

AI Use and Critical Thinking Skills of Public School Teachers in Graduate School

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artificial intelligence, AI usage, critical thinking skills, graduate student teachers, educational technology, teaching and learning, higher-order thinking skills, ai integration

Abstract. This study explored the connection between the use of artificial intelligence (AI) and the critical thinking abilities of graduate student teachers in public schools. Employing a descriptive correlational research approach, this study included 41 participants chosen through purposive sampling. Data were collected using a structured survey questionnaire that evaluated the participants' demographics, extent of AI usage, and critical thinking skills in the areas of analysis, evaluation, interpretation, inference, and reasoning. For data analysis, descriptive statistics, Pearson's r correlation, t -tests, and one-way ANOVA were used. The results indicated that teachers had a moderate level of AI usage ($M = 3.26$, $SD = 0.89$), suggesting that AI tools are occasionally employed in teaching and academic tasks but are not yet fully integrated into regular practice. Conversely, participants displayed a high level of critical thinking skills ($M = 3.49$, $SD = 0.87$), indicating a strong proficiency in advanced cognitive processes. The study also found a significant moderate positive correlation between AI usage and critical thinking skills ($r = 0.52$, $p < 0.001$), implying that greater engagement with AI tools is linked to enhanced critical thinking skills. Furthermore, no significant differences were observed when participants were categorized according to age, sex, and teaching experience. These findings suggest that while AI adoption is still evolving, it has the potential to improve cognitive skills when used responsibly. The study recommends implementing structured intervention programs focusing on AI literacy, ethical use, and enhancing critical thinking skills to ensure effective and balanced AI integration in education.

Introduction

Artificial Intelligence (AI) is making waves in education worldwide. It is bringing in advanced tools such as intelligent tutoring systems, automated grading, and generative AI, which are changing the way teaching and learning occur (Walter, 2024). This shift is a departure from traditional education, opening up opportunities for personalized learning, boosting efficiency, and making educational resources more accessible. However, it is not all smooth sailing. Educators face new challenges, especially in updating curricula and helping students become AI literate (Sağın et al., 2023). A major concern is how AI might affect higher-order cognitive skills, such as critical thinking, which is crucial for problem-solving, decision-making, and lifelong learning in the 21st century (Dumitru & Halpern, 2023). Some research suggests that AI can boost critical thinking by encouraging self-regulation and deeper engagement with AI-generated content. However, there is a warning that relying too much on AI might lead to cognitive offloading and less independent thinking (Gerlich, 2025; Yavich, 2025; Zhou et al., 2024). Therefore, the global conversation is about finding the right balance between using AI effectively and maintaining these essential skills, skills.AI's advantages, and ensuring the development of autonomous, reflective, and critical thinking skills (Jia & Tu, 2024).

In the Philippine context, the integration of artificial intelligence (AI) technologies in education is gradually expanding, particularly in teaching and academic-related activities such as research. Public school teachers, especially those pursuing graduate studies, are becoming increasingly familiar with AI tools for research, lesson planning, and academic writing (Espartinez, 2025). National agencies such as the Department of Education (DepEd) and the Commission on Higher

Education (CHED) continue to emphasize the importance of developing educators' critical thinking skills to enhance instructional effectiveness and improve student learning outcomes. However, despite these efforts, the integration of AI into teacher education remains in its early stages, characterized by a lack of comprehensive policies and structured implementation guidelines (Cacho 2024). This is further supported by studies indicating that teachers' awareness and readiness play crucial roles in the effective implementation of AI in education (Anselmo et al., 2026). The existing literature also highlights the need to better understand how Filipino teachers utilize AI and how such usage influences their cognitive skill development. While AI offers significant benefits in improving efficiency and productivity, it also raises concerns regarding ethical use, academic integrity, and potential overdependence (Alejandro et al., 2024; Ali et al., 2024). At the individual level, graduate student teachers frequently rely on AI tools for tasks such as writing, data analysis, and idea generation, which may enhance productivity but could also affect the depth of cognitive engagement, particularly in analysis, evaluation, and reasoning (Deep & Chen 2025). Moreover, demographic factors such as age, sex, teaching experience, and level of AI usage may further influence the development and application of critical thinking skills in AI-supported environments (Alejandro et al., 2024; Espartinez, 2025). Understanding these dynamics is essential for designing responsive and context-appropriate teacher development programs.

Although there is a lot of research on AI in education, most of it focuses on students. Teachers, especially graduate student teachers who use AI in their academic and professional lives, do not receive as much attention. We also do not have many in-depth studies examining how AI use affects different aspects of critical thinking, such as analysis, evaluation, interpretation, inference, and reasoning, among educators. In the Philippines, there is a lack of localized research in public schools, making it difficult to understand how local factors, such as culture and institutions, affect AI integration and cognitive skill development. In addition, we have not explored how demographic factors, such as age, sex, and teaching experience, play a role in this relationship. This gap makes it difficult to fully understand how these factors might influence the interaction between AI use and critical thinking skills. Without sufficient empirical evidence, it is challenging to create targeted, evidence-based programs to help teachers use AI effectively while boosting their critical thinking. Filling these gaps is crucial for shaping educational policies and teacher development programs that balance the use of AI with higher-order cognitive skills. This study explored the relationship between AI use and the critical thinking skills of graduate student teachers in Philippine public schools, considering key demographic factors to suggest practical, evidence-based intervention strategies.

Research Questions

1. What is the demographic profile of the respondents in terms of age, gender, years of teaching, and graduate and teaching levels?
2. To what extent does graduate-level training influence teachers' integration of AI technology into classroom instruction?
3. What is the level of AI and digital tool use among teachers enrolled in graduate-level programs?
4. Is there a significant difference in AI integration when teachers are grouped according to their graduate level (Master's and Doctoral)?
5. What challenges do teachers face when integrating AI technologies into their instructional practices?

Integrated Conceptual and Theoretical Mapping

The integrated conceptual and theoretical framework of this study elucidates the relationship between artificial intelligence (AI) utilization and the critical thinking skills of graduate student teachers, underpinned by pertinent theoretical foundations and contextual factors. AI utilization was identified as the primary independent variable, encompassing functions such as lesson planning, academic writing, content generation, problem-solving, data analysis, and ethical use. These applications demonstrate how teachers engage with AI tools in instructional and academic contexts. Conversely, critical thinking skills serve as the dependent variable and are represented by the domains of analysis, evaluation, interpretation, inference, and reasoning, which are essential competencies for effective teaching and decision-making.

The framework is anchored in theories such as Cognitive Development Theory and Technology Adoption Theory, which elucidate how individuals develop higher-order thinking skills and adopt emerging technologies in educational settings. These theories support the premise that meaningful interactions with AI tools can enhance cognitive processes when employed critically and responsibly. Furthermore, demographic variables such as age, sex, and teaching experience were incorporated as moderating factors, acknowledging that individual differences may influence the extent of AI utilization and the development of critical thinking skills.

The model further suggests that increased and responsible AI utilization can lead to enhanced critical thinking abilities, consistent with the study's finding of a significantly moderate positive relationship between the variables. This underscores the importance of ethical considerations and professional development in maximizing the benefits of AI. Overall, the

framework provides a comprehensive representation of how AI integration, supported by theoretical and contextual factors, contributes to the enhancement of higher-order cognitive skills among graduate student-teachers.

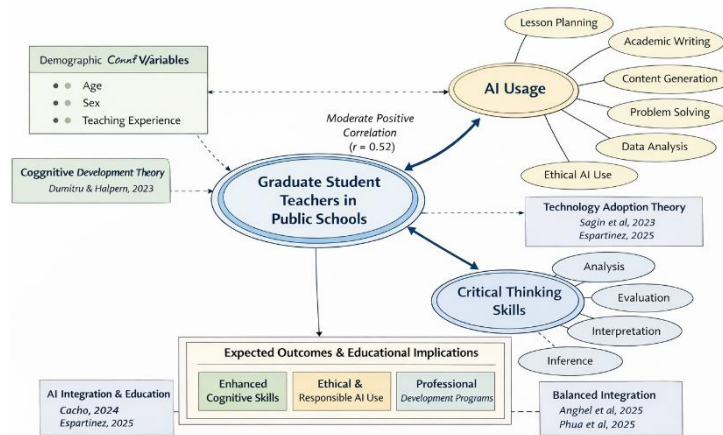


Figure 1. Integrated Conceptual and Theoretical Mapping of AI Usage and Critical Thinking Skills among Graduate Student Teachers

Methodology

Research Design

This study employed a descriptive correlational research design to examine the relationship between artificial intelligence (AI) usage and critical thinking skills among public school teachers enrolled in graduate studies. The descriptive component was used to determine the respondents' profiles and assess their levels of AI usage and critical thinking skills across the dimensions of analysis, evaluation, interpretation, inference, and reasoning. The correlational component was used to identify whether a significant relationship existed between AI usage and critical thinking skills. This design is appropriate because it allows the researcher to describe existing conditions and explore the relationships among variables without manipulating them.

Respondents of the Study

The study respondents comprised 41 graduate student teachers currently teaching in public schools under the Department of Education (DepEd). These participants were enrolled in graduate programs while actively teaching. They were selected using purposive sampling, ensuring that all respondents had relevant experience in teaching and academic work, as well as exposure to AI tools. This group was deemed appropriate for the study as it represented educators who had directly experienced the integration of AI in both professional and academic contexts.

Research Instrument

This study used a structured survey questionnaire as the primary data collection instrument. The questionnaire was divided into three parts: (1) respondents' profile, including age, sex, and years of teaching experience; (2) AI usage scale, which measured the frequency and extent of AI tool utilization; and (3) critical thinking skills scale, covering the dimensions of analysis, evaluation, interpretation, inference, and reasoning. A Likert scale was used to quantify the responses. The instrument was adapted from existing validated tools and modified to suit the study context. The questionnaire was subjected to expert validation and pilot testing to ensure reliability and clarity.

Data Gathering Procedure

Data collection began after securing permission from the relevant authorities and informing the participants about the purpose of the study. The questionnaire was distributed to the selected respondents either in print or through an online platform. Participants were given sufficient time to answer the survey, and their responses were kept confidential. The researcher ensured that all responses were collected completely and systematically organized for analysis. Ethical considerations, such as voluntary participation and informed consent, were strictly observed throughout the data-gathering process.

Statistical Treatment of Data

The collected data were analyzed using the appropriate statistical tools. Frequencies and percentages were used to describe the respondents' profiles. The mean and standard deviation were used to determine the level of AI usage and critical thinking skills. Pearson's product-moment correlation (Pearson r) was employed to test the relationship between AI usage and critical thinking skills. Additionally, t-tests and one-way ANOVAs were used to determine significant differences in critical thinking skills when respondents were grouped according to profile variables. All statistical analyses were conducted at a significance level of 0.05 for all tests.

Results and Discussion

This section presents the demographic profiles of the respondents in terms of age, sex, and years of teaching experience.

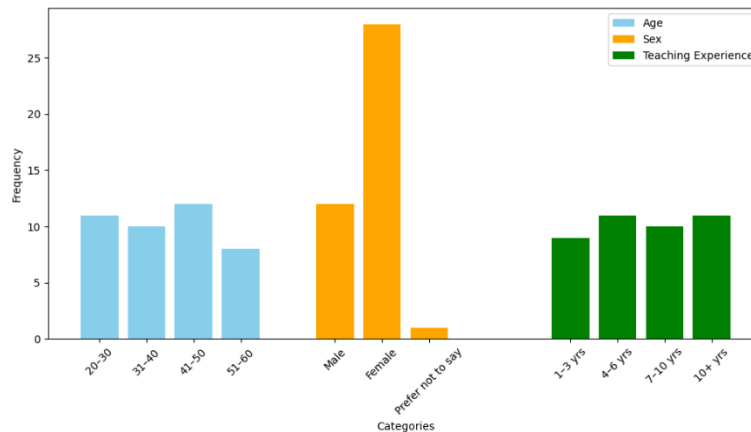


Figure 2. Profile of the Respondents

Figure 2 illustrates the demographic characteristics of the respondents, categorized by age, gender, and teaching experience. Regarding age, the largest segment of respondents was within the 41–50 years age group, constituting 29.27% of the total sample size. This was followed by the 20–30 years group (26.83%) and the 31–40 years group (24.39%), while the 51–60 years group represented the smallest percentage at 19.51%. This distribution suggests that the respondents were predominantly in their mid-career stage, with a balanced representation of younger and more experienced educators. In terms of gender, the majority of respondents were female, accounting for 68.29%, while male respondents comprised 29.27%, and a small proportion (2.44%) chose not to disclose their gender. This indicates that the teaching workforce in the sample was largely female, aligning with the common trends in the education sector. Regarding years of teaching experience, the highest proportions were observed in the 4–6 and more than 10 years categories (both at 26.83%), followed by 7–10 years (24.39%) and 1–3 years (21.95%). This reflects the diverse range of teaching experiences among the respondents, encompassing both early career and highly experienced educators. Overall, the data revealed a heterogeneous group of respondents in terms of age and teaching experience, with a predominance of female participants. This diversity provides a comprehensive perspective for examining the relationship between AI usage and critical thinking skills among public school teachers in graduate school.

This section presents the frequency of AI usage among graduate student teachers in teaching and academic tasks.

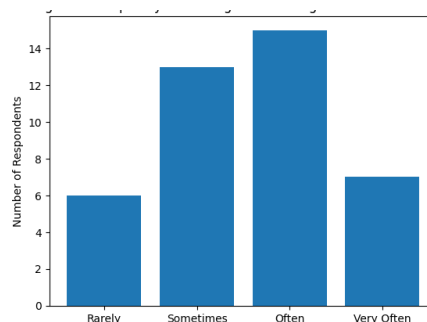


Figure 3. Frequency of AI Usage in Teaching and Academic Tasks

Figure 3 gives us a look at how often graduate student teachers are using AI in their teaching and academic tasks. AI is being used at a moderate level, with an overall mean value of 3.26 and a standard deviation of 0.89. This means that while teachers are using AI tools for lesson planning, research, content creation, and problem-solving, these tools have not yet become a regular part of their daily routine. The moderate mean suggests that teachers are becoming more comfortable with AI, but the standard deviation shows some variation in how often different teachers use it. Some use AI more frequently than others. Overall, the figure shows that AI adoption is on the rise among educators, but there is still a need for better training and support to help teachers use AI more consistently and effectively in their work.

This section presents the level of AI usage by the respondents across various instructional and academic tasks.

AI Usage Indicators	Mean	SD	Interpretation
AI tools are frequently used to assist in lesson planning and instructional preparation	3.29	0.87	Moderate
AI applications are utilized to support academic writing and research tasks	3.34	0.88	Moderate
AI tools improve efficiency in completing teaching and academic responsibilities	3.20	0.89	Moderate
AI-generated outputs are used as references in developing instructional materials	3.22	0.90	Moderate
AI tools are applied in analyzing data or information for academic purposes	3.10	0.92	Moderate
AI applications are used to generate ideas or content for academic tasks	3.29	0.91	Moderate
AI tools are relied upon when solving complex academic or teaching-related problems	3.10	0.93	Moderate
AI-generated information is critically evaluated and verified before use	3.51	0.85	High
Overall (Total)	3.26	0.89	Moderate

Table 1. Level of AI Usage of the Respondents

Table 1 illustrates the extent of AI utilization among graduate student teachers across various instructional and academic tasks, indicating moderate overall usage, with a mean score of 3.26 and a standard deviation of 0.89. The data revealed that respondents moderately employed AI tools in lesson planning (M = 3.29, SD = 0.87), academic writing and research (M = 3.34, SD = 0.88), enhancing task efficiency (M = 3.20, SD = 0.89), generating instructional content (M = 3.29, SD = 0.91), problem-solving (M = 3.10, SD = 0.93), and data analysis (M = 3.10, SD = 0.92). These findings suggest that while AI is increasingly integrated into educational practices, its use remains sporadic rather than fully embedded in routine teaching and academic work. Notably, the only indicator rated highly was the critical evaluation of AI-generated information (M = 3.51, SD = 0.85), indicating that teachers actively assess and verify AI outputs before applying them. This reflects a responsible and reflective approach to AI use, aligning with studies that emphasize the importance of critical engagement with AI tools for maintaining academic integrity and cognitive development (Walter, 2024; Ali et al., 2024). Overall, the table highlights a growing but not yet maximized adoption of AI, underscoring the need for continued professional development and structured integration strategies to enhance effective and ethical AI utilization in educational settings.

This section presents the respondents' level of critical thinking skills across the domains of analysis, evaluation, interpretation, inference, and reasoning.

Critical Thinking Domains	Mean	SD	Interpretation
Analysis	3.46	0.88	High
Evaluation	3.51	0.86	High
Interpretation	3.51	0.86	High
Inference	3.45	0.88	High
Reasoning	3.50	0.87	High
Overall Critical Thinking Skills	3.49	0.87	High

Table 2. Level of Critical Thinking Skills of the Respondents

Table 2 illustrates the critical thinking skills of graduate student teachers across the domains of analysis, evaluation, interpretation, inference, and reasoning, demonstrating an overall high level of competence, with a mean score of 3.49 and a standard deviation of 0.87. Among these domains, evaluation and interpretation achieved the highest mean scores (M = 3.51, SD = 0.86), closely followed by reasoning (M = 3.50, SD = 0.87) and analysis (M = 3.46, SD = 0.88), while inference recorded the lowest mean (M = 3.45, SD = 0.88), yet still within a high level of agreement. These results indicate that the respondents were generally proficient in examining information, making sound judgments, interpreting data, drawing logical conclusions, and applying reasoning in various academic and teaching contexts. The relatively consistent standard deviation suggests that the respondents exhibited similar levels of CT.. This is consistent with the existing literature

emphasizing that critical thinking is a key competency for educators in the 21st century and can be supported by meaningful engagement with AI tools when used appropriately (Dumitru & Halpern, 2023; Zhou et al., 2024). Overall, the findings underscore that graduate student teachers possess well-developed higher-order thinking skills, which are essential for effective decision making and responsible AI integration in education.

This section presents the results of the normality test conducted on study variables.

Variable	W-value	p-value	Interpretation
AI Usage	0.97	0.21	Normal
Critical Thinking Skills	0.96	0.18	Normal

Table 3. Test of Normality of Variables

Table 3 displays the results of the normality test conducted on the study variables, revealing that both AI usage ($W = 0.97$, $p = 0.21$) and critical thinking skills ($W = 0.96$, $p = 0.18$) exhibited a normal distribution, as evidenced by p-values exceeding the 0.05 significance threshold. This finding confirms the assumption of normality, thereby validating the application of parametric statistical tests, specifically the Pearson product-moment correlation, to explore the relationships between variables. Establishing normality is crucial for ensuring the validity and reliability of subsequent statistical analyses and interpretations (Field 2018; Ghasemi and Zahediasl 2012).

This section presents the relationship between AI usage and respondents' critical thinking skills.

Variables	r-value	p-value	Strength of Correlation	Decision
AI Usage and Critical Thinking Skills	0.52	$p < 0.001$	Moderate Positive Correlation	Significant

Table 4 Relationship Between AI Usage and Critical Thinking Skills

Table 4 presents the relationship between AI usage and respondents' critical thinking skills, revealing a moderate positive correlation with an r-value of 0.52, indicating that increased AI usage is associated with improved critical thinking skills among graduate student teachers. The p-value of less than 0.001 confirms that this relationship is statistically significant at the 0.05 level, leading to the rejection of the null hypothesis. This suggests that AI plays a meaningful role in the development of higher-order thinking skills. This finding is supported by the existing literature, which emphasizes that AI tools can enhance critical thinking by providing timely feedback, facilitating deeper engagement with learning tasks, and supporting academic processes (Slimi et al., 2025). Additionally, AI integration has been shown to promote learner motivation and autonomy, which are essential for fostering critical thinking (Anghel et al., 2025), and can serve as a cognitive support tool when used appropriately (Anselmo, 2025). However, despite these advantages, some studies caution that excessive reliance on AI may hinder the development of independent problem-solving skills if not properly managed (Phua et al., 2025). Overall, the significant moderate relationship highlights the potential of AI as a complementary tool in education that can enhance critical thinking, provided that its use is guided by ethical considerations and balanced, instructional practices.

This section presents the differences in critical thinking skills when the respondents are grouped according to their demographic profiles.

Profile Variable	Groups (n)	Test Used	F / t-value	p-value	Effect Size	Interpretation	Decision
Age	20–30 (n=11); 31–40 (n=10); 41–50 (n=12); 51–60 (n=8)	ANOVA	1.21	0.31	$\eta^2 = 0.06$	Small Effect	Not Significant
Sex	Male (n=12); Female (n=28)	t-test	0.84	0.40	$d = 0.26$	Small Effect	Not Significant
Years of Teaching Experience	1–3 yrs (n=9); 4–6 yrs (n=11); 7–10 yrs (n=10); >10 yrs (n=11)	ANOVA	1.35	0.27	$\eta^2 = 0.07$	Small Effect	Not Significant

Table5. Differences in Critical Thinking Skills with Effect Size

Table 5 delineates the variations in critical thinking skills among respondents when categorized by profile variables such as age, sex, and years of teaching experience, along with their corresponding effect sizes. The findings indicate that all computed p-values exceed the 0.05 level of significance (age: $p = 0.31$; sex: $p = 0.40$; teaching experience: $p = 0.27$),

signifying the absence of statistically significant differences in critical thinking skills across groups. Additionally, the effect sizes— $\eta^2 = 0.06$ for age, $d = 0.26$ for sex, and $\eta^2 = 0.07$ for teaching experience— were interpreted as small, suggesting that these demographic variables exert minimal practical influence on critical thinking abilities. This suggests that critical thinking skills are relatively consistent among graduate student teachers, irrespective of their demographic backgrounds. These findings support the notion that higher-order thinking skills are more likely to be shaped by learning experiences and professional engagement rather than by personal characteristics alone (Dumitru & Halpern, 2023; Perugini et al., 2025). Overall, the table underscores that critical thinking is a widely shared competency among the respondents, reinforcing its significance as a universal skill in education.

This section presents the proposed intervention program developed based on the study results.

Program Component	Objectives	Activities	Target Participants	Duration	Expected Outcome
AI Literacy Enhancement Workshop	To improve teachers' knowledge and responsible use of AI tools	Hands-on training on AI tools (ChatGPT, data analysis tools, lesson planning AI)	Graduate student teachers	2 days	Improved AI usage competence
Critical Thinking Skills Training	To strengthen higher-order thinking skills (analysis, evaluation, reasoning)	Workshops on problem-solving, case analysis, reflective thinking	Graduate student teachers	2 days	Enhanced critical thinking skills
AI-Assisted Teaching Integration	To integrate AI effectively in teaching practices	Demo teaching, lesson planning using AI, peer evaluation Seminar on plagiarism, bias detection, verification of AI outputs	Teachers in graduate school	1 week	Improved instructional practices
Ethical AI Use Seminar	To promote responsible and ethical use of AI	Pre-test and post-test, feedback surveys, performance tasks	All participants	1 day	Increased awareness of ethical AI use
Monitoring and Evaluation	To assess effectiveness of the intervention		Participants & facilitators	Continuous	Measurable improvement in AI use and critical thinking

Table 6 Proposed Intervention Program Based on the Findings of the Study

Table 6 presents the proposed intervention program developed based on the study's findings, which aims to enhance both AI usage and critical thinking skills among graduate student teachers. The program consists of several key components, including an AI Literacy Enhancement Workshop, Critical Thinking Skills Training, AI-Assisted Teaching Integration, Ethical AI Use Seminar, and Monitoring and Evaluation. Each component is designed with specific objectives, activities, target participants, duration, and expected outcomes to ensure a comprehensive and structured approach to professional development. The activities emphasize hands-on training, collaborative learning, and reflective practices, enabling teachers to effectively integrate AI into their instructional and academic tasks while maintaining strong analytical and evaluative abilities. Additionally, the inclusion of ethical considerations highlights the importance of responsible AI use, particularly in addressing issues such as bias, plagiarism, and the verification of AI-generated content. This aligns with the existing literature that underscores the need for balanced AI integration, enhancing efficiency and innovation while safeguarding critical thinking and academic integrity (Cacho, 2024; Walter, 2024). Overall, the proposed program serves as a practical and evidence-based framework for supporting teachers in becoming competent, ethical, and reflective users of AI in education.

Conclusion and Recommendations

The study concludes that graduate student teachers exhibit a moderate level of AI usage and a high level of critical thinking skills, with the results further indicating a significantly moderate positive relationship between the two variables. This suggests that the appropriate use of AI can enhance higher-order thinking skills, such as analysis, evaluation, and reasoning. Moreover, the findings show that critical thinking skills do not significantly differ across demographic variables, implying that these competencies are consistently manifested among teachers, regardless of age, sex, or teaching experience. The implications of this study highlight the need for educational institutions to strengthen AI integration through structured

training programs, policy development, and continuous professional support. Emphasis should be placed on promoting the responsible and ethical use of AI while ensuring that teachers remain actively engaged in critical and independent thinking. By fostering both AI competence and cognitive skills, educators can better adapt to evolving technological demands and enhance the overall quality of teaching and learning

Recommendations

In light of the study's findings and conclusions, it is advised that educational institutions enhance the integration of artificial intelligence (AI) in teaching and academic practices by implementing structured and continuous professional development programs. These programs should aim to improve teachers' AI literacy, promote the ethical and responsible use of AI tools, and strengthen critical thinking skills such as analysis, evaluation, and reasoning. Schools and higher education institutions should design workshops, training sessions, and hands-on activities that enable teachers to effectively incorporate AI into lesson planning, research, and instructional delivery while maintaining independent and reflective thinking. Additionally, policymakers and school administrators should develop clear guidelines and support systems to ensure balanced AI integration, prevent overreliance, and maximize its educational benefits. Future researchers are encouraged to explore additional variables and broader populations to further validate and expand the study's findings. Overall, fostering both technological competence and higher-order cognitive skills will empower teachers to become more adaptive, innovative, and effective in an evolving educational landscape.

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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

No Appendix included in this study