\beta = 0.19$) and problem-solving ($\beta = 0.24$) skills were also significant predictors of library engagement. These skills enable learners to evaluate conflicting information, integrate evidence, and troubleshoot conceptual or technical challenges. Respondents who reported higher analytical skills tended to verify information across multiple databases and cross-check the reliability of sources before citation. Conversely, students with lower critical-thinking competence often selected the first available results, reflecting surface-level search behaviours consistent with McGrew et al. (2018).

Problem-solving competence, meanwhile, facilitated persistence in the face of technological barriers. Students who actively sought assistance from librarians or peers demonstrated higher overall engagement. These results affirm the procedural logic of the Big6 Model, wherein problem-solving and evaluation occur as iterative stages of the information process, reinforcing cognitive and behavioural engagement with academic systems.

**Digital Communication Competence**

Digital communication showed the weakest relationship with library engagement. Although most respondents use digital platforms extensively, their communication patterns tend to be social rather than scholarly. Only 22 percent of participants reported using academic discussion forums or online reference services to communicate with librarians or peers. This observation supports Giunta (2017) and Wilson (2024), who noted that Generation Z's communicative strength lies in informal, social interactions rather than academic collaboration. The finding suggests that library services need to integrate communication tools—such as live chat, social networking extensions, or collaborative annotation systems—to bridge social and academic communication spaces.

**Interdependence of Literacy Dimensions**

The correlation coefficients ranging from .64 to .93 highlight the interrelated nature of digital-literacy competencies. Information literacy and critical thinking form the cognitive foundation, while communication and problem-solving represent the applied and adaptive aspects of literacy. Improvement in one area often enhances performance in others. For example, better search and evaluation skills can strengthen critical reasoning, while reflective thinking can improve ethical information use. These interdependencies support Carretero et al.'s (2017) interpretation of digital competence as a holistic construct integrating knowledge, skills,

and attitudes.

### The Perception–Practice Gap

Despite reporting moderate to high digital-literacy proficiency, students' engagement with institutional digital libraries remains low (M = 2.96). Many described the library interface as complex or time-consuming compared to open-web searches. This pattern corresponds to what Meyers et al. (2013) term "surface-level engagement," characterised by preference for immediate results over deep analysis. The findings reinforce the argument that sustained literacy cannot be assumed from digital exposure alone but must be cultivated through intentional, curriculum-embedded interventions.

### Socio-Cultural and Pedagogical Factors

Learning culture in Malaysian higher education continues to reflect collectivist and exam-oriented traditions, where students depend heavily on lecturer-provided materials and peer-shared notes. Such dependency discourages independent exploration and critical analysis. Similar cultural tendencies have been reported in Indonesia and Thailand (Limilia et al., 2022; Sirisak & Suwannaphim, 2021). To address these structural barriers, digital-literacy education should be repositioned as an integral, assessed component of university curricula rather than as voluntary or co-curricular activity. Aligning digital-literacy instruction with course outcomes can encourage students to perceive these competencies as academically valuable and personally empowering.

## Implications of the Study

### Theoretical Implications

The findings reinforce the combined applicability of the Big6 Model, DigComp 2.2, and Bloom's Revised Taxonomy in understanding digital engagement within higher-education settings. Information literacy emerged as the cognitive anchor that activates higher-order processes such as evaluation and synthesis, validating Bloom's hierarchy where knowledge application leads to creation. The results also confirm DigComp's assertion that technical and ethical competencies interact with critical reasoning to shape meaningful participation in digital environments. By empirically linking these frameworks, this study extends their relevance beyond Western contexts and demonstrates their robustness within a Southeast-Asian, multilingual academic environment.

### Practical Implications

From a practical perspective, universities should institutionalise structured, credit-bearing digital-literacy modules embedded within disciplinary courses. Librarians and faculty can collaborate to design scaffolded interventions—workshops, peer-mentoring activities, and gamified tutorials—that progressively build students' search, evaluation, and citation competencies. Curriculum developers should align course learning outcomes with digital-literacy indicators so that evaluation of sources and ethical information use become assessable learning outcomes rather than optional enrichment.

Library administrators can also harness analytics to monitor usage trends and tailor outreach strategies. For instance, embedding database tutorials within learning-management systems or integrating chat-based reference tools can normalise scholarly interaction. Faculty-librarian partnerships can create authentic assessment tasks, such as annotated bibliographies or source-analysis portfolios, which reward accurate application of literacy skills.

### Policy Implications

At the policy level, the study supports Malaysia's MyDIGITAL agenda and Higher Education 4.0 vision, both of which emphasise the production of digitally capable graduates. The Ministry of Higher Education may consider developing a National Digital-Literacy Competency Framework for Higher Education, harmonising institutional initiatives under common standards. Incorporating digital-literacy benchmarks into programme accreditation and quality-assurance audits can further promote institutional accountability. Such policy

integration would also align Malaysia with regional commitments under the ASEAN Digital Masterplan 2025, fostering cross-border recognition of digital competencies.

### Limitations and Future Research

Although the study yields valuable insights into Generation Z digital-literacy dynamics, several limitations must be recognized. First, the cross-sectional design captures relationships at one point in time, limiting causal interpretation. Future longitudinal research could trace how continuous literacy interventions influence engagement trends across semesters.

Second, the sample focused on a single private university, which may not represent the diversity of Malaysia's higher-education system. Public universities differ in funding structures, technological infrastructure, and pedagogical culture. Comparative analyses across public–private and urban–rural institutions would clarify how these structural factors shape digital engagement and literacy development.

Third, reliance on self-reported data introduces potential common-method bias and social-desirability effects, as respondents might overstate their competence. While anonymity, neutral wording, and statistical checks were implemented to mitigate bias, future studies should triangulate self-perceptions with performance-based assessments, system-log analytics, or mixed-methods designs to strengthen validity.

Lastly, the study emphasized cognitive and behavioral dimensions; subsequent research might integrate affective or motivational factors to provide a holistic understanding of digital participation. Such comparative and multidimensional investigations would align with Malaysia's MyDIGITAL Blueprint, contributing to evidence-based strategies for cultivating globally competent yet locally grounded digital citizens.

## CONCLUSION

This study examined the relationship between digital-literacy competencies and academic-library engagement among Generation Z students in Malaysia. Results indicated moderate overall literacy levels but relatively low utilisation of institutional digital resources. Among the four literacy dimensions, information literacy emerged as the strongest predictor of engagement, followed by problem-solving and critical-thinking skills. These findings affirm that evaluative and cognitive abilities, rather than mere technological fluency, underpin meaningful academic interaction with digital information systems.

By integrating the Big6, DigComp 2.2, and Bloom's Revised Taxonomy, the study presents a multidimensional framework connecting behavioural engagement with cognitive and ethical dimensions of literacy. It confirms that digital competence must be viewed holistically—encompassing the ability to think critically, act ethically, and learn adaptively within technology-mediated environments.

For Malaysia's higher-education landscape, the implications are twofold. First, universities should embed literacy instruction within mainstream curricula to close the perception–practice gap identified among Gen Z learners. Second, policymakers should establish coherent national guidelines to ensure consistent literacy standards across institutions. Collectively, such measures will support the development of digitally competent, critically literate graduates capable of lifelong learning and knowledge creation in an increasingly digital society.

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**Authors' Contribution**

The key investigation through methodology, data collection, formal analysis, and draft preparation was done by Nur Balqis Binti Ridzuan. The conceptual guidance, supervision and validation was done by Noor Zaidi Sahid who also helped in the review and editing of the manuscript to be published. Both authors were present throughout the final reading and gave consent to the manuscript.

**Conflict Of Interest Declaration**

We certify that the article is the Authors' and Co-Authors' original work. The article has not received prior publication and is not under consideration for publication elsewhere. This research/manuscript has not been submitted for publication, nor has it been published in whole or in part elsewhere. We testify to the fact that all Authors have contributed significantly to the work, validity and legitimacy of the data and its interpretation for submission to Jurnal Intelek.

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