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Artificial Intelligence in Action: How Preservice Teachers Embark on the Fast-Paced Journey of Mindful AI Use

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ABSTRACT

This exploratory embedded mixed methods study examined preservice teachers' beliefs about artificial intelligence (AI) and their perceived competence in using it for instructional planning. Ten education majors participated in structured activities involving AI platform selection, prompt development, and evaluation of AI-generated lesson plans. Quantitative data from the Teacher Artificial Intelligence Competence Self-Efficacy (TAICS) Scale showed moderate-to-high confidence across most competencies, with lower self-efficacy in AI assessment. Qualitative findings revealed preservice teachers viewed AI as helpful for generating ideas and increasing efficiency, but expressed concerns about accuracy, ethics, and limited personalization. The study introduces an emergent framework, the Triad of AI Literacy Demands for Preservice Teachers, and underscores the importance of integrating critical AI instruction in teacher preparation programs.

Keywords: AI ethics, AI literacy, AI self-efficacy, preservice teachers, teacher preparation

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INTRODUCTION

Preservice teachers today are learning to teach even as artificial intelligence (AI) rapidly reshapes educational environments. AI tools, such as ChatGPT, Magic School AI, and other generative platforms, are becoming increasingly prevalent in educational settings and have the potential to transform how teachers design instruction, support students, and manage classroom tasks. These technologies offer powerful efficiencies: they can generate lesson plans, create customized materials, and support instructional design and accessibility through a range of features (Akgun & Greenhow, 2022; Seo et al., 2024; van den Berg & du Plessis, 2023; Zhang & Aslan, 2021). Students, too, are already using AI tools to draft writing, study, and complete assignments, illustrating that the integration of AI into K–12 learning is not theoretical; it is happening now and often outside the teacher’s direct oversight.

Because of this pervasive use, preservice teachers must be prepared to make informed, ethical, and pedagogically sound decisions about AI. Research consistently shows that teacher candidates and in-service teachers often lack the foundational AI-related knowledge needed to use these tools critically and responsibly (Antonenko & Abramowitz, 2022; Gatlin, 2023; Kosmas et al., 2025; Yue et al., 2024). AI’s rapid adoption also raises concerns related to accuracy, academic integrity, data privacy, equity, and potential bias. Scholars argue that developing teachers’ ethical reasoning and responsible use of AI should be integral to teacher preparation experiences, not addressed as an afterthought (Falloon, 2020; Gouseti et al., 2024).

At the same time, literature suggests that preservice teachers are entering programs already surrounded by AI and are generally optimistic about its usefulness (Yao & Wang, 2024). Studies show that when preservice teachers receive structured opportunities to explore AI, especially through guided lesson planning and reflection, they can learn to critically evaluate AI-generated materials and adjust them to meet the needs of diverse learners (Barbieri & Nguyen, 2025; Powell & Courchesne, 2024). However, systematic reviews highlight that empirical research on AI use in teacher preparation remains limited and often small in scale (Chen et al., 2020; Crompton et al., 2022; Yue et al., 2022; Zafari et al., 2022). Much of this work emphasizes technology demonstrations rather than preservice teachers’ perceptions, learning processes, and confidence development. To address this gap, we are integrating explicit instruction on AI use into our teacher preparation program. In our methods courses, preservice teachers engage with generative AI tools through structured activities that include prompt engineering, lesson plan evaluation, and critical reflection on ethical implications. We are particularly interested in how these experiences shape teacher candidates’ perceptions of AI and how their thinking may differ from their experiences in non-

education coursework, where AI may be discouraged or governed by academic integrity concerns rather than instructional design or ethical use.

The purpose of this embedded mixed methods study is to understand preservice teachers' perceptions of AI and their confidence in using AI for instructional planning and professional tasks. We administered the Teacher Artificial Intelligence Competence Self-Efficacy (TAICS) Scale (Chiu et al., 2024) and conducted focus group discussions to examine how preservice teachers conceptualize AI's role in teaching, what competencies they feel confident in, and where they experience uncertainty. By examining how preservice teachers engage with AI within authentic coursework, this study contributes to the emerging knowledge base on teacher preparation and offers insights into how educator preparation programs can integrate mindful, ethical, and pedagogically grounded AI instruction.

LITERATURE REVIEW

Teacher Preparation and AI

A range of recent studies has focused on using AI in education, and many have explored what AI specifically means in relation to teacher preparation. Altinay et al. (2024) called for capacity-building strategies for student teachers following their analysis of student teachers' reflections on the strengths and drawbacks of AI. They found that generative language models, like ChatGPT, can serve as valuable aids for educators by providing customized resources and support, such as lesson plans. Heine and König (2025) found that preservice teachers' attitudes toward ChatGPT are shaped by their digital self-efficacy.

Teachers learn to teach through preparation programs, in-service learning, and workplace experience, yet research consistently shows that both preservice and in-service teachers lack sufficient AI-related knowledge and skills (Antonenko & Abramowitz, 2022; Gatlin, 2023; Guan et al., 2025; Yue et al., 2024). AI literacy and prompt engineering are therefore essential for enabling teachers to formulate effective prompts and critically evaluate AI outputs (Kosmas et al., 2025; van den Berg & du Plessis, 2023). Collaborative and reflective practices, such as peer review of AI-generated lesson plans, further support pedagogical decision-making and critical engagement with technology (Barbieri & Nguyen, 2025; Kim et al., 2025). Research also emphasizes the importance of customizing AI-supported materials to meet diverse student needs, with qualitative work pointing to a holistic approach to AI curriculum design (Chiu, 2021).

Beyond task automation, AI can support creative lesson planning by facilitating brainstorming, integrating multimedia resources, and personalizing instruction, including the design of engaging, low-anxiety learning experiences for young learners (Baral, 2025; Flavin et al., 2025; Hashem et al., 2023). Generative

AI also enables preservice teachers to explore multiple didactic strategies while reflecting critically on their practice (van den Berg & du Plessis, 2023). In addition, AI may reduce teacher workload and mitigate burnout by shifting attention from administrative tasks to higher-level instructional design (Hashem et al., 2023). Such applications highlight the need for teacher preparation programs to harness the potential of AI as a timesaver and collaborative partner for developing instructional experiences.

Effective implementation of AI tools in preservice classrooms requires training educators to use AI effectively while maintaining a critical stance towards its outputs (Powell & Courchesne, 2024). Prompt engineering is particularly important for guiding AI tools toward producing relevant, contextually appropriate lesson plans (Hashem et al., 2023; Walter, 2024). Powell and Courchesne (2024) found that while AI could rapidly generate a curriculum-aligned lesson, inaccuracies and fabricated resources underscored the need for explicit instruction in evaluating and refining AI-generated content.

Ethical Considerations of AI for Teachers

Despite its potential benefits, the use of AI in education raises significant ethical concerns, including transparency, hallucinated outputs, and the absence of inherent moral reasoning. Scholars are increasingly calling for deliberate discussion and action around ethics and AI, and schools and school systems are scrambling to develop policy and guidance. Flores-Vivar and García-Peñalvo (2023), drawing on a review of global research and policy documents, identify both AI's potential to support UNESCO's 2030 Sustainable Development Goals and concerns about the displacement of human teachers, recommending continued inquiry and coordinated policy actions, including the establishment of an ethical observatory for AI in education.

Ethical use of AI also requires building educators' capacity to deploy these technologies responsibly. Embedding ethical training within teacher preparation programs can help future educators understand the implications of AI use and uphold educational integrity (Altinay et al., 2024; van den Berg & du Plessis, 2023). Such preparation aligns with the moral responsibility of teachers to integrate AI in ways that support, rather than undermine, pedagogical and professional values.

Synthesizing conceptual and empirical research published between 2010 and 2023, Gouseti et al. (2024) describe the current landscape of AI ethics in schooling. Conceptual work emphasizes ethical risks such as privacy, data security, bias, discrimination, and social inequality, alongside a lack of clear ethical frameworks. Empirical studies further highlight students' limited understanding of AI, teacher misconceptions, anxiety about risks, and insufficient professional preparation. Across this literature, proposed responses include constructivist approaches,

integrating ethics into AI literacy and curriculum, and providing targeted professional development focused on AI ethics.

Prior scholarship similarly underscores the need to explicitly introduce ethical challenges of AI to both teachers and students (Akgun & Greenhow, 2022). Frameworks such as Falloon's (2020) Teacher Digital Competence model emphasize ethics and safety as core components of digital practice, suggesting that ethical considerations of AI should be systematically embedded within teacher education coursework and field experiences.

Teacher Self-Efficacy and AI

Chiu (2025) explains teacher AI competency encompasses the full range of professional responsibilities within school contexts, including supporting instruction, assessment, student learning, professional development, communication, and decision-making. It also involves cultivating a reflective mindset, positive attitudes toward AI, and sustained engagement in professional learning. To operationalize this construct, Chiu et al. (2024) developed and validated the Teacher AI Competence Self-Efficacy Scale (TAICS), which is used in the present study.

Conceptually, the TAICS builds on established models of technology integration, particularly the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes the integration of content, pedagogy, and technology (Mishra & Koehler, 2006). However, recent scholarship argues that traditional frameworks must be expanded to address ethical considerations, contextual factors, and emerging digital risks associated with AI. For example, Falloon's (2020) Teacher Digital Competence framework extends TPACK by incorporating ethical and professional dimensions related to digital safety and misinformation. Drawing on these perspectives, Chiu et al. (2024) used a Delphi process and survey data from 434 K–12 teachers to validate a six-dimension model of teacher AI self-efficacy, encompassing AI knowledge, pedagogy, assessment, ethics, human-centered education, and professional engagement.

Beyond TAICS, prior research highlights the relationship between teacher preparation, self-efficacy, and readiness to use AI. Antonenko and Abramowitz (2022) found that teachers' self-efficacy for AI use depends on clear understanding of AI's capabilities and limitations, with their study revealing teachers' enthusiasm for AI's instructional potential alongside limited concern about ethical issues. Similarly, Gatlin (2023) reported that although most preservice teachers were familiar with AI, over half felt unprepared to integrate it into classroom practice, indicating a gap between awareness and confidence. This research ultimately emphasizes the need for teacher preparation programs to integrate AI concepts across coursework to effectively equip the next generation of educators.

Additional studies further underscore the importance of digital literacy and targeted preparation. Yao and Wang (2024) found that digital literacy positively influenced preservice special education teachers' perceptions of AI usefulness, ease of use, and self-efficacy, which in turn shaped their intention to adopt AI. Miller (2024) similarly identified moderate self-efficacy in technological and pedagogical domains but lower confidence in integrating AI with content knowledge, suggesting the need for educator preparation programs to better incorporate AI integration training and calling for further research on preservice teachers' technological proficiency with AI tools. Large-scale survey research by Heine and König (2025) reinforces these findings, showing that higher digital confidence is associated with more positive attitudes toward ChatGPT and greater willingness to use it. Collectively, this literature emphasizes the central role of teacher self-efficacy in shaping meaningful and responsible AI integration in education. As AI continues to evolve, ongoing research and practical implementation will be essential in shaping effective strategies that harness its potential while addressing its challenges in educational contexts.

Rationale for Study

Building on the literature reviewed, recent research shows that AI tools are increasingly used in K–12 education to support lesson planning, differentiation, accessibility, and student engagement. Yet, studies also reveal persistent concerns related to accuracy, hallucination, student academic integrity, data privacy, and ethical use. Although new competency frameworks (e.g., TPACK, Teacher Digital Competence, and the TAICS) emphasize that AI integration requires pedagogical reasoning, ethical judgment, and ongoing reflection, and not just technical proficiency, teacher preparation programs have been slow to embed explicit instruction on responsible AI use. At the same time, the literature base in teacher preparation and AI remains nascent. Little is known about how preservice teachers make meaning of AI when they use it within their coursework, nor how such experiences influence their confidence and instructional decision-making.

RESEARCH METHOD

To address the literature and practice gap, our study examined preservice teachers' perceptions of AI and how their experiences using AI in pedagogy courses shape their thinking. Specifically, we asked: (1) How do preservice teachers perceive the benefits and challenges of using AI for instructional design? (2) How do their coursework experiences influence their confidence (self-efficacy) in AI-related competencies? and (3) In what ways do preservice teachers describe ethical and responsible use of AI in teaching contexts?

Participants and Setting

This study was conducted at a small liberal arts college in the United States. The college's Department of Education offers three undergraduate programs leading to teacher certification: early childhood, elementary/special education, and a secondary education concentration paired with a disciplinary major (e.g., English, history, or mathematics). Study participants included ten undergraduate education majors (3 early childhood education, 5 elementary/special education, and 2 English majors with secondary education concentrations). All participants were in the latter stages of their junior or senior year.

Teacher Preparation AI Coursework Experiences

All teacher preparation students engaged in a series of activities designed to develop and assess their ability to create and critically evaluate AI-generated lesson plans as part of their teaching methods coursework. For early childhood and elementary/special education majors, these activities occurred during a science teaching methods course in the spring semester of their junior year. For secondary education students, these activities took place in an introductory teaching methods course in the fall semester of the junior year.

Across both methods courses, students first received an introduction to generative AI, which included discussions of prompt engineering and optimization, comparisons of free and paid AI platforms, and consideration of issues such as hallucinations, bias, and attribution. Students then created a prompt designed to generate a lesson plan aligned with a grade-level standard for their preferred grade and content area, and tested and refined prompts across multiple generative AI platforms. Students critically evaluated the resulting AI-generated lesson plans, drawing upon their pedagogical, content, and pedagogical-content knowledge to identify the most promising plan for further revision. Selected lesson plans were revised to enhance quality based on pedagogical and content principles. The following class period was devoted to a roundtable discussion, during which students shared their processes and reflected on the benefits and challenges of using AI for lesson planning.

At the conclusion of the course, students completed a final project requiring them to critically evaluate three lesson plans addressing the same grade-level standard and content area. One lesson originated from a local public-school curriculum or textbook, one from an online source of their choosing, and one was AI-generated. Students synthesized strengths across the three plans into an exemplary lesson and provided a comparative analysis of each source.

Although the activities were implemented across methods courses serving preK–12 education students, the assignments were essentially the same, differing primarily by the standards selected by participants. Both courses were taught by

the same professor (one of the study’s authors), ensuring consistent instructional content and perspectives. Students responded positively to the AI-based activities overall, though several expressed concerns regarding the use of AI in lesson planning.

All early childhood, elementary/special education, and secondary education students who completed these AI-based activities in methods courses between 2024 and 2025 were invited to participate in the study. Of 42 eligible students, 10 consented to participate and are included in the sample. Participation was voluntary, and informed consent was obtained. Because the researchers were professors in the participants’ program, established relationships supported open communication while safeguards were in place to minimize coercion. Participation was not tied to course grades, and none of the researchers were teaching any of the participants at the time of data collection.

Data Collection

This study employed an embedded mixed methods design (Creswell & Plano Clark, 2018), in which qualitative data served as the primary source of evidence, and quantitative data were embedded to provide contextual support and enhance interpretation. Data were collected through the Teacher Artificial Intelligence Competence Self-Efficacy (TAICS) Scale (Chiu et al., 2024) and semi-structured focus group interviews. The quantitative results offered a descriptive snapshot of preservice teachers’ AI confidence, while the qualitative data provided deeper insight into how they interpreted and experienced AI use within their coursework.

All participants first completed the TAICS Scale, which measures six dimensions of AI competence, AI Knowledge, AI Pedagogy, AI Assessment, AI Ethics, Human-Centered Education, and Professional Engagement, using a five-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*). Two sample items and the complete scale are provided for reference (Figure 1). The TAICS Scale was administered electronically via Qualtrics.

Figure 1
Sample TAICS Items and Scale

I can assess the benefits of an AI tool.				
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can assess the risks of an AI tool.				
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Participants were then interviewed. Three 30-minute semi-structured focus group discussions were conducted. Focus groups were scheduled to accommodate participants' preferences and schedules (i.e., in-person or video). Each participant participated in a single session of their choosing. The focus group protocol mirrored Chiu et al.'s (2024) six dimensions of AI competence self-efficacy to elicit participants' perceptions, experiences, and reflections related to each area. Two sample questions are presented for reference (Figure 2). Focus groups were audio- and video-recorded and subsequently transcribed verbatim for analysis.

Figure 2

Sample Semi-Structured Focus Group Questions

Describe a time when you successfully utilized AI. What worked well, and what didn't?

Have you encountered any ethical concerns when using AI? How did you address them?

Data Analysis

Quantitative data from the TAICS Scale were analyzed descriptively to establish a baseline understanding of participants perceived competence across AI dimensions. Responses were assigned numeric values ranging from one (*strongly disagree*) to five (*strongly agree*). Scores below three indicated lower levels of self-efficacy in each dimension, while scores above three indicated higher self-efficacy. Individual and group mean scores were calculated for each of the six dimensions, as well as an overall composite mean, to provide a general picture of participants' AI-related competence and confidence. Consistent with the embedded design, these descriptive results were not used to make statistical comparisons but rather to contextualize and enrich the qualitative findings.

Focus group data provided richer contextual insight into how preservice teachers interpreted and applied these competencies in practice. Qualitative data from the focus group transcripts were analyzed thematically. Transcripts were initially read in full by the researchers to develop familiarity with the data and to identify emergent ideas grounded in participants' own language. During this first coding cycle, emergent (in vivo) codes were applied to capture what participants said about their experiences with AI use. Following this inductive phase, categories aligned with the six dimensions of the TAICS framework (Chiu et al., 2024) were applied as a priori codes. This combination of inductive and deductive coding enabled participant-driven insights to be examined in relation to established dimensions of AI competence, thereby supporting the embedded mixed-methods design.

An AI-assisted text analysis tool (ChatGPT) was used to support the second round of analysis. Specifically, the tool was used to generate word frequency summaries, identify potential patterns across coded segments, and suggest connections among preliminary themes. These AI-generated suggestions were used only as analytic supports; all coding decisions, theme refinement, and interpretations were made by the researchers. Initial themes were reviewed, collapsed when conceptually related, and eliminated when not aligned with the purpose of the study. For example, early themes that reflected general technology anxiety but were not specific to AI use in instructional planning were removed.

Coding and theme refinement were conducted by the research team through collaborative review and discussion until consensus was reached. Rather than calculating inter-coder reliability statistics, the researchers engaged in iterative dialogue to resolve discrepancies and clarify code definitions, consistent with qualitative approaches emphasizing meaning-making and interpretive agreement. Several steps were taken to enhance the trustworthiness of the qualitative findings. Preliminary themes were presented at a professional conference and discussed with peers from other institutions, providing opportunities for peer debriefing and external reflection. Feedback from these discussions informed subsequent refinement of themes and contributed to the development of an analytic framework presented later in this paper (Figure 3).

Representative participant quotes were selected to illustrate key findings and to provide contextual depth to the quantitative results, which served a supportive role in triangulating and confirming, rather than determining, the qualitative themes. Integration of the quantitative and qualitative components occurred at the interpretation level, with TAICS results informing how themes were contextualized and discussed, and qualitative findings explaining patterns observed in the descriptive survey data.

RESULTS

Analysis of focus group transcripts revealed five interrelated themes that describe how preservice teachers make sense of AI within their developing teaching identities. Although the study's emphasis was qualitative, the TAICS was administered to situate these insights. Quantitative results from the TAICS indicated that preservice teachers felt most confident using AI for idea generation and lesson planning but reported lower confidence in using AI for assessment or for providing feedback to students. These quantitative patterns provided a meaningful backdrop for interpreting the focus group themes, which revealed why preservice teachers felt confident in some aspects of AI use and cautious in others.

Quantitative Findings

Participants' overall AI competence self-efficacy scores ranged from 2.82 (slightly lower self-efficacy) to 4.23 (higher self-efficacy). The mean score on the TAICS Scale was 3.63, suggesting a moderately high level of confidence in AI-related competencies overall. Among the six dimensions of AI competence measured by the TAICS Scale, participants reported the lowest self-efficacy in AI Assessment ($M = 2.85$, $Range = 1.50 - 4.25$) and the highest in Human-Centered Education ($M = 4.03$, $Range = 3.75-4.75$) and Professional Engagement ($M = 4.00$, $Range = 3 - 4.75$).

Qualitative Findings

Analysis of focus group transcripts revealed that preservice teachers hold nuanced and evolving views of AI. Their perceptions reflect both optimism and apprehension as they negotiate AI's place within their emerging teacher identities. Five themes illustrate their experiences using AI within pedagogy coursework.

AI as a Catalyst for Efficiency and Creative Brainstorming

Preservice teachers repeatedly emphasized that AI's strongest value lies in accelerating the early stages of lesson design. When students experienced "blank page" anxiety or lacked inspiration, AI served as a starting point, rather than a final product. As one participant explained, "I think AI can be useful when generating ideas... if you don't know where to start". Another described how manageable AI becomes when used intentionally: "If I ask it one question at a time, like objectives, it gives good ideas."

Rather than relying on AI to produce a complete lesson plan, participants found value in using AI to generate specific components: lesson objectives, exit tickets, example discussion questions, or differentiation ideas. This reflects a shift from viewing AI as a comprehensive planning tool to seeing it as a collaborative brainstorming partner.

These experiences mirror the quantitative data; preservice teachers rated themselves most confident in AI competencies related to ideation, drafting lesson components, and generating examples. When AI served to streamline the early stages of planning, students described feeling empowered rather than dependent.

AI Generates Content, But Teachers Must Interpret and Evaluate It

Despite recognizing efficiency gains, participants were quick to highlight AI's limitations and the necessity of professional judgment. Students described routinely revising AI outputs, checking alignment with standards, and adjusting

acing to make content developmentally appropriate. One participant noted, “Everything has to be proofread regardless because AI cannot be trusted to be entirely accurate.” Another shared frustration with AI’s unrealistic expectations for instructional pacing: “It gave 10 things to do in 45 minutes...that’s just not possible in a classroom.”

These reflections suggest that preservice teachers are not passively accepting AI output; instead, they are actively evaluating and modifying AI-generated content, demonstrating both pedagogical decision-making and emerging critical AI literacy. The quantitative findings support this: while students felt confident in using AI to generate materials, they expressed less confidence in using it to adapt or evaluate materials for appropriateness. The qualitative data illuminate this gap; preservice teachers recognize that the value of AI depends on their ability to revise and refine its output.

Course Culture Shapes Confidence and Willingness to Experiment

Participants described receiving contradictory messages about AI use across coursework. In education classes, faculty modeled AI use, encouraged experimentation, and facilitated conversations about instructional purpose and ethical use. In contrast, participants reported that most non-education faculty discouraged or prohibited AI outright. As one explained, “All my other professors say no AI... you’re not supposed to use it.”

This discrepancy resulted in feelings of uncertainty and confusion. The supportive culture in teacher preparation courses legitimized AI as a tool worth exploring, whereas prohibition in other courses positioned AI as inherently unethical or academically dishonest. Students attributed much of their growth in confidence to structured experimentation in pedagogy courses, reflected again in TAICS scores, indicating greater confidence in planning-focused tasks. The supportive culture in pedagogy courses made AI use feel *legitimate and purposeful*, whereas prohibition in other courses positioned AI as academically suspect or unethical.

Preservice Teachers View Feedback and Assessment as Human Work

A striking tension emerged around assessment; while preservice teachers welcomed AI for planning and idea generation, they resisted using AI for feedback or grading. Students felt that AI-generated feedback threatened authenticity and the relational nature of teaching. One participant said, “Students would notice... it feels robotic. They’d feel like you don’t care.” For these preservice teachers, grading is part of who they are becoming as teachers.

This finding aligns with the lowest TAICS subscale scores, which were the items measuring confidence in using AI for assessment and feedback. The

qualitative data show why: participants linked assessment to care, connection, and teacher identity dimensions that AI, in their view, cannot replace.

Responsible Use Requires Explicit Instruction, Not Prohibition

Participants expressed that AI literacy should be intentionally taught. They worried that banning AI simply forces students to “figure it out on their own,” often leading to misuse. As one argued, “Teach them how to use AI well... so they learn the line between brainstorming and cheating.” These preservice teachers believe K–12 students will use AI regardless of rules, making instruction in ethical use essential.

Together, the quantitative and qualitative findings illustrate an important developmental arc: Preservice teachers see AI as a valuable idea-generation partner that can reduce planning load and stimulate creativity, yet they draw clear lines around tasks that require human judgment, authenticity, and relationship-building. Their confidence is highest when AI is embedded into coursework and used in ways that honor professional judgment, and lowest when AI threatens the human dimensions of teaching.

DISCUSSION

This embedded mixed methods study examined preservice teachers’ perceptions of AI and their developing competence in using AI for instructional design. The quantitative TAICS results indicated moderately high overall AI competence self-efficacy, with the highest confidence in Human-Centered Education and Professional Engagement, and the lowest confidence in AI Assessment. These findings were reinforced through the qualitative focus group analysis: Preservice teachers described AI as a valuable partner for brainstorming and increasing efficiency, yet they expressed discomfort with using AI for assessment or feedback because those tasks were perceived as tied to authenticity, relationships, and teacher identity. These findings suggest that preservice teachers’ views of AI are shaped not only by perceived utility, but also by how AI aligns with their emerging sense of professional responsibility.

Across the qualitative data, preservice teachers’ engagement with AI reflected a consistent tension between efficiency and professional responsibility, shaped by course-level norms and emerging ethical commitments. Rather than treating AI as a uniform solution or threat, participants articulated context-dependent judgments about when AI supported instructional work and when human judgment needed to take precedence. Together, the data illustrate those preservice teachers value AI when it supports, rather than supplants, their professional judgment. Confidence grows when AI use is modeled, contextualized, and integrated into coursework.

Interpretation by Research Question

RQ1: How do preservice teachers perceive the benefits and challenges of using AI for instructional design?

Preservice teachers saw AI as a productive “idea generator,” especially during early planning stages when faced with “blank-page” uncertainty. AI reduced task load and helped generate lesson components such as objectives, exit tickets, and differentiation ideas. However, students expressed consistent concerns about accuracy, unrealistic pacing, hallucinations, and the need to revise AI outputs for developmental appropriateness. These findings echo research that AI can accelerate planning but requires teacher oversight and pedagogical reasoning (Powell & Courchesne, 2024; Hashem et al., 2023). Importantly, preservice teachers did not interpret these limitations as reasons to reject AI altogether; instead, they framed them as evidence that AI must remain subordinate to pedagogical reasoning and professional judgment.

RQ2: How do preservice teachers’ experiences using AI in pedagogy courses influence their confidence (self-efficacy) in AI-related competencies?

Data showed that structured experiences in pedagogy courses increased confidence. Participants felt empowered to experiment with prompts, compare platforms, and critically evaluate AI-generated lesson plans. In contrast, courses outside teacher preparation tended to prohibit AI, positioning it as academically dishonest rather than a tool for instructional reasoning. Thus, teacher preparation coursework served as a psychological “permission zone” where AI was framed as a pedagogical aid instead of a shortcut. The findings indicate that self-efficacy with AI develops through guided practice and modeling, not merely through informal or personal use of AI tools.

RQ3: In what ways do preservice teachers describe ethical and responsible use of AI in teaching contexts?

Participants believed that their future students will use AI regardless of policy and argued that responsible use must be taught, not banned. They articulated a nuanced ethical stance: Brainstorming with AI is acceptable, while outsourcing thinking or assessment to AI is not. They viewed teachers as central to modeling ethical, transparent decision-making around AI, aligning with emerging literature calling for explicit instruction on ethical AI use in teacher preparation (Gouseti et al., 2024; Falloon, 2020). Rather than reflecting resistance to technology, these views reveal how preservice teachers link ethical AI use to teacher identity and professional responsibility.

Contributions to the Field

This study extends the emerging body of research on AI in teacher preparation programs by foregrounding the voices and lived experiences of preservice teachers. While much of the existing literature emphasizes the functional capabilities of AI tools or explores faculty concerns and instructional strategies, fewer studies focus on preservice teachers' sensemaking as they navigate AI expectations in coursework. By privileging their perspectives, this study reveals the complexities and tensions that preservice teachers experience as they learn to integrate AI into their instructional planning.

Additionally, this study demonstrates that structured and guided exposure to AI within pedagogy courses is a critical factor in developing self-efficacy, rather than the mere availability of AI tools. Quantitative TAICS results and qualitative focus group data converge to show that preservice teachers do not automatically transfer personal or informal experience with AI into professional practice. Instead, confidence grows when AI use is modeled, framed as part of professional decision-making, and embedded in authentic instructional tasks. This finding underscores the central role of teacher preparation programs in shaping preservice teachers' AI-related judgment, not just their technical skill.

Finally, this study contributes a new insight to the field: Teacher identity functions as a boundary for acceptable AI use. Preservice teachers consistently positioned certain instructional tasks as fundamentally relational and therefore inappropriate for delegation to AI. Rather than viewing AI avoidance in these areas as a technical limitation, participants described these boundaries in terms of professionalism, authenticity, and care for students. This reveals that decisions about AI in the classroom are not purely cognitive or efficiency-based; they are tied to preservice teachers' emerging sense of themselves as ethical educators. Together, these contributions position the demands of AI literacy for preservice teachers as a conceptual lens for understanding how novice teacher identity shapes acceptable AI use.

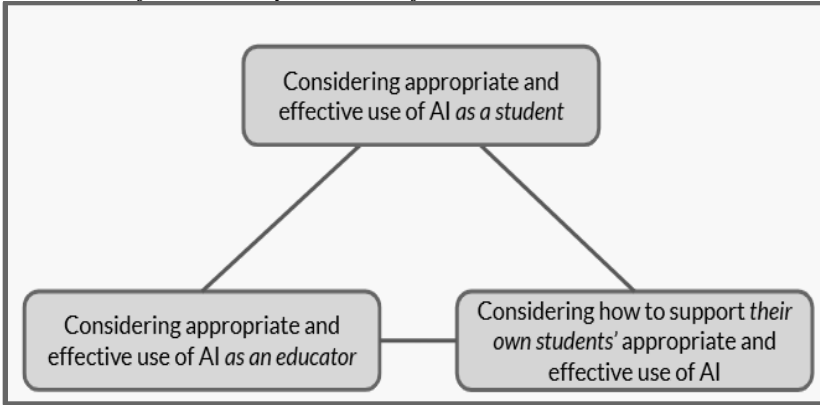
IMPLICATIONS

Findings from this study suggest that preservice teachers are not simply learning how to use AI as a productivity tool; rather, they are navigating three interconnected and developmentally complex roles, a framework we refer to as The Triad of AI Literacy Demands for Preservice Teachers (Figure 3). The Triad of AI Literacy Demands is presented here as an emergent, data-grounded framework that synthesizes preservice teachers' reported experiences and sensemaking about AI use within coursework, rather than as a fully developed or prescriptive model. As preservice teachers engage with AI during coursework, they must learn to use AI as learners, as future educators, and as ethical guides for

K–12 students. Each layer introduces distinct expectations and requires different forms of judgment. This framework helps surface the multiple, embedded dimensions of AI-related work that preservice teachers are already navigating, even in the early stages of AI integration.

Figure 3

The Triad of AI Literacy Demands for Preservice Teachers



First, preservice teachers must learn to use AI as students. This involves developing foundational AI literacy, including skills in prompting, evaluating the accuracy and appropriateness of AI-generated content, and revising outputs to reflect disciplinary knowledge and developmental needs. Participants in this study demonstrated that initial engagement with AI often involves experimentation and uncertainty, and that confidence increases when teacher educators provide explicit modeling and guided practice. This suggests the value of structured, low-stakes learning opportunities, such as guided prompt revision or comparison of AI-generated and human-authored lesson components, that allow preservice teachers to build competence while critically evaluating AI output.

Second, preservice teachers must learn to use AI as educators. This involves determining when AI meaningfully enhances lesson planning, differentiation, or curriculum design, and when it risks oversimplifying or misrepresenting content. Rather than uncritically adopting AI suggestions, participants described weighing AI-generated ideas against their own developing pedagogical reasoning. In this way, preservice teachers use AI not as a replacement for planning but as a catalyst for professional decision-making. For teacher preparation programs, these point to the importance of assignments that foreground pedagogical judgment, such as revising AI-generated lesson plans or justifying decisions to accept, modify, or reject AI suggestions, rather than treating AI use as a technical skill in isolation.

Third, preservice teachers must prepare to teach their future students to use AI responsibly. Participants recognized that K–12 students will encounter AI tools

regardless of school policy and believed that teachers have a responsibility to model ethical use, emphasizing transparency, academic integrity, and boundaries around where AI can and cannot be used. In this study, preservice teachers wrestled with moments when AI-supported learning and when it threatened authenticity or diminished relational elements of teaching. These reflections demonstrate that ethical AI use is not solely technical but deeply tied to teacher identity and professional values. This finding underscores the need for teacher educators to explicitly model ethical reasoning around AI use, rather than relying on prohibition or informal guidance.

Collectively, these implications point to a need for teacher preparation programs to intentionally embed AI into methods courses, rather than positioning it as an optional or peripheral skill. Programs can support preservice teachers by providing scaffolded opportunities to practice prompting, evaluating, and revising AI output; teaching critical AI literacy as a core professional competency; and creating classroom cultures where discussing ethical tensions is normalized. While this exploratory study does not warrant immediate programmatic or policy mandates, the Triad offers a useful lens for thinking about how AI-related learning opportunities might be coherently designed and studied across teacher preparation coursework. When AI is integrated into coursework in thoughtful and reflective ways, preservice teachers begin to move beyond viewing AI as a shortcut and instead understand it as a tool that requires intentional, informed, and ethical judgment.

Limitations

Several limitations warrant consideration when interpreting these findings. This study was conducted with a small sample of preservice teachers from a single teacher preparation program, which limits generalizability. Participation was voluntary, which may mean that individuals who already had an interest in AI, or who felt more confident discussing their experiences, were more likely to participate. As a result, the data may not fully represent the range of perceptions held by preservice teachers who are less comfortable with or more skeptical of AI use. Additionally, AI is a rapidly evolving technology, and preservice teachers' perceptions are likely to shift as tools become more sophisticated and integrated into educational systems. The study captures a snapshot in time during a moment of rapid innovation, and what preservice teachers view as possible or ethically appropriate may change within short periods. These limitations are typical of early-stage research on emerging technologies and further underscore the need for continued inquiry into how AI is understood and enacted in teacher preparation. These limitations are characteristic of early-stage research on emerging technologies and point to the need for continued, iterative investigation.

CONCLUSIONS

Future research should continue to examine preservice teachers' development of AI competence over time. Because this study captures perceptions at a single point in their preparation, longitudinal research following preservice teachers into student teaching and their early years in the classroom would deepen understanding of how AI practices and ethical stances evolve with real classroom responsibility. Comparative research across programs, particularly between those that prohibit AI use and those that intentionally model and scaffold it, may also reveal how program culture shapes preservice teachers' confidence and judgment. In addition, research is needed on the design and impact of explicit AI ethics instruction in teacher preparation, as preservice teachers in this study expressed a desire for structured conversations and modeling around responsible use.

Preservice teachers are entering the profession during a moment of profound technological transformation. While AI can accelerate planning and spark creativity, its value ultimately depends on the teacher's judgment: When to use it, when to question it, and when human presence matters more than efficiency. This study demonstrates that when teacher educators create supportive spaces to explore AI, preservice teachers develop confidence not only in using AI effectively, but in discerning when not to use it. AI is not replacing teachers; rather, its limitations illuminate what is distinctly human about teaching: relational connection, professional judgment, and ethical decision-making.

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