

Graduate-Level Training and Its Impact on Teachers' Use of AI Technologies In the Classroom

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artificial intelligence, graduate-level training, AI integration, teacher development, educational technology, classroom instruction

Abstract. Artificial intelligence (AI) is increasingly transforming modern education by enhancing teaching strategies, improving efficiency, and supporting personalized learning. As schools adopt more digital tools, teachers are expected to integrate AI technologies into their instructional practices effectively. This study examines the impact of graduate-level training on teachers' integration of artificial intelligence (AI) technologies into classroom instruction. Using a quantitative descriptive-correlational design, the research involved 30 teachers who were currently enrolled in graduate programs and actively teaching. Data were collected using a structured questionnaire that assessed respondents' demographic profiles, level of AI integration, influence of graduate training, and challenges encountered in using AI. Descriptive and inferential statistics were used to analyze the data. The findings revealed that teachers demonstrated a moderate level of AI integration and innovative teaching practice. Graduate-level training was found to have a moderate influence on the use of AI technologies, with a statistically significant moderate positive relationship identified between training and AI integration. However, no significant difference was observed when respondents were grouped according to their graduate level, suggesting that exposure to graduate education, rather than the degree attained, contributes to AI adoption. Teachers also reported moderate challenges, particularly in terms of limited training, access to AI tools, and confidence in their implementation. The study concludes that while graduate-level training supports AI integration, enhanced professional development and institutional support are necessary to maximize its effectiveness in education settings.

Introduction

Artificial Intelligence (AI) is transforming education globally by enhancing teaching and learning processes through technologies such as intelligent tutoring systems and automated grading, which support adaptive, personalized learning tailored to individual student needs (Alzakwani et al., 2025; Kazimova et al., 2025). Worldwide emphasis has been placed on integrating AI to improve instructional efficiency and student engagement, facilitating real-time feedback and differentiated instruction across educational levels (Tohănean et al., 2025; Kazimova et al., 2025). Teachers are pivotal in adopting AI tools and acting as facilitators and assessors. However, widespread faculty readiness and consistent use remain limited, underscoring the need for systematic professional development and advanced training to build technological competence (Salas-Pilco et al., 2022; Sysoyev, 2023). Such training ensures ethical and effective AI integration into pedagogical practices globally (Karan & Angadi, 2023).

In many national education systems, including the Departments of Education, there is a strong push toward digital transformation and the integration of technology in teaching to align with evolving educational demands (Pratiwi et al., 2025). Graduate-level education programs are designed to enhance teachers' pedagogical, technological, and research skills, preparing educators for such advancements (Şimşek et al., 2025). Despite these initiatives, AI integration among teachers varies considerably, influenced by factors such as access to AI tools, institutional support, and the availability of

training opportunities (Alshammari et al., 2025; Traga Philippakos & Rocconi, 2025). Formal education, particularly at the graduate level, is increasingly recognized as pivotal in fostering teachers' readiness and confidence to adopt AI technologies effectively in classrooms (Kazmaci et al., 2025).

This study specifically focuses on teachers currently enrolled in graduate programs who are actively teaching, and explores how advanced training shapes their use of AI tools. It examines prevalent AI technologies in use, identifies variations in adoption, and addresses challenges faced by teachers, providing empirical evidence of the impact of graduate education on the sustainable integration of AI into pedagogical practices (Kazmaci et al., 2025; Traga Philippakos & Rocconi, 2025). Understanding these dynamics supports informed policy-making and targeted professional development to enhance AI inclusion in education.

Despite extensive research on AI in education, a significant gap remains in our understanding of the specific influence of graduate-level training on teachers' integration of AI tools. Most existing studies broadly address technology use in educational settings but lack focused examinations of AI-specific applications. Furthermore, comparative analyses between teachers with graduate education and those without are scarce, limiting our understanding of how advanced academic preparation may affect AI adoption. Additionally, the interplay between teachers' training, confidence in using AI, and practical implementation of these tools in classrooms is underexplored. There is also a notable absence of localized data investigating how graduate programs within particular institutions or teacher populations shape AI integration practices. This study fills these gaps by offering quantitative evidence on the relationship between graduate-level training and the sustainable use of AI in teaching, thereby providing valuable insights for policymakers and professional development initiatives aimed at enhancing AI inclusion in education.

Research Question

This study aimed to examine the impact of graduate-level training on teachers' integration of artificial intelligence (AI) technologies in classroom instruction. Specifically, it sought to describe the respondents' profiles, determine the extent of AI integration, identify commonly used AI tools, examine differences based on graduate level, and explore the challenges teachers encountered in using AI in their teaching practices. Specifically, this study seeks to answer the following questions

1. What is the demographic profile of the respondents in terms of age, gender, years of teaching experience, and graduate and teaching levels?
2. To what extent does graduate-level training influence teachers' integration of artificial intelligence (AI) technologies into classroom instruction?
3. What types of AI and digital tools are utilized by teachers with graduate-level training in their instructional practices?
4. Is there a statistically significant difference in the level of AI technology integration when respondents are grouped according to their graduate level?
5. What challenges do teachers encounter when integrating AI technologies into classroom instruction?

Review of Related Literature

Artificial Intelligence in Education (AI Integration in Teaching)

Artificial Intelligence (AI) in education encompasses a wide range of technologies designed to enhance teaching and learning processes, including machine learning algorithms, generative AI models, intelligent tutoring systems (ITS), adaptive learning platforms, and natural language processing tools. These systems analyze learner data to deliver personalized instruction, provide real-time feedback, and automate routine tasks, thereby transforming educational practices and their outcomes (Stošić et al., 2025; Kazimova et al., 2025). Common tools used by educators include ChatGPT and similar chatbots, which help students understand complex concepts, improve their language skills, and conduct research through tailored explanations and interactive support. AI-powered grading systems streamline assessments by offering immediate feedback, while adaptive platforms adjust content and pacing based on student performance, often incorporating intelligent tutoring systems that enhance knowledge retention (Davar et al., 2025; Recalde Drouet et al., 2024; V G & N S, 2025). The integration of AI also offers significant benefits, such as improved lesson planning, efficient content creation, and support for inclusive education through personalized learning experiences. Additionally, AI increases student engagement through the use of interactive tools, simulations, and real-time feedback (Guettala et al., 2024; Gupta et al., 2024). However, challenges remain, including ethical concerns such as algorithmic bias and data privacy, as well as issues related to reliability and teacher readiness. Many educators hesitate to adopt AI due to limited training, lack of confidence, and concerns about its implications, highlighting the importance of adequate support and professional development (Hussein et al., 2025; Reina-Parrado et al., 2025; Kazimova et al., 2025). Supporting this, teachers' awareness and readiness have been shown to significantly influence the effective implementation of AI in educational settings

(Anselmo et al., 2026). Despite these challenges, research indicates that AI can enhance learning outcomes through intelligent feedback systems, adaptive learning, and increased engagement, particularly in fields such as language and medical education (Bidry et al., 2025; Guettala et al., 2024; Recalde Drouet et al., 2024). Overall, while AI has strong potential to improve education, its success depends on responsible use, ethical considerations, and collaboration between educators and technology developers.

Graduate-Level Training and Teacher Professional Development

Graduate-level training is important for teachers' professional development. This helps them learn more about teaching methods, technology, and research. This training improves teachers' ability to use technology in their lessons. Studies have shown that graduate courses help teachers create digital teaching materials. These courses focus on improving digital skills using frameworks such as SAMR (Tseng & Lin, 2025). Advanced training also helps teachers conduct educational research, which supports evidence-based teaching and new ideas. Continuous Professional Development (CPD) is a process through which teachers continuously update their skills. It often focuses on technology and new teaching methods. The TPACK framework, which combines technology, teaching, and content knowledge, is important for CPD programs (Adipat et al., 2023). Research shows that teachers with more education are more open to using new technology. This is because they learn about digital tools and AI during their graduate studies, which helps them in the classroom. For example, learning about technology in postgraduate training makes teachers more confident and skilled in using it. This helps them move from traditional teaching to using technology in a student-centered manner. Studies have confirmed that professional training improves teachers' confidence and skills in using technology. Teachers in blended learning and CPD programs show better skills in using digital tools for teaching (Damrongpanit et al., 2023). However, challenges such as limited infrastructure and the need for ongoing support remain. This highlights the need for continued investment in teachers' development. In conclusion, graduate education and CPD together improve teachers' skills in teaching, technology, and research. This helps them teach effectively and adapt to the needs of 21st-century education (Dinçer, 2024; Rukajat et al., 2023).

Challenges and Barriers in AI Integration

The use of artificial intelligence (AI) in education faces many challenges. One major problem is the lack of technology. Many schools, especially in poorer areas, do not have the right tools or the Internet to use AI. This makes it difficult for everyone to have equal access to AI (Kim, 2025; Rony et al., 2025). Poor internet and old computers make it difficult to use AI fully in teaching. Another issue is that teachers often do not have sufficient training to use AI effectively. Many teachers feel that they do not know enough about AI to use it in their classes. They require more training to learn how to use AI tools and understand the ethical issues involved (Kim, 2025; Rony et al., 2025). Ethical concerns are also problematic. Students might misuse AI to cheat, making it difficult for teachers to grade fairly (Alali & Wardat, 2024; Kim, 2025). Relying too much on AI can reduce critical thinking and personal interaction in education settings. Teachers stressed the need to maintain human empathy and judgment in teaching and warned against relying too much on automated decisions. There is often a gap between what policies state and what happens in classrooms. Even with good plans, schools sometimes struggle to use AI effectively in their teaching. This is because of limited resources, incomplete training, and insufficient support, leading to uneven use of AI (Kim, 2025; Yousif Alhajji et al., 2025). To address this, strategies need to be practical and fit local needs, not just general rules. Some solutions have been attempted. Special training programs help teachers learn both technical skills and ethical understanding, thereby boosting their confidence in using AI. Clear ethical rules and data privacy guidelines help teachers handle moral issues and trust AI systems (Badawy et al., 2025; Plevris & Hosamo, 2025). Fair distribution of resources and investment in infrastructure are suggested to reduce technology gaps and ensure access for all (Kim, 2025; Rony et al., 2025). In addition, encouraging discussions among teachers, policymakers, technology experts, and students help create AI tools that work well in different educational settings and promote shared responsibility for using technology.

Integrated Conceptual and Theoretical Mapping

The conceptual and theoretical framework of this study presents how graduate-level training influences teachers' integration of artificial intelligence (AI) technologies in classroom instruction. Graduate-level training, which includes advanced pedagogical skills, technological competence, and research capability, serves as the foundation for shaping teachers' ability to use AI tools effectively. This training influences key aspects of AI integration, such as AI tool usage, innovative teaching practices, and the ability to address challenges and barriers to implementation. The framework further shows that teacher-related factors, including beliefs, attitudes, and digital competence, play an important role in AI adoption in the classroom. Simultaneously, contextual factors such as school resources, institutional support, and available infrastructure can either support or limit the effective use of AI technologies.

The framework is grounded in established theories. Social Cognitive Theory explains how teachers' self-efficacy, expectations, and behaviors influence their willingness to adopt AI in teaching. Meanwhile, the Diffusion of Innovations Theory highlights how teachers adopt and adapt to new technologies based on their perceived usefulness and the stages of innovation adoption. These theoretical perspectives help to explain why some teachers integrate AI more effectively than others. Overall, the framework suggests that when graduate-level training is supported by positive teacher factors and strong institutional support, it leads to enhanced teaching practices and improved learning outcomes for students. This aligns with the findings of this study, which show that while AI integration is evident, its effectiveness depends on training, readiness, and support systems.

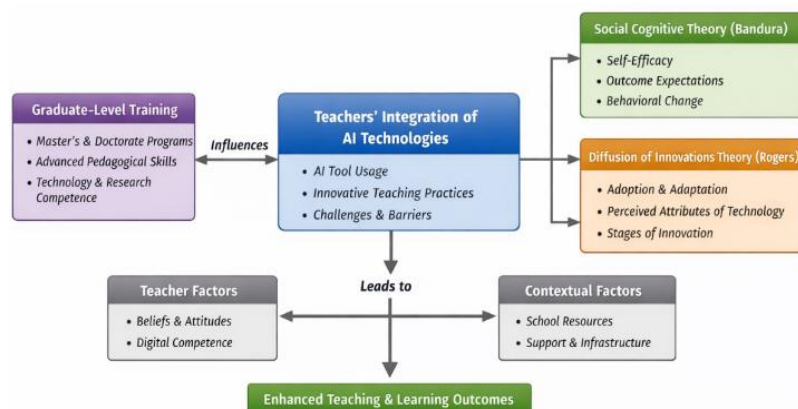


Figure 1. Framework Showing the Impact of Graduate-Level Training on Teachers' Integration of AI Technologies

Methodology

Research Design

This study employed a quantitative descriptive-correlational research design to examine the impact of graduate-level training on teachers' integration of AI technology in classroom instruction. A descriptive approach was used to assess the level of AI use, innovative teaching practices, and challenges, while a correlational approach was used to determine the relationship between graduate training and AI integration.

Respondents of the Study

The respondents of the study consisted of 30 graduate students who were currently teaching. These participants were selected because they were engaged in both graduate-level education and actual classroom instruction, making them suitable for examining the influence of advanced training on AI use.

Sampling Technique

The study utilized purposive sampling, a non-probability sampling method in which respondents were selected based on specific criteria. Participants were required to be currently enrolled in a graduate program and actively teaching to ensure relevance to the research objectives of this study.

Research Instrument

Data were collected using a structured questionnaire developed by the researchers for this study. The instrument consisted of sections on demographic profiles, AI technology integration, innovative teaching practices, challenges in AI integration, and graduate training influence. Responses were measured using a 4-point Likert scale.

Data Gathering Procedure

The researchers secured permission before conducting the study and informed the respondents of its purpose. The questionnaire was distributed and collected after completion of the survey. The responses were then checked, organized and prepared for analysis.

Statistical Treatment of Data

Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were used to summarize the data. Inferential statistics, including correlation and comparative tests, were applied to examine the relationships and differences among the variables.

Ethical Considerations

Ethical standards were followed throughout the study. Participation was voluntary, and the respondents were informed of the purpose of the study. Confidentiality and anonymity were ensured, and all data were used strictly for academic research purposes.

Results and Discussion

Demographic profile of the respondents in terms of age, gender, years of teaching experience, graduate level, and teaching level

Variable	Category	Frequency	Percentage (%)
Age	20–29	10	33.33%
	30–39	10	33.33%
	40–49	10	33.33%
Gender	Male	15	50.00%
	Female	15	50.00%
	Prefer not to say	0	0.00%
Years in Teaching	1–5 years	4	13.33%
	6–15 years	16	53.33%
	15–20 years	7	23.33%
	21–25 years	3	10.00%
Graduate Level	Master's	15	50.00%
	Doctorate	15	50.00%
Teaching Level	Elementary	6	20.00%
	Junior High	13	43.33%
	Senior & Junior High	10	33.33%
	Elementary & Junior High	1	3.33%

Table 1. Demographic Profile of Respondents

The demographic profiles of the respondents revealed a balanced and diverse group of teachers in terms of age, gender, teaching experience, and educational background. In terms of age, respondents were evenly distributed across the 20–29, 30–39, and 40–49 age brackets, each comprising 33.33% of the sample. This suggests that the study captures perspectives from early-, mid-, and more experienced teachers, providing a well-rounded view of AI integration across different age groups. With regard to gender, the respondents were equally divided between male and female teachers, each representing 50% of the total population. This balanced distribution minimizes gender bias and allows for a more objective understanding of AI use in teaching.

In terms of teaching experience, the majority of respondents (53.33%) had 6–15 years of teaching experience, indicating that most participants were in their mid-career stage. This is significant because teachers within this range are often more adaptable to new technologies while remaining grounded in classroom practice. Meanwhile, smaller proportions of respondents fell within the 1–5 years (13.33%), 15–20 years (23.33%), and 21–25 years (10.00%) categories, ensuring representation from both novice and highly experienced educators. Regarding graduate-level education, the respondents were equally split between those pursuing Master's and Doctorate degrees (50% each). This balance is important as it allows for meaningful comparisons and insights into how different levels of advanced education may influence AI technology use in teaching. Finally, in terms of teaching level, the largest group of respondents taught at the junior high school level (43.33%), followed by those teaching both senior and junior high (33.33%). A smaller proportion of the respondents taught at the elementary level (20.00%), while a minimal number handled both elementary and junior high (3.33%). This indicates that the findings of this study are more reflective of secondary education contexts, where the integration of AI technologies may be more prevalent. Overall, the demographic data suggest that the respondents are well positioned to provide relevant and credible insights into the impact of graduate-level training on the integration of AI technologies in classroom instruction.

Graduate-level training influence teachers' integration of AI technologies in classroom instruction

Dimension	Mean	SD	Interpretation
Use of AI Technologies	2.93	0.52	Moderate
Innovative Teaching Practices	3.19	0.54	Moderate
Graduate Training Influence	3.15	0.53	Moderate
Overall Mean	3.09	0.53	Moderate

Table 2. AI Integration and Graduate Training Influence

Table 2 shows that teachers demonstrate a moderate level of AI integration and innovative teaching practices, with an overall mean of 3.09. Among the variables, innovative teaching practices had the highest mean, suggesting that AI positively contributes to enhancing instructional strategies. This implies that AI not only supports teaching efficiency but also promotes higher-order thinking skills in students. In particular, AI has been found to enhance students' critical thinking, especially in science education (Anselmo et al., 2025). Graduate training also showed a moderate influence, indicating that advanced education helps improve teachers' confidence and ability to integrate AI into their teaching. However, the moderate level of AI use suggests that integration is still developing and requires additional support and training.

Challenges in AI Integration

Statement	Mean	SD	Interpretation
I lack sufficient training in using AI tools.	2.73	0.74	Moderate
I have limited access to AI technology in my school.	2.60	0.50	Moderate
I am uncertain about the effective use of AI in teaching.	2.67	0.80	Moderate
AI tools are difficult to use in my teaching context.	1.73	0.69	Very Low
I am concerned about the reliability of AI tools.	2.80	0.48	Moderate
Overall Mean	2.51	0.64	Moderate

Table 3. Challenges in AI Integration

Table 3 presents the challenges teachers encountered when integrating AI technology. The overall mean of 2.51 indicates a moderate level of challenge. Most indicators, including lack of training ($M = 2.73$), limited access to AI tools ($M = 2.60$), uncertainty in using AI ($M = 2.67$), and concerns about reliability ($M = 2.80$), were rated as moderate, suggesting that teachers experienced some barriers in adopting AI. However, the statement that AI tools are difficult to use ($M = 1.73$) was rated very low, indicating that teachers do not find AI tools difficult to operate. Overall, the results suggest that the main challenges are related to training, access, and confidence, rather than technical difficulty.

Difference in AI Integration Based on Graduate Level

Variable	Mean (Master's)	Mean (Doctorate)	t-value	p-value	Interpretation
AI Integration	3.02	3.16	1.23	0.230	Not Significant

Table 4. Difference in AI Integration Based on Graduate Level

Table 4 presents the differences in AI integration between teachers pursuing Master's and Doctorate degrees. The results indicated no statistically significant difference ($p > 0.05$), suggesting that graduate education level does not significantly influence the extent of AI integration in classroom instruction. This implies that both groups exhibit comparable levels of AI use, regardless of whether they are enrolled in master's or doctorate programs. The findings suggest that graduate-level training, rather than the degree level attained, plays a more critical role in shaping teachers' ability to integrate AI technologies. This supports previous research indicating that teacher readiness, awareness, and access to training opportunities are more influential factors than academic qualifications alone in determining successful AI adoption (Anselmo et al., 2026; Kazmaci et al., 2025). Therefore, continuous professional development and practical training experiences may be more essential than formal degree advancement for enhancing AI integration in teaching.

Relationship Between Graduate Training and AI Integration

Variables	r-value	p-value	Interpretation
Graduate Training & AI Integration	0.47	0.009	Significant (Moderate Positive Relationship)

Table 5. Relationship Between Graduate Training and AI Integration

Table 5 shows the relationship between graduate training and AI integration, revealing a statistically significant moderate positive correlation ($r = 0.47$, $p < 0.05$). This indicates that as teachers' exposure to graduate-level training increases, their level of AI integration in classroom instruction tends to improve. The results suggest that graduate education contributes to developing teachers' technological competence, confidence, and readiness to adopt AI tools in teaching. This finding aligns with existing studies that emphasize that training and preparedness are key factors influencing the effective implementation of AI in education (Anselmo et al., 2026; Kazmaci et al., 2025). Moreover, the moderate strength of the relationship implies that while graduate training plays an important role, other factors such as institutional support, access to AI technologies, and continuous professional development also contribute to successful AI integration in teaching. These results highlight the importance of strengthening training programs and providing ongoing support to maximize the benefits of AI in education.

Conclusion and Recommendations

This study concludes that graduate-level training has a significant yet moderate influence on teachers' integration of artificial intelligence (AI) technologies into classroom instruction. Although teachers demonstrated a moderate level of AI usage and innovative teaching practices, the findings indicate that graduate education enhances their confidence, skills, and readiness to adopt AI tools. However, the absence of a significant difference between master's and doctorate levels suggests that exposure to graduate education itself, rather than the degree level attained, plays a more critical role in shaping AI integration. Additionally, the study revealed that teachers face moderate challenges, particularly in terms of insufficient training, limited access to AI technologies, and uncertainty in effective implementation, although technical difficulty is not a major barrier. These findings highlight the need for strengthened professional development programs that focus on practical and hands-on training in AI integration. Educational institutions and policymakers should prioritize improving access to AI tools, provide continuous support, and develop clear guidelines to promote the ethical and effective use of AI in teaching. Furthermore, graduate programs should incorporate more applied and technology-focused components to better prepare teachers for the demands of modern classrooms in the future. By addressing these areas, schools can enhance the sustainable and meaningful integration of AI technologies, ultimately improving teaching effectiveness and student learning outcomes in the long term.

Recommendations

Based on the study's findings, it is recommended that educational institutions strengthen professional development programs by providing continuous and hands-on training focused on the effective integration of artificial intelligence (AI) in classroom instruction. School administrators and policymakers should improve access to AI technologies and ensure the availability of the necessary infrastructure, such as reliable Internet connectivity and updated digital tools, to support teachers in implementing AI-based strategies. Additionally, clear guidelines and policies on the ethical and responsible use of AI should be established to address concerns related to reliability, data privacy, and academic integrity issues. Graduate programs should incorporate more practical and technology-oriented courses that emphasize the application of AI in teaching and learning processes. Furthermore, future researchers may explore other factors influencing AI integration, such as institutional support, attitudes toward technology, and student outcomes, to provide a more comprehensive understanding of AI adoption in education.

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