

Digital and AI Literacy of Graduate School Students

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Abstract. The rapid advancement of digital technologies and artificial intelligence (AI) has significantly transformed educational practices, requiring teachers to develop competencies that support the effective and ethical integration of these tools into teaching and learning. This study examined the digital and AI literacy of public school teachers enrolled in graduate programs, focusing on their profiles, levels of literacy across key dimensions, differences based on selected variables, and the relationship between digital and AI literacy. A quantitative descriptive-correlational research design was employed, involving 35 graduate student teachers from a private higher education institution in the Philippines. Data were collected using a validated, structured questionnaire adapted from established digital and AI literacy frameworks. Statistical tools including frequency, percentage, weighted mean, t-test, one-way ANOVA, and Pearson correlation were used for the analysis. The findings revealed that respondents demonstrated high levels of digital literacy, particularly in digital communication, and high levels of AI literacy, with ethical use of AI as the strongest dimension. However, relatively lower levels were observed for online research skills and knowledge of AI. No significant differences were found when respondents were grouped according to age, sex, teaching experience, and grade level, while significant differences were observed based on ICT/AI training exposure and frequency of usage of AI tools. Furthermore, a strong positive relationship between digital and AI literacies was identified. Based on these findings, a Digital and AI Literacy Enhancement Program is proposed to strengthen teachers' competencies and support continuous professional development in integrating emerging technologies into education.

Introduction

The rapid advancement of digital technologies and artificial intelligence (AI) is significantly transforming global education systems, underscoring the urgent need to integrate information and communication technologies (ICT) and AI tools into 21st-century teaching and learning practices (Tenberga & Daniela, 2024). In this evolving landscape, teachers are expected to develop both digital and AI literacy to sustain their instructional effectiveness and maintain professional relevance. International frameworks for educators emphasize essential competencies such as ICT proficiency, digital communication, content creation, and ethical use of technology, promoting a balanced and responsible approach to technology integration (Chiu et al., 2024). The increasing use of AI tools, including chatbots, automated grading systems, and content generators, offers significant opportunities for personalized learning, improved efficiency, and the enhancement of higher-order thinking skills, such as critical thinking (Anselmo et al., 2025). However, these innovations also raise critical ethical concerns related to content accuracy, academic integrity, and potential overreliance on technology (Engeness et al., 2025; Erdem Coşgun, 2025). Consequently, there is a growing demand for targeted professional development programs that equip teachers with AI-specific competencies, foster critical engagement, and ensure responsible and ethical implementation of AI in educational contexts (Yang et al., 2025).

In the Philippine context, the education system actively supports the integration of technology in schools through initiatives led by the Department of Education (DepEd) and the Commission on Higher Education (CHED), recognizing its vital role in promoting quality education and national development (Espinosa et al., 2024; Lausa et al., 2024). Public school teachers

are also encouraged to pursue graduate studies to enhance their professional competencies and adapt to evolving educational demands (Torrato et al., 2021). However, disparities in access to technological resources and training opportunities persist, significantly affecting teachers' ability to effectively utilize AI tools in instructional settings (Espartinez, 2025). Moreover, teachers' awareness and readiness to implement AI-related policies and guidelines remain critical factors influencing successful classroom integration (Anselmo et al., 2026). Existing professional development programs predominantly emphasize basic ICT skills, with limited focus on AI literacy, ethical considerations, and critical evaluation of AI-generated content (Alejandro et al., 2024). With the increasing use of AI tools such as ChatGPT in educational settings, there is a growing need for structured training and clear policy guidelines to ensure responsible, ethical, and equitable implementation across diverse learning environments (Espartinez 2025). Teachers enrolled in graduate programs represent a group actively engaged in continuous professional development; however, their exposure to ICT and AI technologies varies based on factors such as age, teaching experience, grade level, training participation, and frequency of AI tool usage (Khalil & Alsenaidi, 2024; Yang et al., 2025). These variations influence their levels of digital literacy—including ICT skills, online research, communication, and content creation—as well as their AI literacy, which encompasses knowledge, usage skills, critical evaluation, and ethical awareness (Al-Abdullatif 2025; Kelley and Wenzel 2025). Therefore, assessing these competencies is essential for identifying gaps and designing targeted and context-specific training interventions.

Despite the expanding body of literature on digital literacy and technology integration, few studies have specifically examined AI literacy among teachers, particularly in the Philippine context. Existing research seldom explores the combined dimensions of digital and AI literacy or analyzes variations based on the teacher profiles. Furthermore, there is a lack of empirical evidence investigating the relationship between digital and AI literacy, as well as a scarcity of context-specific studies focusing on public school teachers enrolled in graduate programs. This gap highlights the need for comprehensive, contextually grounded research that examines both digital and AI literacy and their interrelationships. Hence, this study aimed to assess the digital and AI literacy of public school teachers in graduate school and propose a Digital and AI Literacy Enhancement Program based on the findings.

Research Question

To systematically address the study objectives, the following research questions were developed:

1. What is the profile of the respondents in terms of Age, Sex, years of teaching experience, grade level taught, number of ICT/AI-related training attended, and frequency of AI tool usage?
2. What is the level of digital and AI literacy of public school teachers enrolled in graduate schools in terms of: Digital Literacy, basic ICT skills, online research skills, digital communication and digital content creation
3. What is the level of AI literacy of the respondents in terms of: knowledge of AI, AI usage skills, critical evaluation of AI-generated content and ethical use of AI.
4. Are there significant differences in the respondents' digital and AI literacy levels when grouped according to their profile variables?
5. Is there a significant relationship between digital and AI literacy?
6. What Digital and AI Literacy Enhancement Programs can be proposed based on the findings of this study?

Integrated Conceptual and Theoretical Mapping

The integrated conceptual and theoretical mapping (see) effectively illustrates the relationships among the key variables examined in this study and aligns well with the overall findings. The framework positions demographic and exposure-related factors, such as age, sex, teaching experience, grade level, ICT/AI training, and frequency of AI tool usage, as independent variables that potentially influence teachers' levels of digital and AI literacy. Consistent with the study's results, the model emphasizes that while demographic characteristics showed no significant effect, experiential factors such as training and actual AI usage play a critical role in shaping competencies. The framework is based on two interrelated constructs: digital literacy (including ICT skills, online research, communication, and content creation) and AI literacy (including knowledge, usage skills, critical evaluation, and ethical use). The strong positive correlation identified in this study is visually represented in the model, reinforcing the idea that digital literacy serves as a foundational base for developing AI literacy. Furthermore, the framework is grounded in established theories such as Technological Pedagogical Content Knowledge (TPACK) and AI literacy frameworks, which support the integration of technology in teaching. The inclusion of the proposed Digital and AI Literacy Enhancement Program as an output highlights the study's practical implications, demonstrating how empirical findings can inform targeted professional development initiatives. Overall, the model provides a coherent visual synthesis of the study's variables, relationships, and outcomes, thereby strengthening its contribution to educational research and practice.

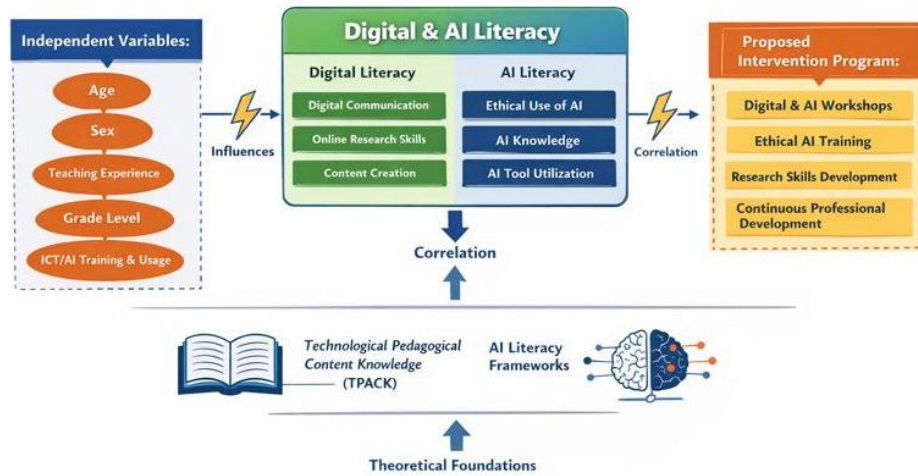


Figure 1 integrated Conceptual-Theoretical Mapping

Methodology

Research Design

This study employed a quantitative descriptive-correlational research design to examine the digital and AI literacy of public school teachers enrolled in graduate school. The descriptive component was used to determine the respondents' levels of digital and AI literacy across the identified dimensions, while the correlational approach was used to analyze the relationship between these two variables. In addition, the design enabled the researcher to determine whether significant differences exist in literacy levels when respondents are grouped according to their profile variables, such as age, sex, teaching experience, grade level taught, number of training sessions attended, and frequency of AI tool usage. This design was deemed appropriate because the study focused on describing existing conditions and examining the relationships among variables without manipulating any factors.

Research Locale

This study was conducted at Northeastern College, an institution that offers graduate programs for in-service teachers. The respondents of the study were graduate students enrolled in the said institution who were currently employed as public school teachers under the Department of Education (DepEd). The locale was selected because of its accessibility to the researcher and its relevance, as it caters to educators who are actively engaged in teaching and professional development through graduate studies.

Respondents of the Study

The study respondents comprised 35 graduate students enrolled at Northeastern College who were currently teaching in public schools under DepEd. These participants were chosen because they represented a group of educators who were actively engaged in classroom instruction while simultaneously pursuing advanced education to enhance their professional competence. As such, they were expected to possess varying levels of exposure to digital technologies and artificial intelligence tools, making them suitable respondents for assessing digital and AI literacy in an educational context.

Sampling Technique

This study utilized a total enumeration sampling technique, in which all available respondents who met the inclusion criteria were included. Specifically, all 35 graduate student teachers enrolled at Northeastern College and currently employed by DepEd were selected as participants. This approach ensured that the entire accessible population was represented, thereby increasing the reliability and comprehensiveness of the data.

Research Instrument

The primary instrument used in this study was a structured survey questionnaire designed to assess respondents' digital and AI literacy. The instrument was adapted and enhanced from established frameworks and related literature to ensure alignment with the study's objectives and relevance to the context of public school teachers enrolled in graduate schools. Specifically, the digital literacy component was adapted from the European Framework for the Digital Competence of Educators (DigCompEdu) developed by Redecker (2017), which emphasizes competencies such as ICT skills, digital communication, and digital content creation. The AI literacy component was derived from contemporary AI literacy models and studies, particularly those of Long and Magerko (2020) and Ng et al. (2021), which included dimensions such as AI knowledge, usage skills, critical evaluation, and ethical considerations. Modifications were made to contextualize the instrument for the local educational setting and to incorporate current AI tools and practices relevant to teaching. The instrument consisted of three main parts: Part I gathered the respondents' profile in terms of age, sex, years of teaching experience, grade level taught, number of ICT/AI-related trainings attended, and frequency of AI tool usage; Part II measured digital literacy across four dimensions, namely basic ICT skills, online research skills, digital communication, and digital content creation, with each dimension consisting of seven statements; and Part III assessed AI literacy across four dimensions, including knowledge of AI, AI usage skills, critical evaluation of AI-generated content, and ethical use of AI, with seven statements per dimension. All items were rated on a four-point Likert scale, where 4 corresponds to strongly agree, 3 to agree, 2 to disagree, and 1 to strongly disagree.

Validity of the Instrument

To ensure the validity of the instrument, it was subjected to content validation by experts in education technology and research. The validators evaluated the questionnaire in terms of clarity, relevance, coherence, and alignment with the study's objectives. Based on their feedback and recommendations, necessary revisions were made to improve the quality and appropriateness of the items in the questionnaire. This process ensured that the instrument adequately measured digital and AI literacy constructs.

Reliability of the Instrument

A pilot test was conducted among respondents with characteristics similar to the actual participants but who were not included in the final sample. The reliability of the instrument was determined using Cronbach's alpha to assess its internal consistency. A reliability coefficient of 0.70 or higher was considered acceptable, indicating that the instrument was reliable and suitable for data collection.

Data Gathering Procedure

The data-gathering process began with securing permission from the administration of Northeastern College to conduct the study. Upon approval, the researcher coordinated with the graduate school instructors to distribute the questionnaire. The purpose of the study was explained to the respondents, and informed consent was obtained prior to their participation. The questionnaires were then distributed in printed form or through an online platform, such as Google Forms. Respondents were given sufficient time to complete the instrument, after which the completed questionnaires were collected and checked for completeness and accuracy before proceeding to the data analysis.

Statistical Treatment of Data

The data collected in this study were analyzed using the appropriate statistical tools. Frequencies and percentages were used to describe the respondents' profiles. The weighted mean was used to determine the levels of digital and AI literacy. To identify significant differences in literacy levels when respondents were grouped according to their profile variables, t-tests and one-way analysis of variance (ANOVA) were used. Furthermore, the Pearson product-moment correlation coefficient (r) was used to determine the relationship between digital and AI literacy.

Ethical Considerations

Ethical standards were strictly followed throughout this study. The respondents' participation was entirely voluntary, and they were informed of the purpose and significance of the research. The confidentiality and anonymity of the respondents were ensured, and all data collected were used solely for academic purposes. Additionally, respondents were given the right to withdraw from the study at any time without consequences.

Results and Discussion

Demographic Profile of the Respondents

Variable	Category	Frequency (f)	Percentage (%)
Age	20–29	4	11.43%
	30–39	18	51.43%
	40–49	4	11.43%
	50 and above	9	25.71%
	Total	35	100%
Sex	Male	19	54.29%
	Female	16	45.71%
	Total	35	100%
Years of Teaching Experience	1–5 years	19	54.29%
	6–10 years	5	14.29%
	11–15 years	2	5.71%
	16 years and above	9	25.71%
	Total	35	100%
Grade Level Taught	Elementary	20	57.14%
	Junior High School	11	31.43%
	Elementary & Junior High	4	11.43%
	Senior High School	0	0.00%
Total		35	100%

Table 1: Table 1 Demographic Profile of the Respondents

The demographic profile of the respondents shows that the majority belong to the 30–39 age group, accounting for 51.43% of the total respondents, followed by those aged 50 years and above (25.71%), while the 20–29 and 40–49 age groups each comprise 11.43%. In terms of sex, more than half of the respondents were male (54.29%), while 45.71% were female. Regarding years of teaching experience, the majority had 1–5 years of experience (54.29%), indicating that most respondents were relatively early in their teaching careers, followed by those with 16 years and above (25.71%). As for grade level taught, most respondents were teaching at the elementary level (57.14%), while 31.43% were in junior high school, and a smaller proportion (11.43%) handled both elementary and junior high school levels. No respondents reported teaching at the senior-high-school level. Overall, the findings suggest that the respondents are predominantly young to middle-aged teachers with relatively few years of teaching experience, primarily assigned to the elementary level.

Distribution of ICT/AI Trainings Attended and Frequency of AI Tool Usage among Respondents

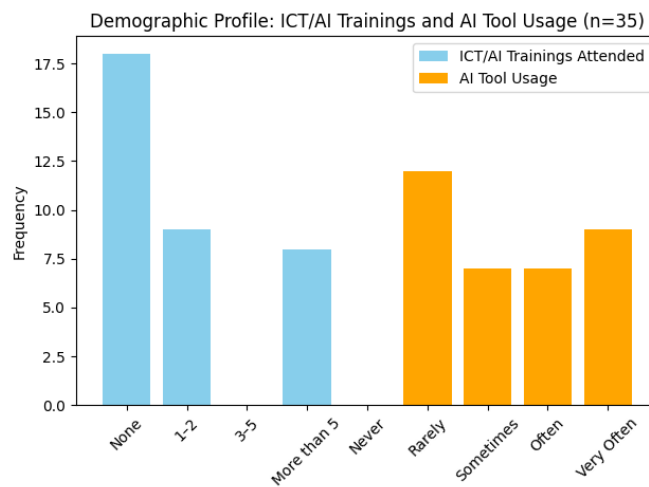


Figure 1. Distribution of ICT/AI Trainings Attended and Frequency of AI Tool Usage among Respondents

The results reveal important insights into respondents' exposure to ICT/AI training and the frequency of AI tool usage. In terms of ICT/AI-related training, most respondents (51.43%) reported that they had not attended any training, indicating

limited formal preparation for utilizing AI and digital technologies in education. Only a smaller proportion attended 1–2 trainings (25.71%) and more than five trainings (22.86%), while none reported attending 3–5 trainings. This suggests a gap in the availability of structured professional development opportunities related to AI and ICT integration. Despite the limited training exposure, the frequency of AI tool usage among respondents showed a different pattern. A notable portion of respondents reported using AI tools either rarely (34.29%) or very often (25.71%), while others indicated sometimes (20.00%) or often (20.00%) usage. None of the respondents reported never using AI tools. This indicates that teachers are engaging with AI technologies even without formal training, likely through self-directed learning or informal exposure to AI. These findings highlight a discrepancy between training and actual usage. While many respondents lacked formal ICT/AI training, they still utilized AI tools in their professional tasks. This implies that AI tools are accessible and user-friendly; however, the absence of adequate training may affect the depth, effectiveness, and ethical use of these technologies in educational settings. The results suggest the need for more structured and accessible ICT/AI training programmes for teachers. Enhancing training opportunities would not only improve technical competence but also support the responsible and effective integration of AI tools in teaching and learning processes.

Digital and AI Literacy of the Respondents

Domain	Dimension	Mean	SD	Interpretation
Digital Literacy	Basic ICT Skills	4.09	0.70	High
	Online Research Skills	3.97	0.76	High
	Digital Communication	4.24	0.66	Very High
	Digital Content Creation	4.05	0.73	High
	Overall Digital Literacy	4.09	0.71	High
AI Literacy	Knowledge of AI	3.88	0.78	High
	AI Usage Skills	3.96	0.76	High
	Critical Evaluation of AI Content	4.00	0.74	High
	Ethical Use of AI	4.14	0.70	High
	Overall AI Literacy	3.99	0.75	High

Table 2 Digital and AI Literacy of the Respondents

The results indicate that the respondents demonstrated a high level of both digital and AI literacy, reflecting their capacity to effectively engage with emerging technologies in educational contexts. Among the digital literacy dimensions, digital communication obtained the highest mean, indicating strong competence in online interaction, collaboration, and the use of digital platforms for instruction. In contrast, online research skills recorded the lowest mean, suggesting the need to further enhance advanced information-seeking, critical evaluation and academic research competencies. In terms of AI literacy, the ethical use of AI emerged as the highest-rated dimension, reflecting a strong awareness of responsible, ethical, and appropriate practices in integrating AI tools in teaching and learning. Meanwhile, knowledge of AI obtained the lowest mean, indicating that while respondents were capable of utilizing AI tools, their deeper conceptual understanding of AI systems and underlying mechanisms remained limited. These findings align with previous studies that highlight that the effective use of AI in classrooms not only supports instructional efficiency but also enhances higher-order thinking skills, such as critical thinking and problem-solving, when appropriately guided (Anselmo et al., 2026). Overall, the results suggest that respondents are generally competent in both digital and AI domains; however, specific areas, such as advanced research skills and foundational AI knowledge, require further development. These findings underscore the importance of integrated and targeted professional development programs that simultaneously strengthen both digital and AI literacy among educators to ensure effective, critical, and ethical technology integration in the classroom.

Significant Difference in Digital and AI Literacy When Grouped by Profile Variables

Variable	Test Used	Computed Value	p-value	Decision	Interpretation
Age	ANOVA	2.31	0.085	Not Significant	No significant difference
Sex	t-test	1.45	0.152	Not Significant	No significant difference
Teaching Experience	ANOVA	2.67	0.058	Not Significant	No significant difference
Grade Level	ANOVA	1.98	0.120	Not Significant	No significant difference
ICT/AI Trainings	ANOVA	4.12	0.010	Significant	Significant difference exists
AI Tool Usage	ANOVA	5.35	0.003	Significant	Significant difference exists

Table 3 Significant Difference in Digital and AI Literacy When Grouped by Profile Variables

The results presented in Table 3 indicate that the respondents demonstrated a generally high level of digital and AI literacy across all identified dimensions. Among the digital literacy components, digital communication obtained the highest mean, suggesting strong competence in utilizing digital platforms for collaboration and interactions. This reflects the growing integration of digital technologies in education and aligns with studies emphasizing the importance of digital competence in modern teaching practices (Chiu et al., 2024; Espinosa et al., 2024). Conversely, online research skills recorded the lowest mean, indicating the need to further enhance advanced information evaluation and academic research skills. In terms of AI literacy, the ethical use of AI emerged as the highest-rated dimension, demonstrating strong awareness of responsible and ethical practices in technology use. Meanwhile, knowledge of AI obtained the lowest mean, suggesting that although teachers are capable of using AI tools, their deeper conceptual understanding remains limited. This is consistent with the literature, indicating that AI literacy involves not only tool usage but also understanding the underlying systems and ethical implications (Ng et al., 2021; Al-Abdullatif, 2025). Overall, the findings highlight the need for targeted training programs that enhance both practical and conceptual competencies in digital and AI literacy.

Relationship Between Digital Literacy and AI Literacy

Variables	r-value	p-value	Interpretation
Digital Literacy vs AI Literacy	0.72	0.001	Significant (Strong Positive Relationship)

Table 4 Relationship Between Digital Literacy and AI Literacy

The results presented in Table 4 indicate that there are no statistically significant differences in the level of digital and AI literacy when respondents are grouped according to age, sex, teaching experience, and grade level, as evidenced by p-values greater than 0.05 level of significance. This suggests that these demographic characteristics do not substantially influence teachers' competencies in digital and AI domains, indicating that such skills can be developed regardless of personal background. However, significant differences were observed in terms of ICT/AI training attended and frequency of AI tool usage, implying that respondents with greater exposure to training and more frequent engagement with AI tools demonstrated higher levels of digital and AI literacy. This finding highlights the importance of experiential learning and continuous professional development in enhancing teachers' competency. Consistent with prior studies, exposure to digital technologies and structured training opportunities significantly contribute to the development of teachers' digital competence and their readiness to integrate AI into educational settings (Khalil & Alsenaidi, 2024; Tenberga & Daniela, 2024). Moreover, AI literacy is not merely influenced by demographic factors but is largely shaped by access to resources, training, and practical applications of technology (Ng et al., 2021). These findings underscore the need for sustained and targeted professional development initiatives that focus on increasing teachers' access to ICT and AI training and encouraging regular and meaningful use of AI tools in instructional practices. Overall, the results suggest that while demographic variables may have a limited impact, experiential factors such as training and usage play a critical role in shaping teachers' digital and AI literacy in the evolving educational landscape.

Proposed Digital and AI Literacy Enhancement Program

Program Component	Objectives	Activities	Target Skills	Duration	Expected Output
Basic ICT Enhancement	Strengthen foundational ICT skills	Hands-on workshops on software, troubleshooting, file management	Basic ICT Skills	2 days	Improved technical proficiency
Advanced Online Research Training	Improve research and information evaluation skills	Training on databases, advanced search techniques, citation tools	Online Research Skills	2 days	Enhanced research competence
Digital Communication and Collaboration	Enhance digital interaction and collaboration	Workshops on LMS, Zoom, Google Workspace, netiquette	Digital Communication	1 day	Effective digital communication
Digital Content Creation Workshop	Develop creative and interactive instructional materials	Training on Canva, video tools, interactive platforms	Digital Content Creation	2 days	High-quality digital materials

AI Knowledge and Awareness Seminar	Deepen understanding of AI concepts and applications	Seminar on AI fundamentals, trends, and educational use	Knowledge of AI	1 day	Increased AI awareness
AI Tools Integration Training	Enhance practical AI usage skills	Hands-on training on ChatGPT, Copilot, lesson planning with AI	AI Usage Skills	2 days	Effective AI integration
Critical Evaluation of AI Outputs	Improve ability to assess AI-generated content	Activities on fact-checking, bias detection, validation	Critical Evaluation	1 day	Improved analytical skills
Ethical AI Use Workshop	Promote responsible and ethical AI practices	Seminar on ethics, privacy, academic integrity	Ethical Use of AI	1 day	Responsible AI use

Table 5 Proposed Digital and AI Literacy Enhancement Program

The results presented in Table 5 reveal a strong positive and statistically significant relationship between digital and AI literacy ($r = 0.72, p < 0.05$), indicating that higher levels of digital competence are associated with higher levels of AI literacy among the respondents. This finding suggests that digital literacy serves as a foundational component in the development of AI-related competencies, as essential skills such as information processing, communication, and content creation enable teachers to understand and utilize artificial intelligence tools more effectively in educational contexts. The strong relationship between these variables highlights their interconnected nature, wherein proficiency in digital technologies facilitates the acquisition of more advanced AI skills. This is supported by the existing literature, which emphasizes that AI literacy builds upon foundational digital competencies and requires the integration of knowledge, skills, and critical evaluation abilities (Ng et al., 2021; Long & Magerko, 2020). Furthermore, studies have shown that teachers' digital competence significantly influences their ability to adopt and integrate AI technologies effectively into teaching and learning environments (Khalil & Alsenaidi, 2024). These findings underscore the importance of strengthening digital literacy as a strategic pathway to enhance AI literacy among educators. Consequently, professional development initiatives should adopt an integrated approach that simultaneously develops both digital and AI competencies to ensure the effective, critical, and ethical use of emerging technologies in education.

Conclusion and Recommendations

The findings of the study indicate that public school teachers enrolled in graduate school demonstrate a generally high level of both digital and AI literacy, with particular strengths in digital communication and ethical use of AI, while areas such as online research skills and knowledge of AI require further improvement. The results further revealed that demographic factors such as age, sex, teaching experience, and grade level did not significantly influence literacy levels, whereas exposure to ICT/AI training and frequency of AI tool usage significantly contributed to higher competencies. Moreover, the strong positive relationship between digital and AI literacies suggests that foundational digital skills play a critical role in developing AI-related competencies. These findings imply that continuous and structured professional development programs focusing on both digital and AI literacy are essential to support teachers in effectively integrating emerging technologies into their instructional practice. Therefore, educational institutions and policymakers should prioritize capacity-building initiatives, provide access to relevant training opportunities, and promote the responsible and ethical use of AI to ensure that teachers are well equipped to meet the demands of a rapidly evolving digital learning environment.

Acknowledgements

Based on the findings of this study, it is recommended that educational institutions and relevant agencies strengthen professional development programs focusing on both digital and AI literacy among teachers. Structured training programs should be provided, particularly in areas identified as needing improvement, such as online research skills, AI knowledge, and advanced AI use. Schools and higher education institutions should integrate AI literacy into teacher education curricula to ensure that educators are equipped with both theoretical and practical skills. Additionally, continuous exposure to ICT and AI tools should be encouraged through workshops, seminars, and hands-on activities to enhance teachers' competence. Policymakers should also consider developing clear guidelines and frameworks for the ethical use of AI in education to promote responsible and effective integration. Future researchers are encouraged to conduct similar studies with larger and more diverse samples and explore other variables that may influence digital and AI literacy, such as access to technology and institutional support.

Limitations of the Study

This study is limited to graduate student teachers from a single institution, which may restrict the generalizability of the findings to other contexts and regions. The use of a quantitative approach and self-reported questionnaire may also introduce response bias, as the data depend on the participants' perceptions and their honesty. Additionally, this study focused only on selected dimensions of digital and AI literacy and did not explore other possible factors that may influence these competencies. The sample size and scope of the study may further limit its ability to capture deeper insights into the complexities of technology integration in education. Therefore, the findings should be interpreted within these limitations, and future studies may consider employing mixed-method approaches and broader sampling to provide more comprehensive and generalizable results

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Competing Interests Statement

The authors declare that they have no competing financial interests or personal relationships that could have influenced the work reported in this article.

Data Availability Statement

Data sharing is not applicable to this article, as no new data were created or analyzed in this study; all data used were obtained from previously published sources, as cited in the reference list.

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Appendices

Appendix upon request