

Preparing Educators for the Artificial Intelligence Era: Digital Competencies, Pedagogical Readiness, and Ethical Challenges in Education

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ABSTRACT

This narrative review examined how educators can be prepared for the artificial intelligence (AI) era by synthesising recent scholarship across three interrelated domains: digital competencies, pedagogical readiness, and ethical challenges. Peer-reviewed studies, systematic reviews, and competency frameworks published mainly between 2022 and 2026 were analysed thematically to identify converging patterns and persistent gaps. The review found that teacher preparedness extends beyond technical skill to encompass critical evaluation, prompt literacy, and human-AI collaboration, and that established models such as TPACK have been expanded to incorporate AI-specific and ethical knowledge. Readiness was shown to depend on professional development, self-efficacy, institutional support, and digital leadership, while uneven infrastructure widened disparities in low-resource settings. Ethical concerns, including data privacy, algorithmic bias, academic integrity, and the erosion of learner autonomy, emerged as central to responsible integration. The review concluded that preparing educators requires integrated frameworks linking competence, pedagogy, and ethics, supported by sustained training and context-sensitive policy.

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1. INTRODUCTION

The rapid diffusion of artificial intelligence (AI) into education has shifted the relationship between teachers, learners, and technology in ways that few previous innovations have. Where digital tools were once largely passive instruments responding predictably to commands, contemporary generative AI systems create content, adapt to learners, and participate in instructional decisions, reframing the classroom as an interaction among teacher, AI, and student (Bai, 2025). This shift places new and substantial demands on educators, who are expected not only to use AI tools competently but also to evaluate them critically, integrate them pedagogically, and govern them ethically. Understanding how educators can be prepared for this era has therefore become an urgent concern for teacher education, professional development, and education policy.

A growing body of evidence indicates that the transformative potential of AI in education is contingent on the readiness and self-efficacy of teachers rather than on the sophistication of the technology itself (Zeng et al., 2025). Yet research on teacher preparation remains fragmented, with separate literatures addressing digital competence, pedagogical integration, and ethical risk, often in isolation from one another. Frameworks such as the Technological Pedagogical Content Knowledge (TPACK) model have provided a

foundation for analysing technology integration, but their underlying assumptions were developed for deterministic tools and require rethinking in light of AI's autonomy, epistemic complexity, and ethical weight (Chiu, 2025). Meanwhile, international bodies have moved quickly to articulate the competencies educators now require, most visibly through the AI competency framework for teachers released by UNESCO in 2024 (UNESCO, 2024).

This narrative review responds to that fragmentation by bringing three interrelated domains into a single analytical frame: the digital competencies educators need, their pedagogical readiness to deploy AI in authentic teaching, and the ethical challenges that responsible integration entails. The aim is not to test a hypothesis but to map the current landscape, surface points of convergence and tension across the literature, and identify what a coherent agenda for preparing educators might look like. Three guiding questions organise the review: What competencies define an AI-ready educator? What conditions support or constrain pedagogical readiness? And how can ethical considerations be embedded into preparation rather than treated as an afterthought? By synthesising recent scholarship across these questions, the review offers educators, teacher educators, and policymakers an integrated view of a field that is currently developing faster than the structures meant to support it.

2. LITERATURE REVIEW

This section establishes the theoretical and conceptual grounding of the review. It first revisits the dominant frameworks used to understand teachers' technology integration and their recent adaptation to artificial intelligence, then surveys the prior empirical studies that motivate the present synthesis, and finally sets out the conceptual framework that organises the analysis around competencies, readiness, and ethics.

2.1. Theoretical Foundations

The most influential lens for analysing teachers' technology integration is the Technological Pedagogical Content Knowledge (TPACK) framework, which conceptualises effective practice as the interplay of technological, pedagogical, and content knowledge. TPACK has provided a durable foundation for teacher education, yet its assumptions were formed in an era of largely passive and deterministic digital tools, and scholars now question whether it adequately captures the demands of AI (Chiu, 2025). In response, the framework has been deliberately extended. Chiu (2025) proposed an Intelligent-TPACK (I-TPACK) framework that integrates AI literacy and AI competency and adds knowledge domains for validation, prompt engineering, human-AI collaboration, and ethics, reflecting the recognition that AI represents a paradigm shift rather than an incremental advance. International guidance has moved in a parallel direction: the UNESCO AI competency framework for teachers organises competencies around a human-centred mindset, the ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional development, treating ethical understanding as foundational (Bai, 2025; UNESCO, 2024).

Alongside knowledge frameworks, theories of adoption and readiness inform how educators come to use AI. The Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology (UTAUT) explain behavioural intention through perceived usefulness, ease of use, and social and facilitating conditions, while technology-readiness and self-efficacy perspectives emphasise the psychological dispositions, confidence, and beliefs that shape whether competence translates into practice (Ayanwale et al., 2022; Zeng et al., 2025). Generic digital-competence frameworks such as DigCompEdu, together with frameworks for twenty-first-century skills, provide the wider backdrop against which AI-specific competencies have been articulated, and they were explicitly adapted by Ng et al. (2023) to accommodate AI technologies. These theories are complementary: knowledge frameworks specify what educators should know, while acceptance and readiness theories explain the conditions under which that knowledge is enacted.

2.2. Previous Studies

Empirical and review scholarship has expanded rapidly since accessible generative AI became widespread. Studies of teacher readiness have identified attitudes, confidence, perceived relevance, and the perception of AI as serving social good as determinants of the intention to teach and use AI, while flagging limited training and low confidence as barriers (Ayanwale et al., 2022). Systematic reviews have begun to consolidate this evidence: Tan et al. (2025) synthesised a decade of research and documented a marked imbalance between studies of AI in classroom teaching and the comparatively neglected question of AI in teacher professional development. Reviews of digital competence have likewise shown that self-perceived competence is multidimensional and unevenly distributed even within single institutions (Moreira-Choez et al., 2024), and that institutional and leadership conditions strongly mediate teachers' capacity to integrate AI (Zeng et al., 2025).

A second strand of prior work concentrates on ethics. Systematic reviews have classified the ethical risks of AI in education across technological, educational, and societal dimensions, encompassing privacy, algorithmic bias, transparency, academic integrity, learner autonomy, and the digital divide (García-López &

Trujillo-Liñán, 2025; Marín et al., 2025; Zhu et al., 2025). A recurring observation across these studies is that ethical reasoning has often been treated as implicit, prompting calls to embed it explicitly within competency frameworks and teacher preparation. Together, the previous studies establish that competence, readiness, and ethics are each well represented in the literature but are seldom examined in an integrated way, which is the gap this review addresses.

2.3. Conceptual Framework

Drawing on these foundations, the review adopts a three-domain conceptual framework for preparing educators for the AI era. The first domain, digital competencies, captures the layered knowledge and skills an AI-ready educator requires, extending from technical fluency to critical evaluation and ethical reasoning, as articulated in TPACK extensions and the UNESCO framework. The second domain, pedagogical readiness, captures the dispositional and conditional factors, attitudes, self-efficacy, professional development, and institutional and leadership support, that determine whether competence is enacted in authentic teaching, drawing on acceptance and readiness theories. The third domain, ethical challenges, captures the values and risks that responsible integration entails, including privacy, bias, integrity, and autonomy. The framework treats these domains as interdependent: competence without readiness remains latent, readiness without ethical grounding risks harm, and ethical aspiration without competence and support cannot be realised. As a narrative review rather than an empirical study, no hypotheses are proposed; instead, the conceptual framework guides the thematic synthesis presented in the Results and Discussion.

3. RESEARCH METHOD

This study adopted a narrative review approach, which is appropriate for synthesising a broad and rapidly evolving body of literature where the goal is interpretive integration rather than exhaustive statistical aggregation. The review drew on peer-reviewed journal articles, systematic and scoping reviews, and institutional competency frameworks published predominantly between 2022 and 2026, a period chosen because it captures the surge of scholarship that followed the public release of accessible generative AI tools in late 2022. Sources were identified through academic databases and publisher platforms using combinations of search terms including “teacher competence,” “artificial intelligence,” “digital literacy,” “pedagogical readiness,” “AI literacy,” and “ethics in education.”

Selected works were read closely and organised thematically into three domains: digital competencies, pedagogical readiness, and ethical challenges. Within each domain, recurring constructs, framework proposals, empirical findings, and identified gaps were extracted and compared to build a synthesis that emphasises patterns across studies rather than the details of any single investigation. Priority was given to systematic reviews and competency frameworks, which aggregate primary evidence, supplemented by empirical studies that illustrate or complicate the broader patterns. Because the review is interpretive, its conclusions are offered as a structured reading of the field rather than as definitive measures, and care was taken to represent contrasting positions where the literature is unsettled.

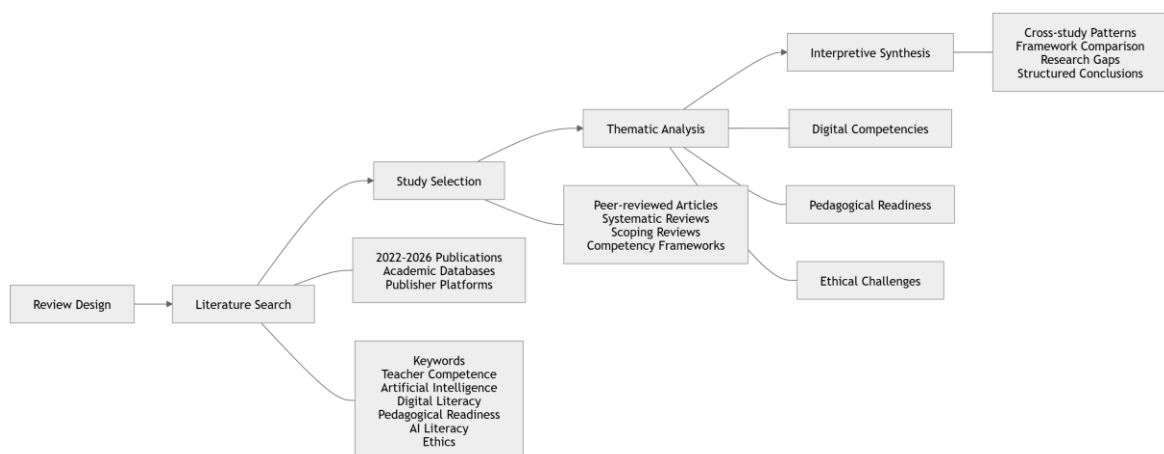


Figure 1. Conceptual Workflow of the Narrative Review Process

Figure 1 presents the narrative review process employed in this study. Relevant literature published between 2022 and 2026 was identified through academic databases and publisher platforms, screened according to relevance, and organised into three themes: digital competencies, pedagogical readiness, and

ethical challenges. The selected studies were then synthesised interpretively to identify common patterns, compare existing frameworks, and provide a structured understanding of teacher competence in the AI era.

4. RESULTS AND DISCUSSION

The synthesis is presented across four subsections. The first three correspond to the review's guiding domains, while the fourth considers how competence, pedagogy, and ethics might be integrated within equitable and context-sensitive models of teacher preparation. Table 1 summarises the three domains and their associated demands, supports, and risks.

Table 1. Three domains of preparing educators for the AI era

Domain	Core demands on educators	Key supports and risks
Digital competencies	AI literacy, critical evaluation, prompt literacy, data and algorithmic awareness, human-AI collaboration	Support: framework-guided training (UNESCO, TPACK extensions). Risk: treating competence as technical skill alone
Pedagogical readiness	Integrating AI into lesson design, assessment, and feedback; managing attitudes, anxiety, and self-efficacy	Support: professional development, digital leadership, institutional resources. Risk: technology outpacing pedagogy
Ethical challenges	Safeguarding privacy, addressing bias, protecting integrity and learner autonomy, ensuring transparency	Support: ethics-embedded literacy, governance. Risk: widening digital divide, weak policy frameworks

4.1. Digital Competencies for the AI Era

The first domain concerns what educators need to know and be able to do. A consistent theme across recent scholarship is that digital competence for the AI era cannot be reduced to operating particular tools; it is a layered construct that combines technical fluency with conceptual understanding, critical judgement, and ethical reasoning. Drawing on established frameworks such as DigCompEdu and the P21 framework for twenty-first-century learning, Ng et al. (2023) argued that teachers in AI-rich environments require not only the ability to use AI educational applications but also the pedagogical and content knowledge to design appropriate learning experiences and to cultivate students' own AI capabilities. Their work underscored that few existing frameworks adequately specified the competencies teachers themselves need, as distinct from those expected of learners. The UNESCO AI competency framework for teachers, released in 2024, represents the most prominent attempt to fill this gap at the international level. The framework defines competencies across developmental levels and aspects, emphasising human-centred values that safeguard human agency, accountability, and self-determination, and positioning ethical understanding as foundational rather than peripheral (Bai, 2025; UNESCO, 2024). Complementary empirical work has sought to assess where educators actually stand. In a study of higher education faculty, Moreira-Choez et al. (2024) used structural equation modelling to examine self-perceived digital competence, finding meaningful variation across dimensions and reinforcing the argument that competence is multidimensional and unevenly distributed even within single institutions.

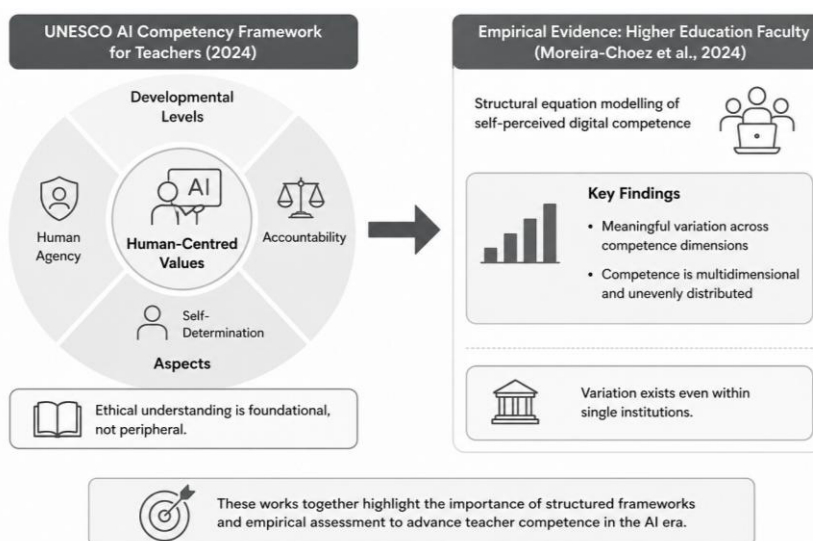


Figure 2. International Framework and Empirical Evidence on AI Competence for Teachers

A notable development is the extension of the TPACK framework to accommodate AI. Chiu (2025) proposed an Intelligent-TPACK (I-TPACK) framework that integrates AI literacy, defined as a foundational understanding of AI concepts, ethical implications, and critical evaluation skills, with AI competency, defined as the confident, reflective, and ethical application of AI in pedagogical practice. The framework foregrounds emerging competencies such as validation of AI outputs, prompt engineering, and human-AI collaboration, reflecting the recognition that AI shifts the teacher's role from content deliverer to critical validator. This expansion of TPACK signals a broader consensus that AI is not merely an incremental tool but a paradigm shift that challenges the sufficiency of earlier integration models.

Taken together, the literature suggests that the AI-ready educator possesses a composite of literacies, technical, data, algorithmic, media, and ethical, woven into pedagogical practice. The persistent risk identified across studies is that training programmes may emphasise tool operation while neglecting the critical and ethical dimensions, leaving educators able to use AI but ill-equipped to evaluate or govern it (Daher, 2025). Competence, in this reading, is necessary but not sufficient; it must be activated through readiness, the subject of the next subsection.

4.2. Pedagogical Readiness and Professional Development

The second domain concerns whether educators are willing and able to put competence into practice. Readiness is consistently framed in the literature as encompassing both psychological disposition and practical capability, allowing teachers to integrate AI into authentic teaching and learning. Ayanwale et al. (2022), in an influential study of in-service teachers, identified determinants of behavioural intention to teach AI that included the perceived relevance of AI, attitudes toward its use, confidence, and the perception of AI as serving social good, while noting that limited training and low confidence could hinder adoption. Their findings illustrate that readiness is shaped as much by belief and attitude as by skill.

Systematic reviews have begun to map the wider terrain. Tan et al. (2025), synthesising research published between 2015 and 2024, found a pronounced imbalance: most studies examined AI applications in teaching, while comparatively few addressed AI's role in supporting teacher professional development itself. They concluded that the development needs of teachers remained under-researched and that professional development must explicitly address technological and ethical challenges to ensure responsible and effective integration. This points to a recurring tension in the field, namely that technological innovation frequently outpaces the pedagogical integration and support structures teachers require.

Institutional and leadership conditions emerge as decisive. In a systematic thematic review combining the Unified Theory of Acceptance and Use of Technology with transformational leadership theory, Zeng et al. (2025) found that school principals shape teachers' capacity to integrate AI by allocating resources, supporting professional development, building learning communities, and cultivating a positive culture, thereby strengthening teachers' technological self-efficacy. Readiness, in other words, is not solely an individual attribute but is enabled or constrained by organisational context. This systemic view is reinforced by evidence that adequate resources, recognition, and supportive policies are prerequisites for sustained adoption.

Context matters profoundly. In a regional study, Harsanti et al. (2025) examined Indonesian teachers' intention to use AI and found that digital leadership, digital readiness, and perceived usefulness jointly shaped adoption, highlighting how readiness is mediated by local leadership and infrastructure. Such findings caution against assuming that readiness operates uniformly across settings, and they anticipate the equity concerns discussed below. Across the readiness literature, a common implication is that preparation cannot rely on one-off training; it requires ongoing, practice-based professional learning, embedded in supportive institutions, that develops confidence and pedagogical judgement alongside technical skill.

4.3. Ethical Challenges and Responsible Integration

The third domain concerns the values and risks that responsible integration entails. The literature is unusually consistent in identifying a recurring cluster of ethical concerns. In a systematic review classifying AIED risks across technological, educational, and societal dimensions, Zhu et al. (2025) catalogued risks ranging from privacy invasion, data leakage, and algorithmic bias at the technological level, to homogenised teaching and academic misconduct at the educational level, to the exacerbation of the digital divide and the absence of accountability at the societal level. This comprehensive mapping illustrates that ethical challenges are not confined to misconduct but permeate the entire educational system.

Empirical and review studies of higher education echo these themes. Marín et al. (2025) found that data privacy concerns, algorithmic bias, lack of transparency, and the erosion of human connection bear materially on academic outcomes, and they observed that many institutions have not yet developed policies to regulate AI use, leaving educators and students exposed. Focusing on generative AI specifically, García-López and Trujillo-Liñán (2025) identified three principal constructs of ethical concern: privacy and data protection, algorithmic bias, and cognitive autonomy, the last of which is threatened when learners rely

excessively on AI tools at the expense of critical thinking. Academic integrity recurs throughout this literature as a flashpoint, as generative tools can facilitate plagiarism while also offering legitimate support for learning.

A crucial insight from this domain is that ethical competence must be cultivated rather than assumed. Educators are increasingly cast as the front line of responsible AI use, expected to model critical engagement and to teach students to interrogate, verify, and revise AI outputs rather than accept them as authoritative (Landa-Blanco, 2026). Yet several studies note that teachers themselves often lack the transparency comprehension and ethical literacy required to fulfil this role, which has prompted calls to embed ethical reasoning explicitly within competency frameworks rather than leaving it implicit. The I-TPACK proposal and the UNESCO framework both reflect this turn, treating ethics as a core knowledge domain (Chiu, 2025; UNESCO, 2024). The implication is that preparation programmes must integrate ethics into the substance of teacher learning, equipping educators to navigate privacy, bias, integrity, and autonomy as routine pedagogical concerns.

4.4. Toward Integrated, Equitable, and Context-Sensitive Preparation

Reading the three domains together reveals that they are interdependent rather than separable. Competence without readiness remains latent; readiness without ethical grounding risks harm; and ethical aspiration without competence and institutional support cannot be realised in practice. The most promising responses in the literature are therefore integrative. Daher (2025) advanced an EQUIP framework, encompassing ethical governance, qualified professional learning, unified collaborative partnerships, implementation readiness, and progressive adaptation, arguing that AI literacy must extend beyond technical skill to ethical principle, and warning that without such foundations educators may unintentionally deepen the digital divide and disadvantage marginalised learners. Framework proposals of this kind attempt to bind competence, pedagogy, and ethics into a single developmental architecture.

Equity is the thread that runs through the integrated view. Evidence indicates that the benefits of AI accrue unevenly, and that uneven infrastructure, funding, and digital literacy can transform a promising technology into a new axis of disadvantage. Landa-Blanco (2026) examined applications and limitations of AI for teachers in low- and middle-income countries and emphasised that sustainable integration depends on policy coherence, ethical regulation, and data governance, with teacher-training colleges acting as incubators for context-sensitive AI literacy. This perspective resonates with the OECD's analysis of AI's potential impact on equity and inclusion, which cautioned that AI may either narrow or widen existing disparities depending on how access, bias, and teacher training are addressed (OECD, 2024). For many education systems, including those in the Global South, preparing educators is therefore inseparable from questions of access and justice.

Synthesising across the literature, several priorities emerge for preparing educators. Preparation should be framework-guided, drawing on international references such as the UNESCO competency framework while adapting them to local realities. It should be sustained and practice-based rather than episodic, developing confidence and pedagogical judgement over time. It should be institutionally supported, with leadership, resources, and policy aligned to teachers' needs. And it should be ethically integrated from the outset, treating privacy, bias, integrity, and autonomy as core rather than supplementary concerns. These priorities are mutually reinforcing, and the evidence suggests that progress on any one is limited without attention to the others.

5. CONCLUSION

This narrative review set out to map how educators can be prepared for the artificial intelligence era by synthesising scholarship across digital competencies, pedagogical readiness, and ethical challenges. The synthesis indicates that preparedness is a composite and relational achievement rather than a discrete skill set. Digital competence in this era layers technical fluency with critical evaluation, prompt literacy, and human-AI collaboration, and established models such as TPACK have been deliberately expanded to incorporate AI-specific and ethical knowledge. Pedagogical readiness depends not only on individual attitudes, confidence, and self-efficacy but also on professional development and the enabling conditions provided by institutional leadership and resources. Ethical challenges, including privacy, algorithmic bias, academic integrity, and the erosion of learner autonomy, are pervasive and must be embedded into preparation rather than appended to it. The central conclusion is that these three domains are interdependent and are most effectively addressed through integrated frameworks that bind competence, pedagogy, and ethics within equitable and context-sensitive models of teacher preparation. Sustained, practice-based professional learning, supportive institutions, coherent policy, and explicit attention to equity emerge as the conditions under which such preparation can succeed, particularly in low-resource settings where the risk of a widening divide is greatest. For teacher educators and policymakers, the practical implication is to design preparation that is framework-guided, ongoing, institutionally supported, and ethically grounded from the start. Several directions for

further study follow. The review highlights a relative scarcity of research on AI in teacher professional development as distinct from classroom application, an imbalance that warrants redress. Longitudinal and intervention studies are needed to establish how preparation translates into sustained practice and improved learning outcomes, and more evidence is required from diverse and under-represented contexts so that frameworks developed elsewhere can be validated and localised. As a narrative review, this study offers an interpretive synthesis rather than an exhaustive or quantitative account, and its conclusions should be read as a structured reading of a fast-moving field. Even so, the convergence across the literature is sufficiently strong to suggest that preparing educators for the AI era is, at its core, a task of integrating competence, pedagogy, and ethics in the service of equitable and human-centred education.

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7. REFERENCES

- Ayanwale, M. A., Sanusi, I. T., Adelana, O. P., Aruleba, K. D., & Oyelere, S. S. (2022). Teachers' readiness and intention to teach artificial intelligence in schools. *Computers and Education: Artificial Intelligence*, 3, 100099. <https://doi.org/10.1016/j.caeai.2022.100099>
- Bai, J. (2025). Overview and summary of AI competency framework for teachers. *Global Medical Education*, 2(1), 47–51. <https://doi.org/10.1515/gme-2024-0029>
- Chiu, T. K. F. (2025). Developing intelligent-TPACK (I-TPACK) framework from unpacking AI literacy and competency: Implementation strategies and future research direction. *Interactive Learning Environments*, 33(7), 4189–4192. <https://doi.org/10.1080/10494820.2025.2545053>
- Daher, R. (2025). Integrating AI literacy into teacher education: A critical perspective paper. *Discover Artificial Intelligence*, 5(1), 217. <https://doi.org/10.1007/s44163-025-00475-7>
- García-López, I. M., & Trujillo-Liñán, L. (2025). Ethical and regulatory challenges of Generative AI in education: A systematic review. *Frontiers in Education*, 10, 1565938. <https://doi.org/10.3389/educ.2025.1565938>
- Harsanti, H. R., Sudibjo, N., Riady, S., & Yu, P. (2025). Exploring Indonesian teachers' intention to use artificial intelligence in schools: The impact of digital leadership, digital readiness, and perceived usefulness. *Cogent Social Sciences*, 11(1), 2593596. <https://doi.org/10.1080/23311886.2025.2593596>
- Landa-Blanco, M. (2026). Artificial intelligence in education: Applications and limitations for teachers in low- and middle-income countries. *Frontiers in Education*, 10, 1681836. <https://doi.org/10.3389/educ.2025.1681836>
- Marín, Y. R., Cruz Caro, O., Carrasco Rituay, A. M., Guimac Llanos, K. A., Tarrillo Perez, D., Sánchez Bardales, E., Alva Tuesta, J. N., & Chávez Santos, R. (2025). Ethical challenges associated with the use of artificial intelligence in university education. *Journal of Academic Ethics*, 23, 2443–2467. <https://doi.org/10.1007/s10805-025-09660-w>
- Moreira-Choez, J. S., Gómez Barzola, K. E., Lamus de Rodríguez, T. M., Sabando-García, A. R., Cruz Mendoza, J. C., & Cedeño Barcia, L. A. (2024). Assessment of digital competencies in higher education faculty: A multimodal approach within the framework of artificial intelligence. *Frontiers in Education*, 9, 1425487. <https://doi.org/10.3389/educ.2024.1425487>
- Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world. *Educational Technology Research and Development*, 71(1), 137–161. <https://doi.org/10.1007/s11423-023-10203-6>
- OECD. (2024). The potential impact of artificial intelligence on equity and inclusion in education (OECD Artificial Intelligence Papers No. 23). OECD Publishing. <https://doi.org/10.1787/15df715b-en>
- Tan, X., Cheng, K. S., & Ling, M. H. A. (2025). Artificial intelligence in teaching and teacher professional development: A systematic review. *Computers and Education: Artificial Intelligence*, 8, 100355. <https://doi.org/10.1016/j.caeai.2024.100355>
- UNESCO. (2024). AI competency framework for teachers. UNESCO Publishing. <https://doi.org/10.54675/ZJTE2084>
- Zeng, M., Cheah, K. S. L., & Abdullah, Z. (2025). The influence of school principals' digital leadership on teachers' competency in integrating artificial intelligence: A systematic thematic review. *Frontiers in Education*, 10, 1655967. <https://doi.org/10.3389/educ.2025.1655967>
- Zhu, H., Sun, Y., & Yang, J. (2025). Towards responsible artificial intelligence in education: A systematic review on identifying and mitigating ethical risks. *Humanities and Social Sciences Communications*, 12, 1111. <https://doi.org/10.1057/s41599-025-05252-6>