Teacher Perspectives on AI Integration: Pedagogies, Technologies, Confidence, and Readiness Across Disciplines

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Abstract: *Artificial intelligence (AI) is transforming educational practice. However, little attention is known about how teachers can systematically implement AI through specific pedagogical approaches across different educational settings and disciplines. This study reviews 119 peer-reviewed publications to examine four critical dimensions: pedagogical approaches to AI use, AI technology integration patterns across disciplines, teachers' AI self-efficacy, and teachers' readiness for AI adoption. This study reveals that effective AI integration involves multiple instructional strategies, including personalized learning, project-based learning, support for self-regulated learning, and innovative assessment approaches. These pedagogies differ substantially across educational contexts and disciplines, which means that a one-size-fits-all approach may not work. AI technologies in classrooms take three primary forms: generative AI chatbots, intelligent tutoring systems, and AI-powered mobile learning platforms. Teachers' confidence in using AI varies by discipline, Science, Technology, Engineering and Mathematics (STEM) teachers reporting higher self-efficacy. Regarding the teacher readiness, it involves several connected aspects such as acceptance, attitudes, awareness, and confidence. These areas support one another and grow stronger through professional development that encourages hands-on practice, mentoring, and thoughtful reflection on ethics. The study highlights that successful AI integration requires comprehensive, discipline-responsive professional development addressing technical skills, pedagogical knowledge, ethical reasoning, and the emotional dimensions of professional change. This study provides educators with guidance on suitable AI pedagogical strategies, tools, and assessment methods for AI-enhanced education, offering research insights and future directions for teachers' professional development.*

Keywords: Artificial Intelligence, pedagogical approaches, self-efficacy, professional development, TPACK

1. Introduction

Artificial intelligence includes technological systems designed to simulate human cognitive processes, solve complex problems, and enable adaptive learning across domains (Gosh & Thirugnanam, 2021). The introduction of ChatGPT in 2022 catalyzed substantial interest among educators and researchers in AI applications for education. Research demonstrates that AI and machine learning enhance teaching and learning efficiency by optimizing instructional design and improving measurable student outcomes (Holmes et al., 2019). In education, AI streamlines administrative tasks such as grading and data analysis, allowing educators to focus more on teaching (Tang, 2025). AI systems also increase student engagement through immersive, interactive, and gamified learning experiences, particularly when combined with virtual and augmented reality technologies (Chan, 2025).

While AI shows its potential for improving teaching, most current research focuses on what AI can do technically rather than exploring the specific ways teachers should actually teach when using these tools in their classrooms. Research has not examined how teachers adapt fundamental instructional strategies. Furthermore, while diverse AI technologies are entering educational practice, little is known about how technology adoption and implementation patterns vary across academic disciplines and educational levels. AI applications may be highly appropriate for computational thinking in computer science. Current research fails to compare how different disciplinary teachers select and implement AI for teaching. Also, teacher self-efficacy represents a well-established predictor of instructional quality, yet current research provides minimal insight into how teachers' confidence in teaching with AI varies across subject matters. Finally, teacher

readiness for AI integration brings together several closely connected elements, including acceptance, attitudes, ethical awareness, and confidence, but existing studies tend to treat these aspects separately. There is limited information on a systematic understanding of current practices and challenges. This study addresses this by examining pedagogy, AI technology, self-efficancy and readiness. It targets unexplored ares includes teaching practice with AI and subject specific pattern. To address these gaps and provide a holistic view of AI's role in competency-based teaching, this study poses the following research questions:

RQ1 What pedagogical approaches are teachers using when implementing AI in classroom teaching?

RQ2: How are specific AI technologies being integrated into classroom practice across different disciplines and educational levels?

RQ3: How does AI teaching self-efficacy vary across subject matters, and how is this reflected in teachers' classroom practice?

RQ4: How ready are teachers to integrate AI into their teaching?

Through a systematic review of recent empirical studies, this research maps current AI applications in educational practice from teachers' perspectives, focusing on pedagogical approaches, patterns of technology integration, self-efficacy in teaching with AI, and overall teacher readiness. The synthesis of these dimensions offers a contemporary overview that informs future professional development initiatives and guides the ethical implementation of AI in education.

2. Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines using a four-phase process: (1) searching and filtering qualified articles in the databases, (2) conducting full-text reviews of eligible articles, (3) coding the articles based on the research questions, and (4) analyzing and interpreting the results. The article selection prioritized high-quality research by drawing from the Scopus and Web of Science citation databases, and Table 1 presents the search strings used in these databases.

Table 1.

Searching strings in databases

Database	Search strings
Scopus	(TITLE-ABS-Keywords("Artificial Intelligence" OR "AI") AND TITLE-ABS-Keywords ("preschool" OR "kindergarten" OR " elementary school" OR "high school" OR "K-12" OR "university" OR "higher education" OR "students") AND TITLE-ABS-keywords("AI tools" OR "education technology" OR "classroom technology" OR "educational tools") AND ABS ("practice" OR "assessment" OR "curriculum" OR "method" OR "teaching" OR "learning" OR "pedagogy" OR "management" OR "instructional") AND ABS("model" OR "framework" OR "theoretical" OR "foundation" OR "conceptual" OR "paradigm" OR "principle" OR "approach")
Web of Science	"Artificial Intelligence" OR "AI" (Title) AND "kindergarten" OR "preschool" OR "K-12" OR "university" OR "higher education" OR "students" (Abstract) AND "AI tools" OR "education technology" OR "classroom technology" OR "educational tools" (Abstract) AND "practice" OR "assessment" OR "curriculum" OR "method" OR "teaching" OR "learning" OR "pedagogies" OR "management" OR "instructional" (Abstract) AND "model" OR "framework" OR "theoretical" OR "foundation" OR "conceptual" OR "paradigm" OR "principle" OR "approach" (Abstract)

The initial search identified 1,332 records in Web of Science and 537 records in Scopus, yielding a total of 1,869 articles retrieved on December 31, 2025 using the predefined search strings. Inclusion and exclusion criteria were then applied to enhance the generalizability of the findings and reduce bias (Table 2), which involved excluding review articles, technical development papers, surveys, and studies in which AI was not used as an innovative educational tool, model, or pedagogy in areas such as curriculum or assessment. In total, 119 articles proceeded to full-text screening from the initial pool after 1,720 exclusions, and the overall selection process is summarized in the PRISMA diagram (Figure 1).

Two coders created a preliminary three-tiered framework that includes (1) AI tools for teaching and learning; (2) pedagogical strategies for AI integration; and (3) the incorporation of AI theories into education. Both coders independently applied the framework to all articles. Disagreements were resolved through discussion or consultation with a third reviewer.

Figure 1

PRISMA diagram

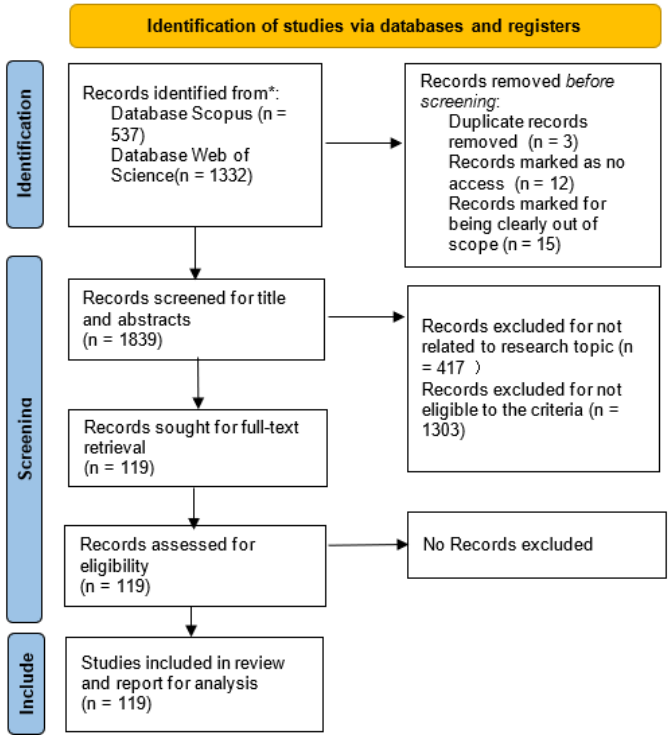

Table 2.

Inclusive and exclusive criteria from databases

Inclusion criteria	Exclusion criteria
(1) The studies had to be published journal articles indexed by the Scopus and Web of Science databases (2) Studies that were empirical, practical, evidence-based and case studies, conducted in any education level and subjects' practices, including K12 and higher education settings (3) Studies that provided theoretical discussion on AI integration in all educational practices (4) The studies had to provide descriptions of the underlying theories and methods used	(1) Review and editorial papers were excluded (2) Articles that were not related to AI application in education application filed were excluded (3) Articles that were not written in English were excluded (4) Conference proceedings and abstract without full text assess papers were excluded

3. Results

The 119 reviewed studies reveal a research landscape heavily weighted toward higher education (n = 68, 57.1%), with K-12 contexts (n = 42, 35.3%) as a secondary area of interest. Within the K-12 sector, scholarly attention was distributed between secondary (20.2%) and primary (15.1%) levels, while early childhood and cross-level studies remain notably scarce. From a disciplinary perspective, AI research is firmly rooted in STEM (n = 47, 39.5%), particularly within the technical domains of computer science and engineering. However, a significant thematic cluster also emerged in English language instruction, which represents the second most active domain with 28 identified studies.

3.1. Pedagogical approach to AI-Enhanced Teaching

AI technologies enable unprecedented customization of instructional content and pacing to individual student characteristics. In English as a Foreign Language (EFL) contexts, AI-powered systems including chatbots and large language models facilitate personalized tutoring, data-driven instructional adjustments, and enhanced student engagement (Nguyen & Dinh, 2024; Thinh et al., 2020). These findings align with prior theoretical work emphasizing AI's capacity to customize learning experiences and reduce cognitive load through scaffolding aligned to learner needs (Van Lehn, 2011). In Science, Technology, Engineering and Mathematics (STEM) education, pedagogies such as project-based learning, self-regulated learning (SRL) supported by AI chatbots, and computational thinking through robotics highlight the role of AI in fostering critical thinking and creativity (Chang et al., 2023; Maqruf et al., 2025). These pedagogical applications align explicitly with the AI-TPACK framework's emphasis on integrating technological pedagogical knowledge with discipline-specific content (Celik, 2023). In general, robotics platforms and AI-integrated programming environments foster computational thinking and coding skills in K-12 and higher education settings (Husain, 2024; Thinh et al., 2020). Students engage with AI as both a learning domain (understanding AI principles and applications) and a pedagogical tool (using AI to enhance learning across disciplines). Beyond instructional delivery, AI systems support classroom management through automated attendance tracking and behavioral monitoring. More substantively, AI enables innovative assessment approaches, including learning analytics that identify struggling students in real time, automated feedback on written assignments, and evaluation of programming code (Wong et al., 2026).

3.2. AI Technologies and Integration Patterns Across Disciplines and Educational Levels

Analysis reveals substantial variation in technology adoption and implementation across academic disciplines. STEM disciplines (particularly computer science, engineering, and physics) demonstrate high diversity in AI tool adoption(Chang et al., 2023; Maqruf et al., 2025). English Language Teaching shows concentrated use of robot-assisted learning and conversational AI systems (Thinh et al., 2020). Mathematics, while increasingly incorporating AI, shows adoption primarily focused on problem-solving scaffolding rather than conceptual instruction (Opesemowo & Ndlovu, 2024). Social sciences and arts disciplines demonstrate more limited but emerging applications, often focused on simulation and creative design tasks (Izgi, 2025; Wong, 2025). This variation suggests that disciplinary epistemology and pedagogical traditions substantially influence technology adoption patterns.

Higher education settings exhibit substantially greater diversity in AI tool adoption than K-12 settings. K-12 settings rely more heavily on generative AI tools (e.g., ChatGPT, Midjourney) that require minimal institutional infrastructure while supporting immediate instructional applications (Kim, 2025).

3.3. Teachers' AI Teaching Self-Efficacy Across Subject Matters

In contrast to the broad affective orientation of confidence (Hazaymeh et al., 2024), AI teaching self-efficacy refers to a teacher's task-oriented beliefs about their capabilities within the domain of AI instruction (Kim & Kim, 2022). As a measurable construct, it is typically operationalized through certainty ratings regarding specific AI teaching performances (Meegan & Young, 2025). Teachers' perceived capability to teach effectively with AI tools varies across academic disciplines. STEM teachers generally report high self-efficacy, using AI to scaffold scientific writing and support complex problem-solving, although they also raise concerns about transparency and changing professional roles (Husain, 2024). English as a Foreign Language (EFL) teachers tend to exhibit moderate self-efficacy, with experienced instructors recognizing the benefits of AI but often lacking the initiative to pursue deeper and more innovative integration (Hazaymeh

et al., 2024). In the social sciences and arts, teachers primarily treat AI as a creative catalyst for simulation and design activities, and their sense of efficacy depends heavily on clearly defined, well-scaffolded project contexts (Wang et al., 2024). These patterns support the AI-TPACK view that subject-specific AI competencies are crucial for effective teaching and that professional development should be tailored to both disciplinary demands and individual teacher backgrounds, including prior training and qualifications (Celik et al., 2023; Chan & Tang, 2024). In cross-disciplinary or general education contexts, such as teacher education and ICT courses, both self-efficacy and outcome expectations are strongly shaped by the availability and quality of professional development opportunities. Empirical studies show that targeted training can directly enhance pre-service and in-service teachers' self-efficacy, which in turn becomes a key driver of their readiness and intention to adopt AI in their practice (Kim, 2025; Yue et al., 2024). This indicates that teacher readiness is a multidimensional state that both precedes and results from self-efficacy, providing a conceptual bridge to the next focus of this review: how teachers' overall AI readiness is formed and manifested in educational practice.

3.4. Teachers' AI Readiness

Readiness refers to multi-dimensional constructs including insituational support, ethical awareness and general preparation (Al-Abdullatif, 2025). Readiness and self-efficacy are reciprocal, with a high level of readiness providing the necessary foundation for self-efficacy to flourish and drive further engagement (Li et al., 2025). Teachers' readiness to adopt AI is shaped by factors such as their acceptance of AI, attitudes toward its use in education, and ethical awareness, all of which are strongly influenced by the nature of AI (MacDowell et al., 2024). Studies grounded in the Technology Acceptance Model (TAM) consistently show that perceived usefulness and ease of use are central drivers of acceptance, and that hands-on, practice-oriented training plays a critical role in fostering more positive attitudes toward AI (Uygun, 2024). Research shows that when AI is viewed as a supportive partner that helps teachers instead of replacing them, people tend to respond more positively, even though many educators still have concerns about accuracy and reliability (Zhao et al., 2022). At the same time, ethical awareness remains underdeveloped; many teachers are not fully aware of algorithmic bias, data privacy risks, or wider socio-ethical implications unless these topics are explicitly addressed in professional learning opportunities (Fundi et al., 2024).

A key pattern emerging from the literature is the strong positive relationship between teachers' AI teaching self-efficacy and their overall readiness to adopt AI in practice (Granström & Oppi, 2025). Teachers with higher self-efficacy are more likely to accept AI tools, hold more positive attitudes toward AI integration, recognize both the potential and the limitations of AI, and engage in more nuanced ethical reasoning about when and how AI should be used in teaching. This shows that professional development with practical experience, mentoring, and teamwork can strengthen many aspects of teacher readiness. It helps teachers feel more confident, open-minded, positive, and aware of ethical issues when using AI.

3.5. Teachers' ethical concern

Ethical concerns in AI integration are discipline-specific. In the STEM fields, primary concerns focus on transparency and trustworthiness (Husain, 2024), whereas English language teachers' concerns are academic integrity and preservation of authentic work (Nguyen & Dinh, 2024). Meanwhile, social sciences and arts teachers emphasize the critical issues of privacy, bias and student voice (Wang et al.,2024). Training must therefore be discipline-specific, providing contextual strategies for navigating ethical challenges. Teachers often recognize ethical issues but lack a pedagogical framework to address them (Ho and Lee, 2025), which highlights a need for context-sensitive professional development.

4. Discussion

This review provides a comprehensive examination of AI applications in educational practice from teachers' perspectives, synthesizing evidence across four critical dimensions: pedagogical approaches with AI, AI technologies integrated into classrooms, AI teaching self-efficacy, and readiness of teachers.

The evidence demonstrates that AI integration is not simply about adding new tools on top of existing practice. Instead, AI fundamentally reshapes what teachers do, how they spend their instructional time, and how they interact with

students. When intelligent tutoring systems take over parts of assessment, teachers increasingly move into roles as instructional designers and individual mentors. When students work with AI-powered mobile learning, teachers shift from being the main source of information to acting more as learning coaches and facilitators. These changes call for parallel shifts in how teachers are prepared, the professional values they hold, and the ways they make instructional decisions. The traditional view of teachers as the sole source of subject-matter expertise needs to be updated toward a model in which teachers and AI systems work in partnership to support student learning. The evidence clearly shows that a one-size-fits-all approach to AI in education does not work. STEM subjects focus on problem-solving and computational thinking, and lend themselves naturally to AI-supported activities, while English language teaching can draw on AI's conversational strengths and ability to provide rich, authentic language input. In the social sciences and arts, teachers must be especially creative in identifying ways for AI to genuinely enrich interpretation, creativity, and critical inquiry. These differences mean that professional development and policy should respond to the specific opportunities and constraints of each discipline, instead of promoting generic, uniform models of AI integration across all subjects.

Teachers' confidence in their ability to teach effectively with AI varies significantly across disciplines, and this variation has important implications for how support is provided. STEM teachers generally feel more confident with AI tools because these disciplines naturally align with computational problem-solving and analytical thinking. EFL teachers recognize the value of AI for language practice and feedback but often lack the motivation or support to explore deeper applications. Teachers in social sciences and arts require well-designed projects and clear learning goals to feel confident using AI creatively. It is clear that self-efficacy varies across different contexts. With the right professional development, such as hands-on experience, mentoring, and subject-specific support, teachers can become more confident in using AI in their teaching. When teachers experience success with AI through carefully designed learning experiences, their confidence grows, and this confidence then opens the door to greater readiness for broader adoption.

Teacher readiness for AI adoption rests on multiple interconnected foundations: how teachers perceive AI's usefulness and ease of use, their emotional responses to AI in education, their ethical understanding, and their overall confidence in their ability to use these tools well (MacDowell et al., 2024). Yet many teachers remain unaware of important ethical considerations such as algorithmic bias and data privacy unless these topics are explicitly taught and discussed (Fundi et al., 2024). The research reveals that these dimensions of readiness are not separate; they interact and reinforce one another. Teachers with stronger self-efficacy tend to accept AI more readily, hold more positive attitudes, and think more carefully about the ethical dimensions of AI use in their classrooms. This insight suggests that investing in professional development that strengthens self-efficacy through authentic practice, peer collaboration, and mentoring creates positive momentum across all aspects of readiness, helping teachers become not only more confident but also more thoughtful, accepting, and ethically grounded in their approach to AI integration.

The evidence points to a critical need for comprehensive professional development that goes beyond technical tool training. Instead, it requires addressing the full landscape of AI literacy in education. Teachers require a foundational understanding of what AI is, how it works, and where it can meaningfully contribute to learning. (Hur, 2025; Tang & Zhang, 2025). Beyond conceptual knowledge, teachers need practical experience designing lessons in which AI serves clear pedagogical goals rather than becoming an end in itself. This means professional learning needs to be tailored to each subject area; some learning may be conducted collaboratively with the library (Tang, 2020). What works for a computer science teacher differs substantially from what a humanities teacher needs to know (Zhang et al., 2024). Equally important are opportunities for teachers to think critically and together about the ethical implications of AI in their classrooms. When professional development is designed this way, it gives teachers the skills and confidence to use AI well in their classrooms. Without such comprehensive support and tailored professional learning, teachers may leave feeling unprepared and unsure how to use AI effectively and responsibly in classrooms.

5. Conclusion

This study examined AI applications in educational practice from teachers' perspectives, focusing on pedagogical approaches, technology-integration patterns across subjects, self-efficacy, and teacher readiness for AI adoption. The findings reveal that effective AI integration involves diverse pedagogical strategies such as personalized learning, project-based learning, self-regulated learning support, and innovative assessment, and these approaches need to be tailored to fit the particular contexts of different disciplines and the needs of students rather than applied in the same way across all subjects. AI technologies in classrooms take three primary forms: generative AI chatbots (most common in K-12), intelligent tutoring systems (more prevalent in higher education), and AI-powered mobile learning platforms (increasingly widespread). Teachers' confidence in using AI varies significantly by discipline, suggesting that targeted professional development can meaningfully strengthen teacher confidence across contexts. Teacher readiness for AI emerges as a multidimensional construct including acceptance, attitudes, and ethical awareness. In addition, there is a strong relationship between confidence and readiness. In conclusion, these findings establish that successful AI integration requires comprehensive, discipline-responsive professional development that addresses not only technical skills and pedagogical knowledge but also ethical reasoning and the emotional dimensions of professional change.

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