

Digital reading competencies, metacognitive strategies, and engagement in a state university

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Abstract

This study examined the influence of digital reading competencies and metacognitive reading strategies on the online reading engagement of college students enrolled in Engineering Technology program at a State University. Specifically, the study assessed students' levels of digital reading competencies in terms of interface navigation proficiency, strategic information retrieval, critical media evaluation, AI-integrated tool proficiency, and digital responsibility; metacognitive reading strategies in terms of strategic planning, self-monitoring and regulation, problem-solving strategies, strategic resource utilization, and reflective and relational processing; and online reading engagement in terms of behavioral, cognitive, affective, social, and performance engagement. The study also determined significant differences across demographic variables, examined the predictive influence of digital reading competencies and metacognitive reading strategies on online reading engagement, and developed an instructional enhancement program based on the findings. The findings revealed that the respondents generally showed high levels of digital reading competencies, metacognitive reading strategies, and online reading engagement. Significant differences were observed in selected variables when grouped according to demographic characteristics. Furthermore, critical media evaluation, strategic information retrieval, AI-integrated tool proficiency, digital responsibility, and all dimensions of metacognitive reading strategies significantly predicted online reading engagement, whereas interface navigation proficiency did not emerge as a significant predictor. Based on these findings, an instructional enhancement program was proposed to strengthen students' digital reading competencies, metacognitive strategy use, and sustained engagement in online reading environments.

Keywords: college students, digital reading competencies, instructional enhancement program, metacognitive reading strategies, online reading engagement

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1. Introduction

Reading is central to university learning because students must interpret course materials, compare scholarly sources, and use evidence to explain their ideas. Much of this reading now takes place through learning management systems, electronic journals, websites, and AI-assisted tools (Butaya et al., 2026; Corbin et al., 2024; Elegbeleye, 2025). Digital reading therefore requires more than access to a device: students must locate relevant texts, judge their credibility, connect information across sources, and use it responsibly. These competencies are grounded in Coiro's online reading comprehension framework and UNESCO's Digital Literacy Global Framework. Beyond basic technical proficiency, this multidimensional skillset demands that students move past simple decoding to master complex ideas in evolving digital contexts (Smith et al., 2023).

Digital reading competencies refer to students' ability to navigate digital sources, retrieve relevant information, evaluate its credibility, synthesize what they read, and verify information obtained through AI-assisted tools (Hwang et al., 2023; Pondang et al., 2025). A student may find an article or generate a summary quickly yet still struggle to identify the author's argument, reconcile conflicting findings, or support a conclusion with the original source. Such difficulties make it necessary to examine the quality of students' reading practices alongside their familiarity with digital platforms. UNESCO's guidance on generative AI also reinforces the need for learners to examine generated information critically. This shift toward autonomous, digital-first learning necessitates a departure from passive consumption toward the active, critical evaluation of multifaceted information environments (Ángel et al., 2022; Nagel et al., 2022).

Metacognitive reading strategies are the deliberate actions students use to direct and improve their understanding of a text. Operationally, this study treats them as the strategies students report using to set a purpose before reading, select an approach suited to the task, check whether they understand the text, address confusion, and evaluate what they have learned (Bantasan, 2026; Heyne et al., 2023; Neuenhaus et al., 2022). For example, a student may preview an article, reread a difficult passage, compare it with another source, or check whether an AI summary accurately represents the original. Self-regulation is part of this process; the construct also includes planning, monitoring, problem-solving, and evaluation. These actions are consistent with the categories measured by the Metacognitive Awareness of Reading Strategies Inventory. Crucially, integrating these strategies serves as a form of cognitive scaffolding, where learners utilize AI tools to extend their regulation of meaning-making rather than merely outsourcing complex analytical tasks (Mokhtari et al., 2026).

Online reading engagement concerns the extent to which students attend to, persist in, and invest effort in reading digital texts. Behaviorally engaged students complete and participate in reading tasks; cognitively engaged students work to interpret and evaluate ideas; emotionally engaged students show interest in the material. Competence describes what students can do, metacognitive strategies describe how they manage their understanding, and engagement describes how actively they sustain that work. This distinction draws on the behavioral, cognitive, and emotional dimensions of engagement. However, the proliferation of generative AI necessitates a critical re-evaluation of these engagement constructs, particularly regarding whether AI-mediated reading fosters active participation or encourages cognitive offloading that diminishes internal intellectual effort (Fan et al., 2024). Consequently, research must investigate whether these technological interventions function as cognitive shortcuts or as catalysts for deeper metacognitive reflection and synthesis (Mokhtari et al., 2025). Furthermore, recent longitudinal observations indicate that while students often employ AI primarily for initial comprehension, there remains a persistent, underutilized potential for learners to leverage these tools to facilitate higher-order reasoning and metacognitive monitoring (Fu et al., 2026).

In the state university classroom setting, the concern is whether students who routinely access online modules, search results, and AI-generated explanations also examine original readings closely, assess sources, and remain engaged when texts are difficult. The introduction provided does not identify a named university, course, or documented classroom findings, so these concerns should be treated as questions for the study rather than established local deficiencies. The local gap is the lack of evidence, within the state university under study, showing which digital reading competencies students show, which metacognitive strategies they use, and how consistently they engage with assigned online readings. Examining the three variables together can identify where instruction is needed—for example, in source evaluation, comprehension monitoring, or sustained reading—without assuming that frequent technology use already reflects effective academic reading. By analyzing these dynamics, this research aims to determine whether students utilize AI as a "metacognitive mirror" to actively monitor and repair comprehension breakdowns or if they rely on it primarily for superficial surface-level correction (Stofiana et al., 2025; Supardan et al., 2026).

Despite growing body of literature on digital literacy, self-regulated learning, metacognition, and student engagement, existing research has often examined these constructs independently or emphasized students' general technological proficiency without exploring the complex relationships among specific dimensions of digital reading behavior. Although previous investigations have showed the importance of digital literacy, metacognitive regulation, and engagement for academic success, relatively fewer studies have examined how digital reading competencies, metacognitive reading strategies, and online reading engagement collectively characterize the academic reading experiences of college students within technology-intensive learning environments. Moreover, many educational discussions continue to focus on students' overall competence while overlooking subtle variations across specific domains that may require instructional attention. As a result, generally positive levels of technological proficiency may conceal important weaknesses in evaluating digital information, regulating comprehension, or sustaining meaningful engagement during complex reading tasks.

Addressing these gaps is particularly important because understanding students' digital reading experiences requires a holistic perspective that recognizes the interconnected nature of technological competence, cognitive regulation, and learner engagement. Examining these constructs collectively offers greater potential for identifying both students' strengths and the specific areas that may benefit from targeted instructional support. Such evidence can guide curriculum development, instructional planning, faculty interventions, and learner support initiatives that move beyond assumptions of technological familiarity toward cultivating learners who are critical, reflective, self-regulated, and meaningfully engaged readers capable of responding to the demands of contemporary higher education.

Objectives of the Study - This study aims to assess the digital reading competencies, metacognitive reading strategies, and reading engagement of college students in order to determine how these factors influence reading engagement and provide a basis for the development of an instructional enhancement program. In particular, the study seeks to determine the digital reading competencies of college students in terms of interface navigation proficiency, strategic information retrieval, critical media evaluation and AI-integrated tool proficiency and digital responsibility; identify the metacognitive reading strategies employed by college students in terms of strategic planning, self-monitoring regulation, problem-solving strategies, strategic resource utilization and reflective and relational processing; test whether digital reading competencies and metacognitive strategies significantly influence students' online reading engagement and propose an instructional enhancement program grounded in the study's findings to improve students' digital and metacognitive strategies and reading engagement.

2. Methods

Research Design - This study employed a quantitative-descriptive correlational research design to examine the relationships among digital reading competencies, metacognitive reading strategies, and online reading engagement among college students. A quantitative approach was selected because the study aimed to measure variables objectively through numerical data and analyze relationships using statistical techniques. The descriptive

component enabled the researcher to determine the level of each variable, while the correlational component allowed for the identification of associations among them without manipulating any conditions.

Descriptive research is concerned with the systematic observation and recording of phenomena as they exist, without manipulation of variables. When conducted quantitatively, this process involves transforming observations into measurable data, enabling researchers to summarize and interpret patterns through statistical techniques. This type of research is essential in establishing baseline information that can guide further analytical or experimental studies (Ghanad, 2023; Kennedy, 2014; Miksza et al., 2023). The correlational aspect of the study focused on examining how digital reading competencies relate to metacognitive reading strategies and how these variables influence online reading engagement. This design allowed the researcher to explore both direct relationships and predictive influences among the variables. Overall, the selected research design is aligned with the study's objectives of identifying patterns, relationships, and potential predictive factors. It provides a systematic and empirical framework for understanding how students manage digital reading tasks and how these competencies and strategies contribute to their engagement in academic contexts.

Participants of the Study - The participants of this study consisted of 660 samples out of the total population of 2320 second-year and third-year college students enrolled at Batangas State University, specifically from the College of Engineering Technology. The respondents were drawn from various specializations within the college to ensure representation across different technical disciplines. The required sample size was determined using G*Power. An a priori power analysis with an effect size of 0.20, a significance level () of 0.05, and the specified statistical parameters yielded a minimum required sample size of 560 respondents. Purposive sampling technique employed to select participants who are actively engaged in academic tasks that require the use of digital reading materials, such as online modules, technical documents, and web-based resources.

The inclusion of second-year and third-year students was made because these year levels are actively enrolled in General Education and professional courses that require substantial engagement with digital reading materials such as Purposive Communication and Literature subjects, which may require learners to read, analyze, interpret, and evaluate a variety of digital texts, including literary selections, academic articles, essays, research-based readings, and other online instructional resources. First-year students were excluded as they are still in the adjustment phase of tertiary education, while fourth-year students were not included due to potential variability in academic load and specialization focus related to practicum or thesis requirements. Furthermore, the study explicitly excluded students from other colleges within the university, as well as those from year levels outside the second and third year. This delimitation was established to maintain the homogeneity of the sample and ensure that the findings accurately reflect the digital reading competencies, metacognitive strategies, and engagement levels of students within the College of Engineering Technology.

Data Gathering Instrument - The primary instrument used in this study was adapted and modified structured questionnaire designed to measure the three major variables: digital reading competencies, metacognitive reading strategies, and online reading engagement. The development of the instrument was grounded in established theoretical frameworks and supported by existing literature to ensure content validity and alignment with the constructs under investigation. The questionnaire consisted of three major sections corresponding to the study variables: digital reading competencies, metacognitive reading strategies, and online reading engagement. Each major variable contained 25 items, with five items allocated to each of its five subdimensions, resulting in a total of 75 items for the entire instrument. The digital reading competencies section measured interface navigation proficiency, strategic information retrieval, critical media evaluation, AI-integrated tool proficiency, and digital responsibility.

The metacognitive reading strategies section assessed strategic planning, self-monitoring and regulation, problem-solving strategies, strategic resource utilization, and reflective and relational processing, drawing on the work of McBreen et al. (2021). Meanwhile, the online reading engagement section examined behavioral, cognitive, affective, social, and performance engagement and was adapted from the Online Reading Engagement Scale

(ORES) developed by Dang et al. (2026). Collectively, the instrument was designed to comprehensively measure students' digital reading competencies, metacognitive reading strategies, and online reading engagement in higher education contexts. All items were structured using a four-point Likert scale, ranging from strongly disagree to strongly agree. This format allowed for the quantification of responses and facilitated statistical analysis. The Likert scale is widely used in educational research due to its ability to capture degrees of perception and behavior.

The data-gathering instrument utilized in this study underwent a rigorous validation process to ensure its reliability, clarity, and content accuracy. Specifically, the instrument was subjected to evaluation by two internal validators from Lyceum of the Philippines University (LPU), both of whom possess substantial expertise in the researcher's field of specialization. Their role was crucial in assessing the alignment of the instrument with the study's objectives, the appropriateness of the constructs being measured, and the overall coherence of the items. Their feedback led to meaningful refinements, particularly in improving item clarity, eliminating ambiguities, and ensuring that each question effectively captured the intended variables. In addition to the internal validation, the instrument was further examined by an external validator from Batangas State University (BSU), who is likewise recognized as an expert in the language academic discipline. The inclusion of an external validator added a layer of objectivity and strengthened the credibility of the instrument, as it provided an independent perspective beyond the institutional context of the researcher. This external evaluation focused on the instrument's generalizability, content validity, and its capacity to yield data that are both meaningful and applicable across similar research settings.

The combined insights from both internal and external validators contributed to a more robust and well-structured data-gathering tool. Through their expert recommendations, the instrument was enhanced to meet academic and methodological standards, thereby increasing its validity and ensuring that it is capable of generating reliable and accurate data for the study. Additionally, a pilot test was conducted with a small group of respondents to assess the reliability of the instrument.

The reliability of the questionnaire was measured using Cronbach's alpha coefficient, which evaluates internal consistency. A coefficient of 0.70 or higher was considered acceptable, indicating that the items within each subscale reliably measure the intended construct. Necessary revisions were made based on the results of the pilot testing to improve the instrument's reliability and overall quality. The pilot testing process also provided insights into the respondents' understanding of the questionnaire, allowing the researcher to refine ambiguous or complex wording. In addition, the internal consistency results were examined across different sections of the instrument to ensure that each construct was measured with sufficient precision. These systematic procedures contributed to strengthening the psychometric properties of the instrument, thereby ensuring that it produces stable and dependable data for the study.

According to the reliability results, the questionnaire exhibits excellent internal consistency across all evaluated constructs, indicating that it is a reliable and stable tool. Cronbach's alpha coefficients for the majority of subscales under digital reading competencies, metacognitive reading strategies, and reading engagement fell within the good range (0.80–0.89), indicating a high degree of item coherence. The instrument's ability to measure these factors consistently is reinforced by the notably strong reliability of constructs like digital accountability, AI-integrated tool competency, critical media appraisal, and all metacognitive strategy aspects. Even if several subscales—like social involvement and interface navigation proficiency—fall below the acceptable range, their values nevertheless satisfy the minimal dependability requirement. Overall, the results confirm that the instrument is psychometrically sound and suitable for data collection, providing confidence that the responses accurately reflect the intended constructs.

Data Gathering Procedure - The data gathering process began with securing formal approval from the Campus Director and Head for Academic Affairs of the various campus of Batangas State University- The National Engineering University and obtaining permission to conduct the study among selected participants. The questionnaire was administered using an online survey platform, allowing participants to access and complete the

instrument conveniently. This method was particularly suitable given the digital nature of the study and the participants' familiarity with online tools. Clear instructions were provided to guide respondents in answering the questionnaire accurately. Participants were informed about the purpose of the study and were assured that their responses would be treated with confidentiality. They were given ample time to complete the survey, and follow-up reminders were issued to ensure a high response rate. After data collection, responses were carefully reviewed, organized, and prepared for statistical analysis. The data were collected and finally treated statistically with the use of frequency count, percentage, ranking and weighted mean in interpreting, analyzing, and comparing the responses of the participants by using SPSS 27.0.

Data Analysis - Weighted mean, composite mean, and rank were employed to determine the levels of digital reading competencies, metacognitive reading strategies, and online reading engagement. For inferential analysis, the Kolmogorov–Smirnov test was first conducted to assess the normality of the data. Since the results indicated a non-normal distribution ($p < .05$), nonparametric tests were utilized. Regression Analysis was employed to examine the influence of digital reading competencies and metacognitive reading strategies on students' online reading engagement. The results were presented in tabular form to facilitate interpretation, with corresponding narratives explaining the findings. This comprehensive approach will ensure that the analysis addressed all research questions and provided meaningful insights.

Ethical Considerations - Ethical standards were rigorously observed throughout the conduct of this study to ensure the protection of participants and the integrity of the research process. All data collection instruments were subjected to an institutional review board assessment to guarantee that participants' privacy and informed consent were prioritized during all phases of data acquisition (Ritoša et al., 2023). Prior to data collection, formal permission was secured from the appropriate authorities of Batangas State University, particularly from the administration of the College of Engineering Technology. Participants were provided with a clear explanation of the purpose, scope, and procedures of the study, ensuring that they fully understood the nature of their involvement. Informed consent was obtained from all respondents, emphasizing that participation was entirely voluntary and that they had the right to withdraw at any point without any form of penalty or academic consequence.

To uphold confidentiality and anonymity, no personally identifiable information was collected from the respondents. All data gathered were treated with strict confidentiality and were used solely for academic and research purposes. The responses were encoded and stored securely, accessible only to the researcher, and were not disclosed to any unauthorized individuals. Additionally, the study adhered to ethical principles such as honesty, transparency, and respect for participants, ensuring that the data were reported accurately and without manipulation. These measures were implemented to maintain the credibility of the study and to protect the rights and well-being of all participants involved. In this study, ethical considerations were carefully observed through a formal process of institutional review. Prior to data collection, the researcher prepared and submitted all required documents to the university's designated ethics review body for evaluation. These documents typically included the research proposal, data-gathering instrument, informed consent forms, and others. The submission aimed to show that the study adheres to established ethical standards, particularly in ensuring the protection, rights, and welfare of the participants.

Following submission, the research underwent a thorough ethical review wherein the committee assessed the study's compliance with principles such as voluntary participation, confidentiality, anonymity, and informed consent. The researcher addressed any recommendations or required revisions provided by the reviewers to further strengthen the ethical soundness of the study. Only after obtaining formal approval from the university was the researcher permitted to proceed with the data collection process. This systematic approach ensured that the research was conducted responsibly and in accordance with accepted ethical guidelines in academic research.

3. Results and discussion

Table 1 presents the summary of the respondents' digital reading competencies across the five dimensions,

namely interface navigation proficiency, strategic information retrieval, critical media evaluation, ai-integrated tool proficiency, and digital responsibility. The findings revealed an overall composite mean of 3.38, verbally interpreted as Competent. This result indicates that the respondents generally possess the essential competencies required to navigate, retrieve, evaluate, utilize, and ethically manage digital information within technology-enhanced learning environments. The overall rating suggests that the respondents have developed a functional level of digital reading competence that enables them to engage successfully with digital academic resources. However, since the overall mean remains below the "Highly Competent" level, the findings likewise imply that there remains considerable opportunity to further strengthen students' higher-order digital reading skills, particularly in areas requiring advanced technological utilization and complex information processing.

Table 1*Summary Table on Digital Learning Competencies*

Dimensions	Composite Mean	VI	Rank
Interface Navigation Proficiency	3.40	Competent	2
Strategic Information Retrieval	3.35	Competent	4
Critical Media Evaluation	3.39	Competent	3
AI- Integrated Tool Proficiency	3.32	Competent	5
Digital Responsibility	3.44	Competent	1
Overall Composite Mean	3.38	Competent	

Legend: 3.50 – 4.00 = Highly Competent; 2.50 – 3.49 = Competent; 1.50 – 2.49 = Less Competent; 1.00 – 1.49 = Not Competent

The overall level of competence reflects the realities of contemporary higher education, where digital technologies have become indispensable components of teaching, learning, and academic research. Students today routinely interact with electronic journals, online learning management systems, virtual classrooms, multimedia instructional resources, digital libraries, and increasingly, artificial intelligence-supported educational applications. Such continuous exposure naturally contributes to the development of digital reading competencies. Findings also show that exposure alone does not necessarily result in advanced digital expertise. Students must be provided with structured learning experiences that intentionally cultivate higher-order digital literacy skills, critical evaluation, ethical decision-making, and strategic use of emerging technologies.

Digital Responsibility achieved the highest composite mean of 3.44 (Competent). This outcome shows that the ethical, legal, and behavioral aspects of digital reading serve as the primary cornerstone of the respondents' overall digital literacy. Readers show a strong commitment to respecting intellectual property, practicing safe browsing habits, maintaining proper citations, and exercising skepticism on informal platforms. This indicates that ethical awareness and digital citizenship standards are well-integrated into their reading practices, providing a secure, responsible foundation for interacting with online materials. The persistent difficulty with paraphrasing suggests that this foundation of ethical intent has yet to be fully matched by nuanced linguistic skills required for complex academic synthesis. Educational programs must balance the instruction of ethical frameworks with the development of critical processing strategies to ensure that students can effectively navigate, synthesize, and reformulate information from diverse digital sources (Festas et al., 2022; Park et al., 2026).

Interface Navigation Proficiency secured second rank with composite mean of 3.40. Positioned above the overall average, this dimension reflects a well-developed capability to handle the technical and non-linear mechanics of digital environments. Respondents effectively manage multi-tab environments, utilize structural features like headings and subheadings, and maintain comprehension while switching between sources. Their strong performance here indicates that readers possess the operational fluency required to manipulate digital interfaces without experiencing major cognitive overload or navigational friction. This proficiency highlights that these learners can successfully decode digital texts and make meaning across varied devices, suggesting they have moved beyond basic technical engagement toward more autonomous navigation (Mills et al., 2022). This technical agility is further evidenced by their ability to troubleshoot common software errors and adapt existing systemic knowledge when transitioning between disparate digital platforms (Maya et al., 2022).

Among the indicators, at the 3rd rank, Critical Media Evaluation recorded a composite mean of 3.39 (Competent), aligning almost perfectly with the overall standard. This highlights a consistent capability to assess

source credibility, cross-verify facts across multiple digital materials, and scrutinize publication metadata. While readers perform admirably in verifying top-level authority, slightly lower scores in detecting nuanced promotional intent and sensationalized language keep this dimension at the middle tier, confirming that high-level evaluative mechanisms are present but face challenges when confronted with deeply embedded media bias. Consequently, educators must emphasize advanced rhetorical analysis to transition students from basic source verification toward identifying subtle ideological frameworks or persuasive techniques (Son & Ha, 2024). Finally, this underscores the necessity of fostering robust media analysis skills to ensure that students can effectively navigate the increasingly complex landscape of digital discourse (Palomino et al., 2023).

Positioned at the 4th rank, Strategic Information Retrieval reached a composite mean of 3.35 (Competent). Although still reflecting a competent level of performance, its placement near the bottom indicates that the iterative filtering and refinement stages of digital research present greater cognitive demands. While initial keyword searches and broad text selection are executed smoothly, the process of continually refining queries and reintegrating complex hyperlinked information requires active metacognitive monitoring, making continuous retrieval slightly more challenging than navigating known interfaces or following ethical guidelines. This suggests that while operational and ethical proficiency is well-established, advanced research fluency—specifically the ability to perform precise, multi-stage information filtering—remains an area where students could benefit from more structured pedagogical guidance to overcome common search-related barriers. Empirical evidence suggests that such difficulties often stem from an inability to effectively manage the processing power of digital tools to transform raw data into knowledge, hindering the execution of complex computational and investigative tasks (Caton et al., 2022; Stadler et al., 2024).

The lowest-rated dimension at the 5th rank is AI-Integrated Tool Proficiency, with a composite mean of 3.32. While remaining within competent performance band, its position at the bottom of the hierarchy reveals that using digital and assistive technologies to scaffold reading remains a secondary, selective strategy. While readers frequently use quick dictionary lookups and AI tools for conceptual summaries, lower engagement with intensive inline annotation features and text-to-speech technologies lowers the overall dimension score, suggesting that respondents rely primarily on traditional cognitive strategies before turning to full tool integration. Furthermore, this reliance underscores a potential deficit in leveraging sophisticated computational processes—such as those required to organize, transform, or visualize complex data—to enhance deeper reading comprehension. Bridging this gap requires transitioning from passive tool utilization toward intentional metacognitive scaffolding, where AI-integrated support functions specifically to assist learners in planning, monitoring, and evaluating their cognitive processes during complex reading tasks (Mokhtari et al., 2026).

Across all five dimensions, assessment yields overall composite mean of 3.38, corresponding to a verbal interpretation of Competent. This shows that the respondents possess a well-rounded, effective, and balanced digital reading skill set. Their profile is characterized by exceptionally strong digital ethics and interface management, supported by solid critical evaluation skills, while ongoing search query refinement and advanced assistive tool integration mark the specific areas where readers operate closer to their baseline capacity. Findings underscore a persistent gap between basic technical navigation and the advanced cognitive processing required for sophisticated, data-driven synthesis. This suggests that while operational fluency in digital environments is well-established, students require targeted scaffolding to bridge transition from mere information location to higher-order critical synthesis essential for scholarly knowledge construction (Khan et al., 2026).

Overall, the findings show that the respondents possess a satisfactory and well-balanced level of digital reading competence appropriate for higher education. Their strengths in ethical digital behavior, interface navigation, and critical evaluation provide a strong foundation for academic success in technology-mediated learning environments. However, the comparatively lower ratings in strategic information retrieval and AI-integrated tool proficiency indicate that universities should continue implementing instructional interventions that strengthen advanced search strategies, scholarly database utilization, AI-assisted reading, and critical engagement with emerging educational technologies. Enhancing these competencies will enable students not only to become

proficient digital readers but also to evolve into responsible, reflective, and adaptive lifelong learners capable of navigating the increasingly complex digital knowledge landscape of the twenty-first century.

The foregoing findings show that the respondents possess a satisfactory level of digital reading competence across all measured dimensions. Their strengths in digital responsibility, interface navigation, and critical media evaluation indicate that they are capable of engaging effectively and ethically with digital texts, while the comparatively lower ratings in strategic information retrieval and AI-integrated tool proficiency highlight areas that warrant further instructional support. Since effective digital reading extends beyond technical competence and requires learners to consciously regulate their cognitive processes while interacting with digital texts, it becomes equally important to examine the metacognitive strategies employed by the respondents during digital reading. Thus, the succeeding tables present the respondents' metacognitive reading strategies across the dimensions of strategic planning, self-monitoring and regulation, problem-solving strategies, strategic resource utilization, and reflective and relational processing.

Table 2

Summary Table on the Metacognitive Reading Strategies

Dimensions	Composite Mean	VI	Rank
Strategic Planning	3.41	Often	1
Self-Monitoring and Regulation	3.37	Often	3
Problem-Solving Strategies	3.39	Often	2
Strategic Resource Utilization	3.21	Often	5
Reflective and Relational Processing	3.28	Often	4
Overall Composite Mean	3.33	Often	

Legend: 3.50 – 4.00 = Always; 2.50 – 3.49 = Often; 1.50 – 2.49 = Sometimes; 1.00 – 1.49 = Never

Table 2 presents the summary of the respondents' metacognitive reading strategies across the five dimensions, namely Strategic Planning, Self-Monitoring and Regulation, Problem-Solving Strategies, Strategic Resource Utilization, and Reflective and Relational Processing. The findings revealed an overall composite mean of 3.33, verbally interpreted as Often, indicating that the respondents regularly employ metacognitive strategies while engaging in digital reading activities. Overall, the findings suggest that the respondents consciously regulate their thinking before, during, and after reading by planning their approach, monitoring comprehension, solving reading difficulties, utilizing available learning resources, and reflecting on the meaning of digital texts. This result shows that metacognitive regulation has become a routine component of the respondents' learning behavior and supports their ability to comprehend and manage digital academic materials effectively.

Among the five dimensions, Strategic Planning obtained the highest composite mean (3.41), followed closely by Problem-Solving Strategies (3.39) and Self-Monitoring and Regulation (3.37). These findings suggest that respondents place greater emphasis on preparing for reading tasks, responding to comprehension difficulties, and monitoring understanding while reading than on the use of external digital resources or reflective processing. The prominence of Strategic Planning indicates that respondents frequently establish reading goals, preview digital texts, and evaluate task demands before beginning to read. This tendency shows proactive regulation of learning and suggests that respondents recognize preparation as an essential prerequisite for successful comprehension in digital environments.

The high ranking of Problem-Solving Strategies further indicates that respondents actively respond to comprehension difficulties by modifying reading behaviors whenever understanding breaks down. Their frequent use of rereading, adjusting reading approaches, and inferring meaning from contextual clues shows strategic flexibility in addressing challenges encountered while reading digital texts. Likewise, the strong rating for Self-Monitoring and Regulation suggests that respondents consistently evaluate their understanding, identify important information, and regulate attention while reading. Collectively, these three dimensions illustrate that respondents exhibit strong metacognitive control before and during reading, allowing them to maintain comprehension despite the cognitive demands associated with technology-enhanced learning.

Strategic Planning achieved the highest composite mean of 3.41 (Often). This outcome shows that pre-reading

preparation serves as the foundational pillar of the respondents' metacognitive process. Before engaging in deep digital reading, readers consistently set clear reading goals, preview visual and structural features, and evaluate text length to allocate appropriate time. This proactive approach establishes an intentional mental framework, ensuring that screen-based reading begins with target-driven focus rather than passive scanning. Such preparation mitigates the risks of cognitive overload, allowing students to better manage the navigational complexities inherent in non-linear hypertexts (Taky-eddine et al., 2024). By systematically scanning the text and organizing their focus prior to immersion, students significantly enhance their ability to pinpoint critical information and navigate linguistic or cultural barriers (Astafeva, 2025; García et al., 2021)

Ranked 2nd, Problem-Solving Strategies (also referred to as fix-up strategies) secured a composite mean of 3.39 (Often). Positioned above the overall average, this dimension highlights a well-developed capacity for real-time comprehension repair on screen. When readers encounter cognitive barriers or unfamiliar syntax, they actively deploy localized repair mechanisms—such as sentence-level rereading, adjusting reading speed, and dynamically shifting between skimming and deep reading. This strong performance confirms that readers possess adaptive self-regulation to restore clarity whenever textual complexity disrupts understanding. These corrective behaviors illustrate a shift from passive absorption to an active inquiry-based stance, mirroring established findings that prioritize problem-solving as a primary influencer of effective digital information retrieval (Tejida et al., 2025).

At the 3rd rank, Self-Monitoring and Regulation recorded a composite mean of 3.37 (Often), closely aligning with the overall metacognitive baseline. This result underscores a steady, while-reading evaluation of attention and task alignment. Respondents continuously monitor their understanding by tracking task-relevant information for assignments, detecting novel concepts, and correcting mind-wandering. While periodic self-quizzing occurs less frequently, readers maintain effective cognitive oversight to prevent off-task drift during digital reading sessions. These findings suggest that while students are capable of employing metacognitive regulation during independent tasks, they often struggle to elaborate on the strategic relevance of their choices, reflecting a gap between simple awareness and deep-level regulation (Kielstra et al., 2022). Consequently, consistent application of problem-solving techniques remains a critical factor for struggling readers to bridge this gap and achieve higher levels of reading comprehension (Anggia et al., 2024).

Similarly, Reflective and Relational Processing ranked fourth (3.28), indicating that respondents regularly connect new information with prior knowledge and engage in reflective thinking, although these processes occur somewhat less frequently than planning and monitoring activities. Reflection generally takes place after or alongside comprehension, requiring learners to synthesize ideas, relate information to previous experiences, evaluate authors' intentions, and integrate knowledge across contexts. The slightly lower rating may therefore reflect the greater cognitive demands associated with higher-order reflection compared with more immediate regulatory strategies such as planning or rereading. Respondents still show frequent engagement in reflective processing, suggesting that they actively construct meaning rather than merely acquiring information.

Readers regularly connect digital reading to prior classroom knowledge and engage in self-questioning; however, deeper reflections regarding authorial intent and collaborative peer dialogue occur less consistently, making social and critical schema integration secondary to immediate comprehension goals. These findings mirror observations in technical and scientific disciplines where problem-solving—often categorized as the primary cognitive recourse—frequently supersedes the more effortful requirements of global and support strategies (Keller et al., 2024). Furthermore, these findings emphasize that while learners show proficiency in planning and immediate error detection, they are less inclined to initiate intensive self-regulated learning activities until the final stages of a task (Lim et al., 2023).

Conversely, Strategic Resource Utilization obtained the lowest composite mean (3.21), although it remained verbally interpreted as Often. This finding should not be interpreted as a weakness but rather as an indication that respondents rely somewhat less on external digital supports than on internal cognitive regulation. The results suggest that students tend to depend more heavily on planning, monitoring, and problem-solving processes

occurring within their own thinking than on technological tools such as digital annotations, electronic notes, or integrated learning features. Considering that many students already possess established reading habits developed through traditional learning experiences, they may naturally prioritize internally regulated strategies while using external digital resources selectively according to specific academic needs. This suggests that although students are capable of metacognitive monitoring, they may perceive complex digital documentation as an impediment to their primary comprehension flow rather than a facilitation tool (Anthonysamy et al., 2021). This tendency to eschew intensive external aids aligns with research indicating that readers often doubt the utility of digital annotation tools when confronted with significant cognitive load, occasionally opting for print-based interactions instead (Masón et al., 2023; Shin et al., 2025)

Overall, the findings indicate that the respondents often employ metacognitive reading strategies across all five dimensions. Their strong emphasis on strategic planning, problem-solving, and self-monitoring shows that they actively regulate learning before and during digital reading, while their continued use of reflective processing and strategic resource utilization indicates an awareness of the importance of deeper understanding and effective management of digital learning resources. Collectively, these findings suggest that respondents possess a well-developed foundation of metacognitive competence that supports independent learning, effective digital reading, and successful academic performance. Higher education institutions should therefore continue promoting explicit metacognitive instruction that strengthens not only students' planning and monitoring abilities but also their reflective thinking and strategic use of digital learning technologies.

Table 3

Summary Table on the Reading Engagement

Dimensions	Composite Mean	VI	Rank
Behavioral Engagement	3.29	Agree	4
Cognitive Engagement	3.35	Agree	2
Affective Engagement	3.32	Agree	3
Social Engagement	3.28	Agree	5
Performance Engagement	3.37	Agree	1
Overall Composite Mean	3.32	Agree	

Legend: 3.50 – 4.00 = Strongly Agree; 2.50 – 3.49 = Agree; 1.50 – 2.49 = Disagree; 1.00 - 1.49 = Strongly Disagree

Table 3 presents the overall summary of the respondents' reading engagement across its five dimensions: behavioral engagement, cognitive engagement, affective engagement, social engagement, and performance engagement. The findings yielded an overall composite mean of 3.32, verbally interpreted as Agree, indicating that the respondents generally show a positive level of engagement while interacting with digital reading materials. This result suggests that students are not only actively involved in digital reading activities but also exhibit the behavioral persistence, intellectual investment, emotional commitment, collaborative participation, and adaptive learning behaviors necessary for meaningful learning in technology-mediated educational environments. Collectively, the findings portray respondents as engaged digital readers who participate actively in the multiple dimensions of online academic reading.

Across the five dimensions, performance engagement had the highest weighted mean (3.37), followed by cognitive (3.35), affective (3.32), behavioral (3.29), and social engagement (3.28). The narrow range of means suggests that respondents rated the dimensions similarly, with social engagement slightly lower than the others. Although slight differences exist among the dimensions, all obtained the same verbal interpretation of Agree, and the numerical difference between the highest and lowest dimensions is only 0.09. This narrow range suggests that respondents do not exhibit strengths in only one aspect of engagement while neglecting others. Instead, they show a well-balanced pattern of engagement in which behavioral participation, higher-order thinking, positive emotions, collaborative learning, and adaptive performance function together to support meaningful digital reading experiences.

The highest-rated dimension, Performance Engagement, indicates that respondents consistently employ adaptive and self-regulated behaviors while reading digital texts. Students reported adjusting their reading strategies according to the nature of digital texts, organizing information for future application, integrating ideas

across multiple online sources, monitoring comprehension, and persisting through challenging materials. These findings suggest that respondents have progressed beyond passive participation toward strategic engagement, in which learning behaviors are intentionally selected to maximize understanding and academic performance. Rather than simply reading digital materials, respondents actively regulate how they learn from them.

This outcome shows that the respondents' overall reading engagement is primarily driven by task execution, strategy adaptation, and functional outcomes. Readers actively adjust their reading styles across different text genres, systematically organize digital information for application, and integrate multi-source content to deepen understanding. This top-tier placement indicates that when interacting with screen-based texts, respondents prioritize actionable processing and strategic self-regulation to achieve academic mastery. This emphasis on performance aligns with findings that link such goal-oriented behaviors to higher levels of cognitive engagement and improved academic outcomes (Getenet et al., 2024).

The second highest dimension, Cognitive Engagement, further shows that respondents approach digital reading as an active process of knowledge construction. They mentally summarize information, compare multiple online sources, connect new information with prior knowledge, and critically interpret ideas presented in digital texts. Such findings indicate that respondents are intellectually invested in their learning and regularly employ higher-order cognitive processes while engaging with online materials. Together with the high level of performance engagement, these results suggest that respondents possess both the strategic regulation and cognitive depth necessary for successful learning in digital environments.

Positioned above the overall baseline, this dimension reflects high mental investment, active schema activation, and deep inferential processing. Respondents routinely engage in immediate mental summarization after completing sections, cross-reference diverse web sources for verification, and search for underlying authorial intent. Their strong performance here confirms that readers approach digital reading with an analytical mindset, dedicating substantial working memory resources to construct accurate mental models of complex texts. The data further indicates that this intellectual investment is bolstered by task-adaptive navigation, which functions as a primary driver of digital proficiency by allowing users to efficiently map information architectures. Lastly, the dimension Affective Engagement recorded the lowest composite mean of 3.29, suggesting that while students are highly proficient in tactical and cognitive approaches to screen-based materials, their emotional connection to the reading process remains secondary (Abbas, 2023).

Affective Engagement, which ranked third, shows that respondents generally maintain positive emotional dispositions toward digital reading. Respondents particularly enjoyed reading when topics were personally meaningful and intellectually relevant, although they were somewhat less enthusiastic about every assigned online reading activity. These findings indicate that students' emotional engagement is influenced more by the perceived value and relevance of learning materials than by the mere existence of reading assignments. Such a pattern reflects a mature academic orientation in which students appreciate digital reading because of its contribution to learning rather than because it is inherently entertaining. This finding highlights a positive emotional and attitudinal connection to digital reading activities. Readers experience a strong sense of pride upon completing difficult online assignments and exhibit discovery-driven excitement when encountering high-value digital resources. While general enjoyment of screen-based reading is slightly tempered by digital fatigue, their overall emotional profile remains favorable and supportive of academic goals. This equilibrium between task-oriented focus and affective satisfaction suggests that, while cognitive endurance may fluctuate, the integration of positive emotional feedback remains a critical component in sustaining motivation during extended periods of online research (Teng et al., 2024).

Although behavioral engagement obtained slightly lower weighted means than the other dimensions, both remained within the verbal interpretation of Agree, indicating that respondents consistently show persistence and collaboration during digital reading. Behavioral engagement reflected students' willingness to devote time and effort to understanding challenging texts despite distractions, while social engagement showed respondents

strategically sought academic assistance and collaborated with peers when additional support was needed. Readers show reliable academic discipline by completing long assignments and focusing during study sessions; however, resisting the constant temptation of digital notifications and managing screen-induced distractions present ongoing operational challenges during screen reading. These challenges are compounded by the finding that reading purpose significantly moderates the relationship between digital medium use and engagement, as students often invest more time in digital navigation for exam preparation compared to recreational reading. Moreover, because many students prioritize the functional utility of digital devices for information retrieval over aesthetic experience, behavioral engagement may be further hampered when the interface design fails to facilitate efficient navigation (Froud et al., 2024; Vuorinen et al., 2024)

Lowest-rated dimension is Social Engagement, with a composite mean of 3.28 (Agree). Positioned at the bottom of engagement hierarchy, this reveals that collaborative and interactive reading practices are utilized more selectively. While respondents actively seek help during comprehension breakdowns and participate in structured group activities, informal peer discussions and asynchronous forum posting occur less frequently. Readers view digital reading as an individual cognitive task, turning to social interaction mainly as a targeted, problem-solving measure. This perspective contrasts with findings that emphasize the potential of social annotation platforms to transform reading into a collective, discourse-oriented endeavor (Nguyen et al., 2020).

Viewed collectively, the findings reveal that respondents' engagement is characterized by balance rather than dominance. No single dimension overwhelmingly exceeds or falls behind the others, indicating that engagement operates as a multidimensional construct in which observable behaviors, cognitive investment, emotional commitment, social interaction, and adaptive learning strategies complement one another. This balanced profile suggests that respondents' engagement is sufficiently developed across multiple domains to support effective learning in digital environments. Such consistency also strengthens the reliability of the findings, as respondents showed positive engagement regardless of the specific dimension being measured. Overall, the findings indicate that respondents exhibit a consistently positive and well-balanced level of online reading engagement across behavioral, cognitive, affective, social, and performance dimensions. More importantly, the results provide compelling support for the conceptual framework of the present study.

Table 4

Relationship of Digital Reading Competencies and Reading Engagement

(Constant: 1.111)	β	p-value	Interpretation
Interface Navigation Proficiency	0.037	0.460	Not Significant
Strategic Information Retrieval	0.155	0.006	Significant
Critical Media Evaluation	0.230	0.000	Significant
AI- Integrated Tool Proficiency	0.116	0.014	Significant
Digital Responsibility	0.198	0.000	Significant

Table 4 presents the regression analysis examining the influence of digital reading competencies on respondents' online reading engagement. The findings reveal that four of the five dimensions of digital reading competencies significantly predict students' online reading engagement. Specifically, Strategic Information Retrieval ($\beta = .155$, $p = .006$), Critical Media Evaluation ($\beta = .230$, $p < .001$), AI-Integrated Tool Proficiency ($\beta = .116$, $p = .014$), and Digital Responsibility ($\beta = .198$, $p < .001$) all exert statistically significant positive influences on online reading engagement. Conversely, Interface Navigation Proficiency ($\beta = .037$, $p = .460$) was found to have no statistically significant influence. Among all predictors, Critical Media Evaluation showed the strongest influence, followed by Digital Responsibility, Strategic Information Retrieval, and AI-Integrated Tool Proficiency. These findings indicate that higher levels of sophisticated digital reading competencies are associated with stronger online reading engagement, whereas basic navigation skills alone do not appear sufficient to enhance students' engagement with digital academic texts.

The finding that Interface Navigation Proficiency did not significantly influence online reading engagement is particularly noteworthy. Although respondents previously showed competence in navigating hyperlinks, browser tabs, headings, and digital interfaces, these foundational operational skills did not significantly predict how

actively students engaged with digital reading tasks. This suggests that interface navigation has become a basic functional competency among contemporary college students. Since most respondents have already acquired these routine digital skills through years of exposure to technology, variation in navigation proficiency is no longer sufficient to explain differences in reading engagement. In other words, students may know how to locate and access digital texts efficiently, but this technical ability alone does not necessarily motivate them to think deeply, persist, collaborate, or regulate their learning while reading online.

Among all predictors, Critical Media Evaluation emerged as the strongest determinant of online reading engagement ($\beta = .230$). This finding indicates that students who critically examine the credibility, accuracy, authorship, purpose, and reliability of digital information are more likely to become actively engaged during online reading. Critical evaluation requires learners to question evidence, compare multiple perspectives, identify bias, and make informed judgments regarding the quality of information. Such higher-order thinking naturally encourages deeper cognitive investment, sustained attention, and meaningful interaction with digital texts. Rather than accepting information at face value, critically engaged readers actively construct knowledge through continuous evaluation and reflection. This finding is consistent with Hu et al (2023) model of digital reading, which emphasizes that online reading extends beyond locating information to include evaluating source credibility, synthesizing evidence, and making informed decisions across multiple digital texts. Similarly, Martzoukou et al (2020) identified critical evaluation of online information as one of the defining competencies required for successful participation in modern digital learning environments. These perspectives support the present findings by suggesting that students' ability to critically evaluate digital information strengthens intellectual engagement because learners become active participants in knowledge construction rather than passive consumers of information.

The significant influence of Digital Responsibility ($\beta = .198$) further shows that ethical and responsible technology use contributes meaningfully to online reading engagement. Students who show responsible digital behaviors—such as respecting intellectual property, verifying information before sharing it, and practicing ethical online conduct—are more likely to engage thoughtfully with academic reading materials. Responsible digital citizenship encourages learners to approach online information carefully, critically, and ethically, thereby promoting sustained academic engagement rather than superficial browsing. This finding suggests that digital responsibility functions not merely as an ethical expectation but also as a learning competency that supports meaningful participation in digital academic environments.

Likewise, Strategic Information Retrieval significantly predicted online reading engagement ($\beta = .155$). Students who can effectively identify relevant sources, refine search strategies, and retrieve appropriate information are better positioned to engage meaningfully with digital learning tasks. Efficient information retrieval reduces unnecessary cognitive effort associated with searching for materials, allowing learners to devote greater attention to comprehension, analysis, and knowledge integration. Consequently, students who possess stronger retrieval skills are more likely to remain cognitively engaged because they can quickly locate information that directly supports their learning objectives.

The significant influence of AI-Integrated Tool Proficiency ($\beta = .116$) likewise reflects the growing importance of emerging technologies in supporting academic engagement. Students who effectively utilize AI-supported tools, digital assistants, annotation features, and comprehension aids appear more capable of sustaining productive engagement while reading online. Rather than replacing learning, these technologies provide scaffolding that assists students in clarifying unfamiliar concepts, organizing information, and regulating comprehension. The findings therefore suggest that appropriate integration of AI technologies enhances students' engagement by supporting rather than substituting their cognitive efforts.

Collectively, the findings show that higher-order digital competencies, rather than basic operational skills, drive meaningful online reading engagement. While navigation skills enable students to access digital information, competencies involving information retrieval, critical evaluation, responsible digital behavior, and intelligent use

of AI technologies determine how effectively learners interact with that information. This distinction reflects an important progression in digital literacy, where engagement increasingly depends upon cognitive sophistication rather than technological familiarity. Recent empirical studies reinforce these findings. Foster (2020) showed that students who effectively evaluate online information and synthesize evidence from multiple digital sources exhibit deeper cognitive engagement and stronger comprehension outcomes. Similarly, Castillo-Martínez et al. (2021), reported that higher-order competencies such as critical evaluation, responsible digital participation, and purposeful information use are more strongly associated with successful digital learning than basic technological operations. Their findings mirror the present results by showing that advanced digital competencies—not routine navigation skills—serve as the principal drivers of meaningful engagement in technology-rich educational environments.

Overall, the regression analysis shows that online reading engagement is primarily influenced by higher-order digital reading competencies rather than basic operational skills. The findings suggest that while interface navigation enables students to access digital learning environments, meaningful engagement develops when learners critically evaluate information, retrieve relevant resources strategically, utilize AI technologies appropriately, and show responsible digital behavior. These results provide strong empirical support for the conceptual framework of the present study, confirming that advanced digital reading competencies significantly contribute to students' engagement with online academic texts. From an educational perspective, the findings underscore the importance of designing instructional interventions that move beyond teaching students how to use digital technologies toward developing their capacity to think critically, act responsibly, and engage strategically with digital information.

Table 5

Proposed Instructional Enhancement Program to Strengthen Students' Digital Reading Competencies, Metacognitive Strategies and Engagement

Key Result Area	Objectives	Strategies	Persons Involved	Expected Outcomes
Digital Reading Competencies: AI-Integrated Tool Proficiency	Develop students' ability to use text-to-speech or "Read Aloud" features when these help them understand digital texts.	Demonstrate the feature in a digital reading platform. Have students listen to a challenging passage while following the text, then identify unfamiliar ideas and explain the passage in their own words.	Students, instructors, librarians	90% of the Students can use the feature and explain when it supports their comprehension.
Metacognitive Reading Strategies: Strategic Resource Utilization	Encourage students to discuss readings with classmates and consider interpretations different from their own.	Use paired reading discussions in which students share their interpretation of a passage, listen to a classmate's interpretation, and check both against the text.	Students, instructors	90% of the Students can identify differences in interpretation and use textual evidence to clarify their understanding.
Reading Engagement: Social Engagement	Increase students' participation in discussions about online academic readings.	Schedule brief small-group discussions of assigned digital readings. Ask each student to contribute a question, a key point, or a passage for discussion.	Students, instructors, group facilitators	90% of the students contribute to text-based discussions and refer to the reading when explaining their ideas.

Table 5 presents the proposed Instructional Enhancement Program was developed based on the significant findings of the study on digital reading competencies, metacognitive reading strategies, and online reading engagement among college students. The program is designed to address the specific areas identified as needing improvement while reinforcing the variables that significantly predict students' engagement in digital reading. Rather than serving as a remedial intervention, the program functions as a comprehensive instructional framework that equips students with the knowledge, skills, and strategies necessary to become competent, independent, and engaged digital readers in contemporary learning environments. The proposed action plan addresses three areas of digital reading. For AI-integrated tool proficiency, instructors and librarians will demonstrate text-to-speech or "Read Aloud" features and guide students in using them with challenging passages. Students will then explain the passage in their own words to assess whether the tool supported their understanding. For strategic resource

utilization, instructors will organize paired discussions in which students compare their interpretations of a reading and return to the text to examine differences. For social engagement, small-group discussions of online academic readings will give each student an opportunity to share a question, key point, or passage. Together, these activities aim to help students use reading tools purposefully, consider other interpretations, and participate in discussions grounded in the text.

4. Conclusions and recommendations

The respondents showed a competent level of digital reading competencies across all dimensions, indicating that they possess the fundamental knowledge and skills needed to navigate and comprehend digital texts. Among the dimensions, digital responsibility emerged as the strongest competency, while AI-integrated tool proficiency received the lowest rating. The respondents often employed metacognitive reading strategies when engaging with digital texts, indicating that they consciously regulate their reading processes to support comprehension. Strategic planning was the most frequently practiced strategy, whereas strategic resource utilization received the lowest assessment. The respondents generally agreed that they were engaged in online reading activities, demonstrating satisfactory levels of behavioral, cognitive, affective, social, and performance engagement. Performance engagement ranked highest, indicating students' willingness to apply learning from digital texts, whereas social engagement ranked lowest. Both digital reading competencies and metacognitive reading strategies significantly influenced students' online reading engagement. Among the predictors, critical media evaluation, digital responsibility, strategic information retrieval, AI-integrated tool proficiency, reflective and relational processing, strategic resource utilization, strategic planning, and self-monitoring and regulation significantly contributed to students' engagement, whereas interface navigation proficiency and problem-solving strategies did not. These findings indicate that students are more likely to engage in online reading when they possess strong digital competencies and effectively regulate their own learning through metacognitive strategies. An instructional enhancement program focusing on AI-assisted reading, critical evaluation of digital information, strategic resource utilization, reflective reading, and collaborative learning is proposed based on the results of the study.

The school administration may strengthen institutional support for digital literacy by providing adequate digital learning resources, AI-assisted educational technologies, reliable internet connectivity, and faculty development programs that enhance the integration of digital reading competencies and metacognitive reading strategies into instruction. Teachers may incorporate learner-centered instructional strategies that explicitly develop students' digital reading competencies, particularly in AI-integrated tool proficiency, strategic information retrieval, critical media evaluation, and digital responsibility. Students are encouraged to become more active and self-regulated digital readers by maximizing available digital learning resources, utilizing AI-assisted tools responsibly and ethically, practicing metacognitive reading strategies, and participating actively in collaborative online reading activities to enhance their engagement and academic performance. The proposed instructional enhancement program may be implemented by university to strengthen students' digital reading competencies, metacognitive strategies and engagement. Future researchers may replicate or extend this study by involving participants from different higher education institutions or academic disciplines, incorporating additional variables related to digital learning and reading engagement, or employing mixed-methods and longitudinal research designs to further validate and expand the findings of the present study.

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