Can artificial intelligence replace human teachers? Preservice teachers' perspectives on AI in education through the TPACK framework

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Abstract

Purpose – This study investigates how preservice teachers perceive the role of artificial intelligence (AI) as a non-human instructor in both higher education (HE) and mainstream school contexts. It also examines their views on the potential for AI to replace human teachers in the professional workforce and the broader impact of AI on teaching and learning delivery.

Design/methodology/approach – A participatory research design was employed with preservice teachers enrolled in a postgraduate education degree programme at a university in China. Data collected from 76 participants via a virtual learning environment (VLE) classroom online forum were analysed through thematic analysis. 48 comments and discussion threads were identified to capture prevailing attitudes, with the TPACK framework serving as a heuristic analytical lens.

Findings – Preservice teachers expressed interest in the pedagogical possibilities of AI, particularly its capacity to support and enhance instructional practices. However, they remained sceptical about AI's ability to replicate the nuanced, relational and context-sensitive roles of human educators. The study, therefore, recommends positioning AI as a collaborative tool in teaching, rather than as a replacement for human teachers. These findings are drawn from a larger study examining participants' views of their future as educators alongside their evolving uses of AI technologies, online habits and gamification practices. This means responses reported were contextualised within a broader pattern of AI literacy and digital nativity.

Originality/value – This research contributes to emerging discourse on AI integration in education by providing context-specific insights into how preservice teachers in global educational contexts envision the future of teaching in a post-digital era. It highlights the importance of balancing technological innovation with the irreplaceable human elements of education.

Keywords Artificial intelligence, Preservice teachers, TPACK framework, AI literacy, Higher education

Paper type Research article

1. Introduction

Artificial intelligence (AI) is reshaping higher education (HE) and mainstream schooling. Generative AI (GenAI) has introduced new possibilities for enhancing instructional practices, student-focused personalised learning and augmenting marking, mediation and feedback in assessment practices (US Department of Education, 2023). Educators are now exploring AI's potential to assist with lesson planning, provide autonomous guidance and extend support beyond traditional classroom constraints, temporal concerns and spatial locations (UK Parliament POST, 2025). As a result, preservice teachers represent the next generation of educators who will shape how AI is implemented in future classrooms. Their perspectives are therefore important not because they can predict the future of AI in education, but because their beliefs, skills and professional identities will shape how these technologies are adopted and

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implemented in practice. As individuals currently undergoing teacher education, or studying more broadly the concepts of pedagogy, practice and educational transformation, preservice teachers are forming attitudes toward technology that may shape future teaching approaches. They join the workforce at a seminal moment that is reshaping not only how teaching occurs in the age of AI but also who or what may deliver aspects of instruction. Hence, this suggests changing boundaries around graduate destinations and workforce learning (Day, 2024). Such an idea becomes especially relevant as students, at every level of education, require disciplinary knowledge and skill development at the core of their curricula, as educators themselves require new skills and competencies to deliver this learning. This is necessary, and reported, to help educators navigate this rapidly changing AI landscape (see Luo and Day, 2026).

Hence, examining their perceptions of AI can provide insight into how emerging educators interpret the opportunities and challenges associated with AI in education, particularly in a field where research on AI within preservice teacher education, and more broadly on how AI is reshaping teaching practice, remains emergent. Meanwhile, questions remain about whether AI can truly replicate the nuanced, interactive and relational roles humans play in teaching and learning, and whether they can replace teachers in the classroom, a point that may create a sense of AI anxiety, among such preservice teachers, in moving towards future careers (Smutny and Schreiberova, 2020). Consequently, capturing pre-service educators' perspectives helps to understand what the landscape may become, and how AI tools may be used, or institutionalised. While research has focused on AI's technical capabilities and ethical implications like academic malpractice, fewer studies have examined how students, especially those training to become educators, perceive AI's role as a teacher (Zawacki-Richter *et al*., 2019). To this end, a research question (RQ) was adopted:

RQ1. How do preservice teachers studying education perceive the potential of AI, and the extent to which they believe it can replicate or replace the interactive and supportive functions traditionally provided by human teachers?

This study, therefore, makes an original contribution by examining how preservice teachers, representing the next generation of the teaching workforce, perceive the role of AI as a potential non-human instructor. While much existing literature focuses on technological capabilities or in-service teacher adoption, this research foregrounds the perspectives of future educators and interprets their views through the technological pedagogical content knowledge (TPACK) framework, situating AI within the broader pedagogical relationship between technology, teaching practice and disciplinary knowledge. Methodologically, the study demonstrates rigour through a qualitative design analysing over 11,000 words of participant reflections collected via a virtual learning environment (VLE) forum, with TPACK operating as a sensitising analytical frame. The study therefore offers educational development insights for teacher education policy and practice, highlighting the need for initial teacher training programmes to develop AI literacy, ethical awareness and critical engagement with AI tools (see Oh and Ahn, 2024).

2. Literature review

The integration of AI into the training of teachers helps educators conceptualise the interplay between technology, pedagogy and content. Mishra (2019), for example, has advanced the original TPACK model by highlighting the role of contextual knowledge, emphasising that teachers' ability to integrate technology effectively depends not only on their mastery of subject matter but also on their responsiveness to institutional, cultural and technological contexts. This reconceptualisation of TPACK underscores the complexity of preparing teachers for AI-enhanced educational environments. Chen (2025) builds on this and argues that teachers' professional growth and institutional training pathways are interrelated and must therefore adapt symbiotically to the demands of AI. Similarly, Xu and Li (2025) demonstrate

that cultivating teachers' digital literacy through the TPACK framework requires both strategic training and systemic support, suggesting that sustainable teacher preparation cannot be divorced from institutional and curricular realities. Together, these studies frame the key themes discussed in this literature review.

2.1 AI in education: opportunities and challenges

Research foregrounds that while AI can automate administrative and instructional tasks, its impact is likely to be as an assistive tool. AI systems are increasingly found to be capable of handling teaching duties, such as grading and attendance, delivering adaptive, personalised learning (Chan and Tsi, 2023; Treve, 2024; Chen, 2025). These technologies can reduce teacher workload and offer tailored content, resulting in measurable improvements in student engagement. For instance, AI has been associated with increases in student grade point averages and completion rates, as well as fostering innovative thinking skills (Treve, 2024). Yet surveys of educators suggest that the majority view AI as a supportive tool rather than a substitute, emphasising its role in scaling personalised instruction while maintaining essential teacher–student relationships (Chan and Tsi, 2023).

Discussion has highlighted that AI adapts instructional content to meet individual student needs (Treve, 2024). Meanwhile, its impact on administrative efficiency has been noted, with AI automating repetitive teaching tasks, which allows teachers to devote more time to complex pastoral responsibilities (Chan and Tsi, 2023). This has led to discussion about the inevitable workplace role and transformation of the position of a teacher, transitioning from information deliverers to AI-enabled facilitators and mentors, focusing on higher-order skills and emotional intelligence, whilst encouraging AI to guide lower-order aspects of study, teaching and learning (Puri and Mishra, 2020). This has led to exploration of whether AI can promote innovation in pedagogy and how educators adopt the technology (Mishra *et al*., 2023). AI tools have been suggested, across studies, to encourage creative problem-solving and adaptability among students, preparing them for a changing world where AI skills will be a part of their future employment and workplace environments (Treve, 2024).

Effective integration, however, has been suggested to require robust teacher training preparation, alongside institutional infrastructure and careful attention to the limitations of AI in addressing social and emotional aspects of learning (Chan and Tsi, 2023). Zawacki-Richter *et al*. (2019) suggest AI is primarily best-deployed for administrative support, to build strategies for personalised learning, rather than embedding it into curriculum and teaching. Meanwhile, Williamson and Eynon (2020) similarly argue that while AI can automate processes, it cannot replicate the relational and ethical dimensions of teaching central to educational practice (Ayanwale *et al*., 2024). Discussion on the role of technology in the learning process has long situated the need for considering how to embed the development of using technologies into the curriculum to foster graduate skills destinations and lifelong learning capacity. Prensky (2008), for example, highlighted the need for education to prepare students for the future, not the past and urges teachers to embrace technology at a curriculum design choice level. This has been suggested in studies to help foster future-ready skills (Day, 2026).

2.2 Preservice teachers' perceptions of AI

Recent scholarship (2023–2025) highlights a rapidly expanding body of work examining preservice teachers' perceptions of AI and its role in supplementing and, perhaps, assuming responsibility for the delivery of teaching. Preservice teachers have been shown to recognise AI's potential to support lesson planning, assessment and differentiated instruction, particularly in science and language education (Acquah *et al*., 2024; Pokrívčáková, 2024; Mnguni *et al*., 2024). Generative AI tools are also suggested as promising for leading and developing inquiry-based pedagogy, creative lesson design and professional learning (Ramnarain *et al*., 2024; Meegan *et al*., 2025; He *et al*., 2025). Yet, some studies identify

preservice teachers' enthusiasm is tempered by ethical and professional concerns, notably that AI can become a crutch for both teachers and students alike (Meegan *et al*., 2025). The importance of AI literacy and targeted teacher education is a core focus across recent research. For example, studies employing frameworks such as the technology acceptance model (TAM) and the theory of planned behaviour demonstrate that intentions to adopt AI are closely tied to perceived usefulness, ease of use and digital self-efficacy, which influences their curriculum design (Sanusi *et al*., 2024; Yang *et al*., 2024; Zhang *et al*., 2023; Runge *et al*., 2025). Training programmes encouraging AI literacy interventions have therefore been shown to enhance both confidence and preparedness amongst preservice teachers for AI integration (Abdulayeva *et al*., 2025; Laru *et al*., 2025).

At the same time, studies have also highlighted that their attitudes are shaped by broader social and motivational factors such as collaboration, innovation and agility (Şimşek *et al*., 2025; Alagöz Hamzaj *et al*., 2025; Liu *et al*., 2025). Importantly, caution has been raised that preservice teachers often lack the ability to critically evaluate AI outputs, due to lack of AI literacy, underscoring need for novel teacher training design (Adigun *et al*., 2025). There is, of course, contextual variability of preservice teachers' views regarding AI. Cross-national studies in Africa, Asia and Europe demonstrate that institutional conditions, disciplinary specialisms and cultural expectations shape teacher readiness (Guan *et al*., 2025; Karataş and Yüce, 2024; Alejandro *et al*., 2024). In lower-resource contexts, AI is often framed as a tool to reduce workload and address inequities in teaching provision (Acquah *et al*., 2024), whereas in digitally enriched settings the emphasis lies on pedagogical innovation and AI-TPACK informed curriculum development (Runge *et al*., 2025). Despite these differences, a growing consensus suggests that AI may reshape professional roles, positioning educators as facilitators, critical evaluators and ethical decision-makers in AI-enhanced classrooms, redefining the traditional role of the educator (Zhang *et al*., 2023; Guan *et al*., 2025).

2.3 Teachers' broader attitudes towards AI

Hence, while studies recognise AI's potential for personalising learning and automating feedback, they highlight concern about it undermining the role of teachers. Qin *et al*. (2020), for example, found that trust in AI-based educational systems in Chinese educational settings is shaped by transparency, reliability and perceived usefulness, but note that teachers remain cautious about delegating core teaching functions to AI. Oh and Ahn (2024) meanwhile highlighted AI's shortcomings in replicating teachers' socio-emotional capabilities. Wood *et al*. (1976), after all, provided seminal work that suggested the foundational concept of scaffolding requires human perplexity, thereby emphasising that effective learning support often requires nuanced and responsive human interaction. Therefore, while computer-based and AI-driven scaffolds can support skill development (Proske *et al*., 2012; Reiser, 2004), the dynamic, adaptive nature of human scaffolding aligns more effectively with social-emotional learning, which AI can struggle with and thus cannot replace (see Day, 2023).

Kim and Kim (2022) also suggest that teachers' perceptions of AI-based tools are shaped by their familiarity and perceived usefulness. Yurtseven *et al*. (2020) reinforce this, affirming that effective professional development must be tailored to teachers' specific needs. Teachers, then, report that hands-on experience with AI tools increases their awareness of what the technology can do and enhances receptiveness to its future adoption (Kim and Kim, 2022). However, they have been suggested to be reluctant to use AI to teach due to lack of understanding about data privacy and digital divisions (Williamson and Eynon, 2020; Qin *et al*., 2020; Aghaziarati *et al*., 2023). Zimmerman (2006) notes that resistance to change, anxiety about new technologies and a preference for established methods can act as barriers to experimentation and learning in digital skill development (Wood *et al*., 2005).

Teachers' willingness to embrace AI is also shown to be influenced by their pedagogical beliefs, prior experience and the perceived effectiveness (Ryu and Han, 2018; Day, 2024). Karataş and Yüce (2024), however, explored preservice teachers' views and found that their

sample viewed AI as beneficial for enhancing education and tailoring learning to individual needs. This also echoes findings by Yang (2021). Both studies argue clearer guidance is needed; Zhai *et al*. (2020) propose a framework for machine learning-based assessment, suggesting that AI can move beyond simple substitution of human tasks to fundamentally redefining assessment in the classroom, reducing pressure on teachers. Meanwhile, preservice teachers generally perceive AI as a valuable adjunct for administrative tasks, personalised feedback and scaffolding complex learning. For example, recent studies on educational chatbots, such as those reviewed by Smutny and Schreiberova (2020), highlight AI's ability to offer instant feedback outside traditional classroom hours, thus expanding learning opportunities and accessibility. However, these systems are limited in their ability to interpret nuanced student questions, with students reported in studies as preferring to engage face-to-face due to social and cultural inclinations (Roll and Wylie, 2016; Waters and Day, 2022).

While AI systems offer powerful tools for personalising instruction, supporting assessment and managing learning processes, literature indicates that replacing teachers entirely remains both technically unfeasible and pedagogically undesirable (see Luckin and Cukurova, 2019; Holmes *et al*., 2021). AI-powered systems, such as intelligent tutoring systems (ITS) and adaptive learning platforms, are designed to analyse learner data and deliver personalised feedback (Radford *et al*., 2019). These tools can provide individualised learning pathways, identify misconceptions and allow for self-paced progression, functions that have proven useful in subjects like mathematics and language learning (Zawacki-Richter *et al*., 2019). Pane *et al*. (2015), for example, found that Carnegie Learning's "Cognitive AI Tutor" produced statistically significant improvements in algebra achievement across various settings in the United States. However, while AI can support certain instructional functions, teaching is fundamentally more than knowledge transmission. Luckin and Cukurova (2019) argue that educational technologies must be informed by learning sciences, which places emphasis on human-driven collaboration, emotional engagement and socio-cultural contextualisation.

Furthermore, ethical and practical concerns arise when considering AI as a replacement for teachers. Data privacy, algorithmic bias and lack of transparency in decision-making remain major obstacles (Holmes *et al*., 2021). AI systems often draw from large datasets that may contain historical inequalities, meaning that their recommendations can reinforce rather than redress disadvantage (Williamson and Eynon, 2020). In such models, AI supports the automation of routine tasks, such as marking or progress tracking, while teachers retain responsibility for higher-order functions like critical thinking facilitation, emotional support and classroom management (Luckin and Cukurova, 2019). Collectively, the studies discussed reinforce the point that AI should be harnessed as a collaborative tool that supports teachers and students, rather than replaces their agency. Day (2025b) indicates students adopt AI with increased complexity, for example in China where they assign aspects of culturally practiced "guanxi", or personified network capital, onto AI agents and chatbot technologies (Day, 2025a).

2.4 Global perspectives on AI in education and teacher training

Meanwhile, Tomczyk and Majkut (2025) surveyed 289 Polish teachers and found that perceived usefulness and prior digital competence were the strongest predictors of AI adoption. Similar findings are echoed in policy reviews from both the US Department of Education (2023) and UK Parliament (2025), which also reinforce that while AI can reduce teacher workload, improve resource allocation and personalise instruction, the final responsibility for educational quality remains with human educators. Ultimately, the consensus across research and policy is that AI's greatest value is to enrich, rather than diminish, the human dimensions of teaching and learning (Smutny and Schreiberova, 2020; U.S. Department of Education, 2023; UK Parliament POST, 2025). China, meanwhile, has

adopted a highly strategic, centralised approach to integrating AI into its education system, aiming to become a leader in AI-driven educational reform. China's "Digital Education Strategic Action Plan", for example, sets out a comprehensive vision for embedding AI across all levels of schooling by 2035 (Ministry of Education of the People's Republic of China, 2025).

This strategy emphasises not only the enhancement of digital competencies among teachers and students, but the alignment of AI initiatives with industry. AI education will become compulsory for all primary and secondary students from September 2025, with a minimum of eight hours of AI instruction per year, even for children as young as six (Asia Education Review, 2025). The curriculum is tiered: primary students are introduced to foundational AI concepts, junior high students engage with machine learning of AI outputs and senior high students focus on applied innovation and algorithm design. Teacher training frameworks are therefore being rapidly updated, yet concerns have been raised by educators about over-reliance, academic integrity and age-appropriate use (China Daily, 2025; CNBC, 2025). The Ministry's guidelines also urge schools to maintain lists of approved AI tools (China Media Project, 2025). Consequently, researchers have been encouraged to explore views of educators in China (Ministry of Education of the People's Republic of China, 2025; China Media Project, 2025).

2.5 TPACK as a framework for technology integration and AI adoption

The TPACK framework, developed by Mishra (2019), provides a comprehensive model for understanding the knowledge educators require to effectively integrate technology into their teaching practice. It extends Shulman's (1986) concept of pedagogical content knowledge (PCK) by introducing a technological dimension, recognising that effective technology integration involves a dynamic interplay between content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). For preservice teachers, who are navigating the complexities of the classroom while simultaneously developing their professional identity, TPACK offers a valuable lens for how they build confidence and competence in using digital tools; research, for example, suggests while many educators are digitally fluent in their personal lives, they frequently struggle to transfer this familiarity into classroom practice (Koehler *et al*., 2014). This highlights the importance of teacher education programmes that explicitly address the development of integrated knowledge through the TPACK framework.

Initial teacher training (ITT), as a core component to workforce learning, plays a crucial role in shaping preservice teachers' understanding of how technology can support learning. When TPACK principles are embedded into some ITT training and practicum experiences, this is not a universal component. Consequently, framing using TPACK preservice teachers' insights can help us to design learning activities that align with curriculum goals, make more effective use of digital tools and respond better to diverse learner needs. It is, then, a useful analytical model for framing continued professional development (Chai *et al*., 2013). However, developing TPACK around AI is not a straightforward process. It requires reconsidering how to merge AI and TPACK in iterative learning, use it to contextualise experience and promote critical reflection. Voogt *et al*. (2015), for example, argue that authentic classroom practice and mentoring are essential to cultivating TPACK, particularly when they promote experimentation and reflective risk-taking. Therefore, preservice teachers benefit from exposure to real teaching scenarios where they can engage meaningfully with digital tools, supported by experienced mentors. Furthermore, institutional culture and access to resources significantly influence how preservice teachers apply TPACK in practice. Niess (2011) for example suggested that supportive school leadership, access to appropriate technology and a culture of innovation can empower new teachers to integrate technology with purpose and creativity. In contrast, limited support may hinder even the best-prepared educators and determine how they adopt technology in teaching (Shulman, 1986).

Meanwhile, efforts to adapt TPACK as a framework to account for the integration of AI in educational practice are emergent. Researchers have proposed adaptations such as "intelligent-TPACK" or "AI-TPACK" to capture the additional competencies teachers require to evaluate AI outputs, address ethical considerations and integrate AI tools meaningfully into teaching and learning (see Celik, 2023; Ning *et al*., 2024). Empirical studies have also shown that teachers' ability to implement AI in classrooms is closely linked to their AI-related technological knowledge, pedagogical understanding and professional confidence in using emerging technologies (Runge *et al*., 2025; Hava and Babayigit, 2025). Other studies have focused on developing and validating instruments for measuring teachers' AI-TPACK competencies, demonstrating that structured training and professional development programmes can significantly enhance teachers' readiness to use AI tools for instructional design (Setiyawan *et al*., 2025; Tan *et al*., 2025). Within teacher education contexts, studies also emphasise the importance of preparing preservice teachers for AI-enhanced learning environments by integrating AI literacy and critical evaluation skills into teacher training programs (Radloff *et al*., 2025; Heine and König, 2025). More broadly, scholars argue that effective AI integration in education requires not only technical proficiency but also pedagogical reasoning and ethical awareness, positioning AI-TPACK as a critical framework for understanding how educators can responsibly incorporate AI technologies into teaching practice (Daher, 2025).

3. Methodology

Subsequently, to explore preservice teachers' views of the role of AI in teaching, learning and professional preparation, a qualitative approach was adopted, aligning with the need to capture not only attitudinal patterns but also the interpretive reasoning that preservice teachers employ when considering AI in their developing professional identities (Creswell and Plano Clark, 2018; Johnson *et al*., 2007). The study reflected a technology-enhanced learning (TEL) paradigm, and it was informed by the TPACK framework (Mishra, 2019). TPACK provided a sensitising lens for examining how participants who were students enrolled in a practice-focused postgraduate master's degree, related technological knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK). Although surveys formed part of a broader dataset and enquiry, this article reports only the qualitative analysis of digital forum discussions and explores the data that specifically explored discussion related to teaching and professional preparation or anticipated impacts on teaching and learning practice. Therefore, whilst the broader study employed a mixed-methods design, this article reports only the qualitative component.

3.1 Research overview

The study was embedded in a postgraduate MA programme in educational studies at an English-medium of instruction (EMI) Sino-British joint-venture institution in China. Participants were enrolled in a practice-oriented module on pedagogy, innovation and digital education as part of their MA-level training. Students came from a variety of backgrounds, including those already working in schools, with the majority intending to pursue careers in education. Therefore, a classroom-based pedagogical research approach was used to explore the topic outlined in this article through a series of seminars. These seminars formed a larger research study that examined the intersectional impacts of digital technologies, including AI, on teaching and learning, across different themes and dimensions. This classroom-embedded pedagogical scholarship approach allowed the researcher to explore authentic, situated responses. Data were collected through structured surveys, focus group-style seminar discussions, and a VLE discussion forum, with the latter serving as the primary source of qualitative data reported in this paper. This combination of tools was selected to capture both attitudinal breadth and

dialogic depth, methods that align with multi-method qualitative inquiry and triangulation (Denzin, 2012; Bryman, 2016).

3.2 Research participants, context and trustworthiness

76 students accessed the forum, of whom 75 contributed at least one post in a VLE forum activity. This data forms the foundation of this article. Forum participants were aged between 20 and 26, and approximately 76% were identified as female. Engaging students from a single academic degree programme reflected purposeful sampling (Patton, 2015). This sought to align responses attuned in lived, pedagogical experiences, enhancing the ecological validity of the findings. Their forum data encompassed 11,825 words, set across 34 pages; posts ranged between 53 and 434 words with a mean of approximately 160 words per post. This distribution shows both short, concise entries and longer, more elaborated reflections, which demonstrated variable engagement.

3.3 Data collection, instruments and reliability

In line with COPE guidance, other aspects of the larger dataset are reported (Day, 2025b, 2026). Consistent with COPE, no data are cross-reported, and each study addresses distinct questions. An IRB ethics approval was obtained: ID-AOFE11000068720230222195423. This reflected standard practice including participant information and opt-out rights clearly explained (Bryman, 2016). The digital discussion space was enacted on Moodle. Activity was open to comments over four weeks, whereby participants engaged with TPACK-aligned prompts on GenAI's potential to influence teaching and learning practice (Kozinets, 2020). Each instrument was designed to elicit not only attitudes but also the pedagogical reasoning, reflecting British Educational Research Association's (BERA) Ethical Guidelines (2018). To ensure participant anonymity, all forum posts were anonymised, IP addresses were not recorded and the discussion forum was permanently deleted after the study concluded; this reflects best practices in digital ethnography (Kozinets, 2020).

3.4 Data analysis, reliability checks and thematic interpretation

The asynchronous nature of the VLE forum allowed participants time to reflect, articulate and elaborate their views, resulting in more considered and expansive responses than those typically found in face-to-face or survey-based formats (Kozinets, 2020). While seminar and survey data were also collected and reported elsewhere (Day, 2025b, 2026), these sources were not cross reported in the primary analysis below, to avoid diluting the analytical focus and to allow for closer engagement with the specific language, metaphors and interpretive frames used by participants in the VLE. This methodological choice aligns with qualitative principles of thick description and interpretive depth (Geertz, 1973). Themes therefore emerged inductively from participants' contributions, while the TPACK model operated as a sensitising framework (Bowen, 2006). Yet, because TPACK was used as a qualitative sensitising framework rather than a rigid coding schema, participants' reflections were interpreted as broadly aligned with its domains rather than forced into discrete categories. The methodological approach used here recognises that technological, pedagogical and content knowledge frequently intersect in practice, particularly in qualitative discussions of emerging technologies such as AI. As such, some overlap is noted, creating fuzzy themes.

3.5 Analytical approach

Data were analysed using inductive thematic analysis, following Braun and Clarke's (2021) six-step method. In line with a postmodern orientation, the analysis was approached as a pragmatic iterative process, acknowledging multiple possible readings of the data rather than seeking a single fixed truth. Grounded theory principles informed the coding process, with iterative theme refinement used to ensure that emergent categories remained closely tied to the

TPACK codes and data (Charmaz, 2014; Corbin and Strauss, 2008). The inductive orientation was complemented by reflexive practices: the researcher acknowledges their own interpretive positioning shaped theme construction, so sought to distribute a full representation of coding, which was cross-checked across stages, with analytic decisions avoiding specific weighting or over-representation of a particular respondent's voice. Such reflexivity and transparency contributed to the trustworthiness of the findings by showing how meanings were constructed in dialogue between data, researcher interpretation and the theoretical lens. To prevent duplication, a second-coder audited the data used in quotes, tables and analytic claims across related manuscripts (Day, 2025b, 2026). Similarity detection tools were also used to assess potential text reuse. These procedures reflect and align with COPE guidance for managing large datasets (Bryman, 2016).

4. Findings

The discussions revealed a range of sentiments regarding AI as a non-human educator, based on the 48 quotations directly addressing the research question. Most coded quotations (60.4%) expressed positive views, indicating a favourable attitude towards the potential benefits of AI in education, such as enhancing teaching and learning experiences, rather than concern that it could replace teachers in the classroom. Meanwhile, 25% of the responses appeared neutral or ambivalent, suggesting that a proportion of participants remained cautious, or undecided. A smaller segment (14.6%) held critical perspectives, highlighting concerns about AI within teaching and learning. Overall, these views are summarised in Table 1:

Meanwhile, Table 2 suggests that, based upon an exploration of the number of times participants identified a particular code/theme, most felt AI was a helpful tool that improved teaching efficiency and personalised learning. However, they held concerns about academic integrity, alongside the potential for critical thinking reductions, amongst students and teachers alike. While worries about AI-related job loss were less common, perhaps due to their

Table 1. Analysis of data sentiment regarding AI as a non-human teacher

Stance	Number of quotes	% of total quotes
Positive	29	60.4
Neutral	12	25.0
Critical	7	14.6
Total	48	100

Table 2. Frequency of thematic codes identified in participant discussions

Theme	Number of quotations
AI as tool/assistant	23
Improved efficiency	17
Personalised learning	11
Academic integrity concerns	10
AI replacing effort/skills	9
Ethical guidance needed	8
AI hallucination/inaccuracy in T&L	5
Creativity/critical thinking loss	5
Digital literacy required	5
Employment impacts	2

preservice identity, participants did recognise the importance of using AI policy in educational settings, suggesting that they viewed it as an intrinsic feature of future workplaces.

The TPACK framework weaves together these strands of expertise, into a sensitising matrix organised around "Content Knowledge" (the subject matter to be learned), "Pedagogical Knowledge" (evidence-based strategies for how students learn that content) and "Technological Knowledge" (the digital tools available). Using the TPACK framework as an interpretive lens helps to illuminate how preservice teachers conceptualised AI in relation to planning, teaching and reflection. Participants' discussions frequently drew on overlapping technological, pedagogical and content-related considerations, illustrating how they positioned AI at the intersection of these knowledge domains.

4.1 Technological knowledge (TK)

Participants demonstrated awareness of AI as a technological tool, discussing its functions, limitations and broader societal implications. This reflects TK in the TPACK framework, where understanding focuses on the affordances and constraints of technologies themselves, rather than their direct pedagogical applications. Several participants articulated the importance of responsible engagement with AI. Participant D remarked *"... is a very worthy tool to learn and use, which can help the progress of human civilization."* Similarly, Participant E suggested that students were learning in an *"... age of information explosion and AI technology is being used more and more in our studies and work ... we need to control technology rather than be controlled by it."* Participant J framed AI, then, as an inevitable and beneficial technological advancement, discussing resistance to its adoption: *"AI can be considered as an unprecedented wisdom of the third technological revolution ... now why we need to resist AI?"*

Echoing this concern, Participant K stressed the importance of responsible use and control in classroom deployment, noting that *"... students are supposed to be in control of AI instead of being controlled by AI."* Participants also raised questions about the accuracy, reliability and integrity of AI-generated content. Concerns centred on students becoming over-reliant on AI, and the limitations of the technology in producing trustworthy outputs. Participant I, for instance, described AI as a rapid *"information integrator"* rather than an independent educator, observing that it *"... does not have the ability to write independently, it is more like you can search for information related to the tasks you give it in a very short time and integrate them."* Participant M similarly raised issues of academic integrity, warning that *"While it may lead to students using it to cheat on their papers, banning it may also lead to students being more interested in it, which has the opposite effect."* Taken together, these reflections demonstrate preservice teachers' grasp of AI's technological affordances, alongside a critical awareness of its risks. They recognised AI as a powerful tool but cautioned against uncritical adoption or overuse.

4.2 Technological pedagogical knowledge (TPK)

Beyond technological awareness, participants also discussed how AI could be applied in teaching and learning. These responses reflect technological pedagogical knowledge (TPK), where technology is understood in relation to instructional strategies, assessment and classroom practice. Several participants described AI as useful for supporting learning activities and teaching. For example, some acknowledged its role in familiarising students with exam formats, supporting information exploration and serving as a facilitator when used with a professionally minded attitude. Participant H highlighted the positive impact of AI on education, noting its ability to assume many responsibilities of teachers: *"There are many benefits that AI-based tools offer to improve education quality, such as automation of administrative work, including grading and providing feedback, and personalised or adaptive learning ..."* Similarly, Participant L suggested that AI *"... adds diversity of teaching design*

to the class which could attract students . . . students could use AI tool during personalised learning according to their interest . . ."

Across the forum dialogue, then, participants articulated both optimism and caution in considering how AI might be embedded into pedagogical practice. Participant A, for example, identified AI "*. . . can aid in my familiarization with the exam's structure and question types, it cannot entirely replace my preparation and thought. I could struggle on the actual test . . . I wouldn't have fully mastered the necessary information and abilities*." Likewise, Participant B felt that use of AI in teaching and learning is "*. . . related to people's mentality. If you take it as a useful tool to explore more information, it is a facilitator or a teacher*." However, discussion was present that suggested that early-career educators were concerned about the quality of AI's decision-making. Participant C, for example, remarked "*. . . it is also worth noting that there are issues with the citations in the articles . . . many of the actual answers it provides are inherently incorrect, cannot be used, and may be misleading*."

Participants D, E and F emphasised AI's strengths as a fast and professional knowledge source that could aid and enrich teachers' classroom practices. D, for example, noted that "*It provides quick knowledge for all people. And for the students, they would search for professional terms and some examining certificates' requirements directly. What AI searching is doing better is to filter the information to gain a higher probable answer, which saves a step for people to do*." Similarly, E highlighted that "*. . . professional questions. [AI] can give a more professional answer. He is also a good mind map*." F described AI as a "*. . . a teacher because it can provide you with accurate information and knowledge on any subject you want to learn about . . .*" In contrast, Participant G expressed concern that "*. . . students are now looking for artificial writing articles, if artificial intelligence can be less labor, then they will choose this*." G also echoed concern about the risk of AI-taught misinformation, stating that "*. . . it is important to identify and evaluate the reliable sources among the amount of information, which may overwhelm and mislead. Universities and institutions should teach students how to cope with such situations, select and analyse proper data, and make informed decisions . . .*" However, Participant H appreciated AI's creative potential to enrich and enhance their teaching and learning, saying it "*. . . allows it to provide me with some new ideas and broaden my mind*." Together, these participants highlighted a tension between AI's efficiency and professionalism and the need for critical thinking and academic integrity.

Participant W, however, disagreed that AI was useful; they felt that rapid adoption of AI in educational sectors would "*. . . lead to unemployment . . .*" echoing earlier concerns about the disruptive potential of automation in teaching. Yet W also felt that student learners' main "*. . . interest is still chatting with it to see what strange answers can be given, and only a few people use it for productivity . . .*" which contrasts with earlier views from O and Z, who saw AI as an already sophisticated tool that helps "*. . . learning be more individualized . . .*" enabling students to gain "*. . . advantages in dealing their learning and work*." Participant X's reflection echoed this, suggesting educators needed to "*. . . to use it in reasonable range. It can have conversation with people through human's language and it can chat with us like real human, even can write code, email, essay and other things like that . . . it is important for us to think about the positive function about this software*". This aligned with points raised by Participant P: "*. . . students need to be taught how to use it responsibly . . .*".

4.2.1 Linking TK and TPK. The distinction between TK and TPK was not always clear-cut in participants' reflections. While some responses focused on AI as a technological tool, many simultaneously extended these observations into pedagogical domains, illustrating how preservice teachers perceive technology and teaching as inherently interconnected. This overlap reflects the fluidity of the TPACK framework, where boundaries between domains are porous and often negotiated in practice. For these participants, awareness of AI's affordances (TK) frequently informed, and was informed by, their considerations of how such tools could be meaningfully integrated into classroom practice (TPK).

4.3 Content knowledge (CK)

Collectively, participants reflected a shared appreciation for AI's potential to support individualised and flexible learning, while also highlighting the need for responsible use and ethical guidance within educational settings. Participants N, O and Q emphasised that while AI would not become a teacher outright, they felt it could help educators enhance and make learning more personalised. Participant N, for example, noted that AI could "*. . . stimulate students' thinking by showing them more perspectives according to the issue they submit*." Student O described AI as "*. . . a useful tool to facilitate students' study, and that's a tool for students to solve their own problems . . . learning will be more individualized, which I believe would be beneficial for their study.*" Participant Q observed that AI "*. . . can dynamically generate answers and output them in text form, which provides more possibilities for users to personalize their needs*." Participant P, however, was more cautious and stressed the importance of responsible use by educators, suggesting that there was an expectation of them to integrate responsible AI education into their curriculum design: "*. . . artificial intelligence is a tool, so students need to be taught how to use it responsibly . . .*" Meanwhile, Participant R echoed this, and again focused on the educator's role, arguing, "*Teachers should be able to demonstrate in their teaching and research processes and incorporate the rational use of AI technology into the teaching of academic integrity and ethics*."

However, Participant S reflected on the broader context, suggesting that "*. . . coexistence with AI has been the future development trend of the human age*." Yet Participant U acknowledged AI's conversational strengths but warned of risks, stating it is "*. . . capable of generating high quality conversations, there are some issues and challenges. It can generate responses that are inaccurate, inappropriate or unethical, especially when it comes to sensitive or controversial topics*." Across the discussion, however, several participants, such as Participant V, stressed the importance of establishing clear guidance, for both teachers and students, over institutional prohibition, remarking that they felt "*. . . students who are not guided and instructed, they tend to have more serious consequences. So we shouldn't forbid something to happen in college, we should guide them reasonably so that they have a proper perception*."

4.4 Limited evidence of technological content knowledge (TCK)

When analysing the data, explicit evidence of TCK, which refers to the integration of technology with subject-specific content, was largely absent, as was explicit discussion of how such knowledge development may connect directly to mathematical, linguistic, or computational skills, within what may more broadly be termed AI literacy. Instead, participants' reflections centred on more general uses of AI, including administrative efficiency, assessment design, personalisation, and broader professional or ethical concerns that aligned, but did not reach an explicit analysis of TCK. While these ideas do not fully reflect TCK, they can be seen as loosely aligned with it, insofar as they gesture towards how AI might shape aspects of teaching and learning in practice. The lack of explicit TCK evidence is itself an interesting finding: it suggests that preservice teachers, still forming their professional identities, may not yet be envisioning AI in discipline-specific ways, highlighting both the developmental stage of their thinking and possible gaps in teacher education regarding subject-based applications of AI.

Participant X's focus on the positive potential and need for boundaries reinforces, therefore, the consensus generally felt across respondents that responsible education in the classroom and planning is critical as AI's capabilities expand. Participant Z felt whilst AI was unlikely to replace teachers, it had benefits for doing administration, so "*. . . finishing some time-consuming and almost meaningless work like summary report at the end of year that employees need to submit to their managers, people who are able to use it well clearly have advantages in dealing their learning and work*". This complemented earlier perspectives, such as raised by Participant L regarding AI's ability to enable more

personalised learning support. This perspective was framed effectively by Participant W's observation of "AI underutilisation", suggesting that digital literacy and proactive educator-use are increasingly valuable, but perhaps still not yet fully realised, as teachers may not be able to use it effectively to enhance teaching and learning due to lack of knowledge and training.

Participant AA, however, raised a different line of dialogue. They advocated for student-driven learning and moral education, stressing that students used AI to help "*. . . absorbing knowledge; universities should encourage students to learn by their interests, to know more about what students really need*." This echoed earlier concerns from M and K about the risks of misuse and the importance of ethical guidance. AA's suggestion to diversify assessment methods also aligned with L's and HH's emphasis on personalised and learning, which was seen as a repeated benefit. Participant BB recognised AI's value for professional development, especially in fields like educational studies and social sciences, but implicitly pointed out the irreplaceable role of "*. . . emotional empathy . . .*" highlighting the human qualities AI cannot replicate. This complemented Participant FF's assertion that learning "*. . . is not just intellectual indoctrination, so what AI does is not considered education at its root, it is just a tool to help us learn. At the same time, I think we must explicitly teach critical and creative thinking skills . . .*" and Participant DD's warning that if teachers over-rely on it, their students may end up lacking an "*. . . ability to think for themselves. Over time, they lose innovative thinking and critical thinking, which is a very scary thing. The difference between human and artificial intelligence is whether they have flexible thinking*."

4.5 Pedagogical content knowledge (PCK)

Consequently, Participant EE, LL, MM, and NN all praised AI's ability to enhance teaching efficiency and learning accessibility. EE described how AI enabled continuity in teaching:

> With the development of AI, the class mode of college students is gradually changing from physical to online class teaching mode. The importance of AI can be found here especially when major universities are unable to implement education programs during the epidemic and students have no way to arrive at school. In the way of knowledge transfer, the traditional basic concept knowledge can be vividly described through the change of artificial intelligence, which is convenient for college students to learn and understand. It enables teachers to avoid using boring verbal expressions in the teaching process to impart.

LL felt that "*. . . as a teacher, it also saves me some time on students' performance editing. For example, if I want to do some special effects for a video but I do not know how to do that, I can find the answer.*" Participant HH described it as "*. . . like an encyclopaedia-like teacher who can provide targeted answers to personalized questions posed by each learner, providing tailored assistance to students. For example, when students encounter knowledge that they do not understand during the learning process, and it is not convenient to ask the teacher questions, they can promptly ask*." While PP described it as increasingly "*. . . more like a teacher.*" Student II cautioned against over-reliance on AI technologies, however, as an early-career educator, stating that "*. . . technologies are not 'only means to promote educational innovation, nor are they the whole of educational reform. When we use new technology, we must maintain rationality and adhere to human subjectivity. Only in this way can we not lose our way in the digital ocean'.*" This resonates with the recurring theme of responsible, balanced use found throughout the responses, such as K, X and P. Participant KK, however, observed that the rapidly evolving landscape made it difficult for educators to determine when, how and what to teach students regarding AI, because they felt "*. . . it is not easy to change the way students learn in universities in one or two years, because quite a lot of students have different opinions on this new technology.*"

4.6 Consolidating technological pedagogical content knowledge (TPACK)

Collectively, participants across all categories emphasised responsible use, guided implementation, and ethical engagement with AI as foundational to its successful integration into teaching practices. The emphasis on AI having a narrow, repository-like ability to teach knowledge may reflect the more traditional, and rote-focused practices rooted in Chinese educational practices, given the study site being in mainland China. This may explain why such early-career educators saw more commonality in it as a teacher, rather than assistant. The findings of this study demonstrate preservice teachers viewed GenAI as both a practical pedagogical resource and a source of professional unease.

5. Discussion

These findings echo several wider studies. Pokrívčáková (2024) found EFL preservice teachers valued AI for supporting instructional practices but expressed doubts about its reliability, while Mnguni *et al*. (2024) documented similar tensions across educators in South Africa and Thailand. Likewise, Meegan *et al*. (2025) emphasised that teachers and students often conceptualise AI as a tool, not a crutch, a point echoed by Day (2026). As highlighted in Table 2, adoption attitudes were shaped by perceived usefulness, control, and professional identity. The framing of AI as an assistant rather than a replacement for teachers, among those in the participant sample, aligns closely with studies applying the Technology Acceptance Model (TAM), which emphasise perceived ease of use and digital self-efficacy as key predictors of intention to adopt AI (see Sanusi *et al*., 2024; Zhang *et al*., 2023; Liu *et al*., 2025). In addition, participants in this study, who described AI as a resource for fostering collaboration and innovation, appear to mirror findings that motivational and social orientations underpin preservice teachers' readiness to engage with generative tools (see Şimşek *et al*., 2025; Alagöz Hamzaj *et al*., 2025). The TPACK framework provided a useful interpretive lens here, particularly in relation to TPK. However, as Table 2 illustrates, little explicit evidence of technological content knowledge (TCK) emerged. This absence parallels broader research noting the underdevelopment of subject-specific AI applications in teacher education, particularly in STEM disciplines (Zhai *et al*., 2020; Ramnarain *et al*., 2024). The limited articulation of TCK by participants is itself instructive, suggesting that AI is being understood more as a general teaching aid than as a discipline-specific innovation in early-career stages.

These findings carry significant implications for teacher education, professional practice and policy. For teacher education, the results affirm the need for structured AI literacy interventions. Recent studies demonstrate that such training enhances confidence and pedagogical adaptability (Laru *et al*., 2025; Abdulayeva *et al*., 2025), supporting the integration of AI literacy within TPACK-informed curricula. For professional practice, participants' cautious optimism discussed above resonates with wider studies of in-service teachers, who similarly balance efficiency gains with concerns over autonomy (Tomczyk and Majkut, 2025; Guan *et al*., 2025). The alignment between preservice and in-service contexts suggests a continuity of professional challenges that should be addressed through professional development programmes foregrounding both technical AI proficiency and critical evaluative skills.

At the policy level, participants' reflections on ethical use, student dependency and professional responsibility can be situated within wider global reforms. In China, for example, the move to compulsory AI education from 2025 (see Asia Education Review, 2025; Ministry of Education of the People's Republic of China, 2025) intersects directly with preservice teachers' anxieties about AI overreliance and ethical application. Similar concerns underpin recent reviews in the UK and US, where policymakers highlighted the importance of equity, transparency and safeguarding human responsibility in AI-enhanced classrooms (UK Parliament POST, 2025; U.S. Department of Education, 2023). By connecting participants' voices to these policy debates, this study reinforces the position of preservice teachers as both

beneficiaries and gatekeepers of AI reforms. Their perspectives support partnership models where AI complements rather than replaces human teaching, aligning with arguments that effective educational technologies must preserve the social, emotional and ethical dimensions of practice (Luckin and Cukurova, 2019; Williamson and Eynon, 2020). The integration of Tables 1 and 2 consolidate these findings, showcasing a clear awareness that responsible AI integration into teaching and teacher training is essential. This is encapsulated in Figure 1, which describes an *AI-as-Educator Perception Framework* consolidating the study insights.

6. Conclusion

This study offers tentative, modest insights into preservice teachers' experiences with AI and digital technologies, but it has several limitations.

6.1 Limitations

The small sample, and single geographical context, restricts the generalisability of the findings. Data collection methods relying on self-reported responses in a digital forum inherently introduce biases, such as social desirability, observational pressure and selective participation, while the asynchronous nature of virtual discussions can limit depth and spontaneity. Moreover, the 48 quotations represent the subset of responses directly addressing

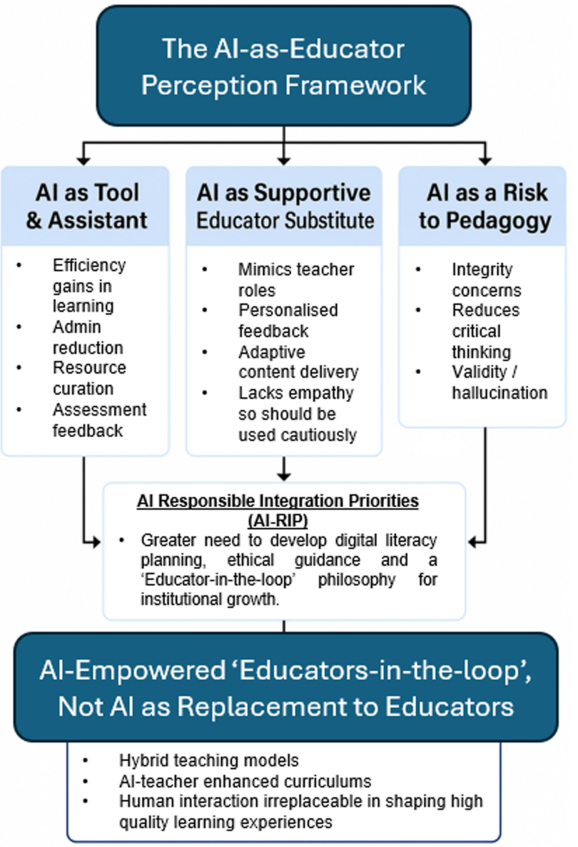

Figure 1. The AI-as-educator perception framework

the research question concerning AI as a potential instructional agent, hence are not framed in the wider discussions that took place. Additionally, the inductive grounded analysis, while flexible, is susceptible to interpretive variability. The technological requirements of the VLE may have also excluded participants with lower digital literacy, further narrowing the representativeness of the data. Moreover, the study captures a snapshot within a specific cultural context, which may not reflect evolving experiences of educators in other settings or over time.

A further limitation relates to the interpretive use of the TPACK framework as an analytical lens. While TPACK provided a useful conceptual structure for organising participants' reflections, qualitative reporting of themes through this framework inevitably creates areas of overlap between categories and may exclude entire discussions that fail to align to TPACK. In practice, preservice teachers' comments frequently touched on technological, pedagogical and content-related considerations simultaneously, making it difficult to assign responses exclusively to a single TPACK domain. This reflects the inherently "fuzzy" integrated nature of teaching knowledge but also introduces a degree of interpretive ambiguity when categorising qualitative data. As such, the themes presented should be understood as analytically aligned within TPACK rather than representing strict or discrete operationalisations of each component. The 48 quotations analysed represent the subset of responses directly addressing the research question concerning AI as a potential instructional agent; the mapping of these quotations to specific TPACK dimensions remains interpretive and may not fully capture the complexity or fluidity of participants' perspectives. Future research could address this limitation by combining qualitative analysis with more structured coding instruments or mixed-method approaches designed specifically to operationalise AI-TPACK constructs in the context of teacher training development (see Ayanwale *et al.*, 2024).

6.2 Policy implications for educators and their institutions

Despite the study's limitations, it provides valuable insight into the perceptions and digital literacy competencies that preservice teachers increasingly require, with clear implications for how training programmes and institutions can respond. Findings indicate that preservice teachers recognise AI as a powerful enabler of efficiency and personalisation but remain cautious about its limitations and ethical risks. This highlights the importance of embedding training on ethical, digital and critical literacies directly into teacher education curricula. These perspectives align with broader research emphasising the irreplaceable role of professional judgement and teacher–student relationships in learning (Luckin and Cukurova, 2019; Williamson and Eynon, 2020). For education degree providers, this suggests that teacher education should focus not on positioning AI as a substitute for pedagogy but as a complementary tool. To guide institutional policy and curriculum design, Table 3 outlines targeted recommendations as a curriculum framework for preservice educator ITT programmes, structured around findings from this study, noted as focus areas.

6.3 Concluding remarks

This study demonstrates that preservice teachers in China largely perceive AI as a supportive tool that enhances efficiency and personalisation, while recognising that it cannot replace the relational, ethical and empathetic dimensions of teaching (Day, 2025c). As a modest educational development study, this article situates participants' perspectives through the TPACK framework. In doing so, the findings highlight the need for teacher education programmes to move beyond basic technological familiarity and instead integrate AI literacy, ethical awareness and pedagogical application within ITT curricula. As AI technologies continue to evolve and become embedded within educational systems, preparing educators to critically engage with these tools will be essential. Strengthening these competencies within preservice training will help ensure that AI enhances, rather than diminishes, the professional judgement and human-centred practice that are fundamental to effective teaching.

Table 3. AI adoption framework for ITT programmes supporting preservice teachers

Focus area	Recommendation	Rationale
1. Digital Literacy Development	Integrate AI literacy modules within ITT curricula, focusing on both technical skills and critical evaluation of outputs	Addresses participants' concerns about reliability and accuracy of AI-generated content; aligns with calls for AI literacy in preservice teacher training (Laru *et al*., 2025; Abdulayeva *et al*., 2025)
2. Ethical and Professional Guidance	Provide training on ethical implications of AI use (e.g. academic integrity, data privacy, authorship)	Responds to participants' emphasis on the risks of misuse and concerns over professional judgement; aligns with broader policy debates (UK Parliament POST, 2025; U.S. Department of Education, 2023)
3. Pedagogical Integration	Embed AI within lesson planning and assessment design workshops, framed through TPACK	Supports preservice teachers' need to see AI as a pedagogical partner rather than a replacement, particularly within technological pedagogical knowledge domains (Runge *et al*., 2025; Sanusi *et al*., 2024)
4. Practical Exposure	Offer hands-on opportunities with AI tools (e.g. chatbots, adaptive learning systems) in classroom simulations	Enhances familiarity and perceived usefulness, reflecting participants' belief that practical experience increases receptiveness (Kim and Kim, 2022; Wood *et al*., 2005)
5. Mentorship and Reflective Practice	Pair preservice teachers with mentors who model critical, responsible AI integration	Strengthens professional judgement and reflexivity, responding to concerns about overreliance and the erosion of human decision-making (Meegan *et al*., 2025; Luckin and Cukurova, 2019)
6. Cross-Cultural and Policy Awareness	Expose trainees to global policy initiatives (e.g. China's compulsory AI education policy)	Broadens perspective, ensuring preservice teachers are aware of how AI is shaping education systems internationally (Asia Education Review, 2025; Ministry of Education of the PRC, 2025)

Ethics approval

The author confirms an IRB ethics approval with ID-AOFE:11000068720230222195423.

AI contribution disclaimer

AI tools were used solely for copy editing. In line with COPE guidance, the larger dataset was also used in Day (2026), a paper on ChatGPT functionality, and Day (2025b), a paper about AI and culture. However, no data is cross-reported, and each study addresses distinct questions.

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