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GENERATIVE ARTIFICIAL INTELLIGENCE AND TEACHER EDUCATION: PROFESSIONAL COMPETENCIES, PEDAGOGICAL MEDIATION, AND ETHICAL CHALLENGES IN TECHNOLOGY-MEDIATED TEACHING

INTELIGÊNCIA ARTIFICIAL GENERATIVA E FORMAÇÃO DE PROFESSORES: COMPETÊNCIAS PROFISSIONAIS, MEDIAÇÃO PEDAGÓGICA E DESAFIOS ÉTICOS NO ENSINO MEDIADO POR TECNOLOGIA

INTELIGENCIA ARTIFICIAL GENERATIVA Y FORMACIÓN DOCENTE: COMPETENCIAS PROFESIONALES, MEDIACIÓN PEDAGÓGICA Y DESAFÍOS ÉTICOS EN LA ENSEÑANZA MEDIADA POR TECNOLOGÍA

Joelson Lopes da Paixão
Doutorando em Engenharia Elétrica e Mestre em Engenharia Elétrica, pela UFSM. Especialista em Educação e em áreas relacionadas à Engenharia Elétrica. Bacharel em Engenharia Elétrica. Licenciado em Matemática, Física, Pedagogia e em Educação Profissional pelo Programa Especial de Graduação de Formação de Professores para a Educação Profissional (PEG/UFSM). Pesquisador na UFSM. Lattes: http://lattes.cnpq.br/6907289379766915 | ORCID: https://orcid.org/0000-0001-8874-5151 | E-mail: joelson.paixao@hotmail.com

Getúlio Antônio de Freitas Filho
Doutor em Ciências da Saúde pela UNESC (Universidade do Extremo Sul Catarinense), Mestre em Engenharia Biomédica pela UNIVAP (Universidade do Vale do Paraíba), Especialista em Docência Superior pela Universidade Gama Filho, Especialista em Acupuntura pelo IMES (Instituto Mineiro de Estudos Sistêmicos). Bacharel em Fisioterapia pelo Centro Universitário do Triângulo. Atua como Professor e Coordenador Pedagógico do Curso de Medicina Da Universidade de Rio Verde (UniRV). Lattes: https://lattes.cnpq.br/6334336383017103

Janete Aparecida Klein
Doutora em Educação em Ciências e Matemática pela Rede Amazônica de Educação em Ciências e Matemática (REAMEC/UFMT). Docente na Licenciatura em Matemática e no Programa de Pós - Graduação em Educação Matemática do Tocantins (PPGEMaT). ORCID: https://orcid.org/0000-0002-9792-2591 | E-mail: janeteklein@uft.edu.br

Marcelo Tavares Gomes de Souza
Doutorado em Ciências dos Materiais pela Universidade Federal de Pernambuco, Mestre em Engenharia Civil e Ambiental pela Universidade Federal de Pernambuco, Pós-graduação em Engenharia de Segurança do Trabalho pelo Instituto Federal de Ciências e Tecnologia de Pernambuco, campus Caruaru, graduado em Engenharia Civil pelo Centro Universitário Vale do Ipojuca - UNIFAVIP. Lattes: https://lattes.cnpq.br/3304502249883627 | ORCID: https://orcid.org/0000-0003-3941-3382 | E-mail: marcelomtgs@gmail.com

Mariana Ferreira dos Santos
Mestre em Estudos da Linguagem pelo PGGEL UFRN. Professora de Língua Inglesa do IFRN. Lattes: https://lattes.cnpq.br/8102377090165500 | E-mail: marysfs35@gmail.com

Antonio Fluminhan
Doutor em Agricultural Sciences pela Instituição Tohoku University Japão. Unesp – Universidade Estadual Paulista, Campus de Jaboticabal – SP. Lattes:

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https://lattes.cnpq.br/0281983303003998 | ORCID: https://orcid.org/0000-0002-2571-0792 |
E-mail: antoniofluminhan@gmail.com

ABSTRACT: The expansion of generative artificial intelligence in education has increased the possibilities for content production, personalized learning, and pedagogical support, while also intensifying dilemmas related to authorship, information reliability, algorithmic bias, and academic integrity. In this context, teacher education requires a more complex set of professional competencies that goes beyond instrumental command of digital tools and includes curricular integration, critical curation, pedagogical mediation, and ethical responsibility. This study analyses the competencies required for teaching practice in educational settings mediated by generative artificial intelligence technologies. Methodologically, it is a qualitative bibliographic review of an exploratory-descriptive nature, developed through a structured literature search and thematic analysis. The corpus comprised academic books, peer-reviewed articles, and institutional documents directly related to the topic, examined considering both classic and recent frameworks on teacher education, digital competence, and generative AI. The analytical synthesis identified five central axes: technopedagogical integration of AI into the curriculum; curation and critical validation of generated outputs; pedagogical mediation and assessment redesign; ethics, authorship, and governance of AI use; and continuous professional development supported by institutional policies. The study concludes that the incorporation of generative AI into education does not reduce the centrality of the teacher; rather, it redefines professional responsibilities and reinforces the need for pre-service and continuing education programmes capable of articulating pedagogical, technological, and ethical dimensions within a critical and reflective perspective.

Keywords: Generative artificial intelligence. Teacher education. Teachers' digital competencies. Pedagogical mediation. Educational ethics.

RESUMO: A expansão da inteligência artificial generativa na educação ampliou as possibilidades de produção de conteúdo, aprendizagem personalizada e apoio pedagógico, ao mesmo tempo em que intensificou dilemas relacionados à autoria, à confiabilidade das informações, ao viés algorítmico e à integridade acadêmica. Nesse contexto, a formação docente passa a exigir um conjunto mais complexo de competências profissionais, que ultrapassa o domínio instrumental de ferramentas digitais e inclui integração curricular, curadoria crítica, mediação pedagógica e responsabilidade ética. Este estudo analisa as competências requeridas para a prática docente em contextos educacionais mediados por tecnologias de inteligência artificial generativa. Metodologicamente, trata-se de uma revisão bibliográfica qualitativa, de caráter exploratório-descritivo, desenvolvida por meio de busca estruturada da literatura e análise temática. O corpus foi composto por livros acadêmicos, artigos revisados por pares e documentos institucionais diretamente relacionados ao tema, examinados à luz de referenciais clássicos e contemporâneos sobre formação docente, competência digital e inteligência artificial generativa. A síntese analítica identificou cinco eixos centrais: integração tecno pedagógica da IA ao currículo; curadoria e validação crítica de conteúdos gerados; mediação pedagógica e redesenho da avaliação; ética, autoria e governança do uso da IA; e desenvolvimento profissional contínuo apoiado por políticas institucionais. Conclui-se que a incorporação da inteligência artificial generativa na educação não reduz a centralidade do professor; ao contrário, redefine suas responsabilidades profissionais e reforça a necessidade de programas de formação inicial e continuada capazes de articular dimensões pedagógicas, tecnológicas e éticas em uma perspectiva crítica e reflexiva.

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Palavras-chave: Inteligência artificial generativa. Formação docente. Competências digitais docentes. Mediação pedagógica. Ética educacional.

RESUMEN: La expansión de la inteligencia artificial generativa en la educación ha ampliado las posibilidades de producción de contenidos, aprendizaje personalizado y apoyo pedagógico, al tiempo que ha intensificado dilemas relacionados con la autoría, la fiabilidad de la información, el sesgo algorítmico y la integridad académica. En este contexto, la formación docente exige un conjunto más complejo de competencias profesionales, que va más allá del dominio instrumental de las herramientas digitales e incluye la integración curricular, la curaduría crítica, la mediación pedagógica y la responsabilidad ética. Este estudio analiza las competencias requeridas para la práctica docente en contextos educativos mediados por tecnologías de inteligencia artificial generativa. Metodológicamente, se trata de una revisión bibliográfica cualitativa, de carácter exploratorio-descriptivo, desarrollada mediante una búsqueda estructurada de la literatura y un análisis temático. El corpus estuvo compuesto por libros académicos, artículos revisados por pares y documentos institucionales directamente relacionados con el tema, examinados a la luz de marcos clásicos y recientes sobre formación docente, competencia digital e inteligencia artificial generativa. La síntesis analítica identificó cinco ejes centrales: integración tecnopedagógica de la IA en el currículo; curaduría y validación crítica de los contenidos generados; mediación pedagógica y rediseño de la evaluación; ética, autoría y gobernanza del uso de la IA; y desarrollo profesional continuo respaldado por políticas institucionales. Se concluye que la incorporación de la inteligencia artificial generativa en la educación no reduce la centralidad del docente; por el contrario, redefine sus responsabilidades profesionales y refuerza la necesidad de programas de formación inicial y continua capaces de articular dimensiones pedagógicas, tecnológicas y éticas desde una perspectiva crítica y reflexiva.
Palabras clave: Inteligencia artificial generativa. Formación docente. Competencias digitales docentes. Mediación pedagógica. Ética educativa.

1 INTRODUCTION

The development of digital technologies has increasingly reconfigured the ways in which knowledge is produced, circulated, and validated in contemporary society. In the educational field, this movement gained renewed momentum with the diffusion of generative artificial intelligence systems capable of producing texts, images, code, summaries, scripts, exercises, and other symbolic artefacts with high linguistic fluency and broad accessibility. As a result of this expansion, schools and universities now coexist with tools that not only support information retrieval but also intervene directly in study practices, authorship, and the organisation of pedagogical work.

In educational settings, the adoption of these technologies has been accompanied by expectations of greater efficiency, personalised learning, and an expanded didactic repertoire. Recent studies indicate that generative AI can support

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the development of instructional materials, the adaptation of explanations to different student profiles, and lesson planning, provided that its use is pedagogically guided and critically supervised. At the same time, the literature highlights important limitations, such as the generation of factually inaccurate responses, the reproduction of biases, the opacity of algorithmic criteria, and the encouragement of outsourcing cognitive effort when mediation is weak (MIAO; HOLMES, 2023; MAI; DA; HANH, 2024).

These transformations reopen, in new terms, the discussion about the teacher's role in technologically mediated environments. Whereas earlier phases of digitalisation focused primarily on access to resources, connectivity, and platform use, the current scenario shifts attention to the quality of pedagogical mediation in the face of systems that produce language, simulate dialogue, and influence pedagogical decisions. The presence of generative AI therefore does not eliminate the centrality of the teacher; rather, it redefines responsibilities regarding the selection of legitimate uses, the assessment of the reliability of generated content, the preservation of authorship, and the development of students' intellectual autonomy.

In this context, the concept of teaching competence cannot be understood in a strictly instrumental sense. The preparation required for work with AI demands articulation among pedagogical, technological, curricular, and ethical knowledge. For at least two decades, the teacher education literature has indicated that meaningful technology integration depends on the combination of content knowledge, pedagogical knowledge, and technological knowledge, rather than on mere operational command of tools (MISHRA; KOEHLER, 2006). The emergence of generative AI expands this demand by adding problems of epistemic validation, authorship, safety, equity, and governance.

From an institutional perspective, the rapid dissemination of these technologies challenges pre-service and continuing teacher education programmes that still often operate with models centred on conventional digital resources. Preparing teachers merely to use platforms, virtual learning environments, and devices is no longer sufficient. It is necessary to prepare professionals capable of critically understanding how generative systems function, what their limits are, how they may be incorporated into the curriculum, and which risks require pedagogical and ethical regulation. Recent UNESCO documents and empirical studies on teacher education in AI contexts have

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therefore stressed the urgency of more robust frameworks to guide curricula, training pathways, and criteria for assessing professional development (MIAO; CUKUROVA, 2024; PRILOP et al., 2025; PANDAY-SHUKLA, 2025).

Against this background, the present study is guided by the following research question: which professional competencies are required for teaching practice in educational contexts mediated by generative artificial intelligence technologies? The general objective is to analyse, based on a qualitative bibliographic review, the competencies required for teachers to integrate generative AI into their practices in a critical, ethical, and pedagogically consistent manner. The relevance of the investigation lies in the need to qualify the debate on teacher education at a moment when the presence of AI in education has ceased to be a future hypothesis and has become part of the concrete daily reality of teaching and learning.

2 THEORETICAL FRAMEWORK

The discussion of teacher education in contexts mediated by artificial intelligence requires a framework capable of avoiding two frequent reductions: the first consists in understanding competence as the mere technical ability to operate tools; the second lies in treating generative AI as a simple continuation of previous digital technologies, disregarding its epistemological, communicational, and ethical specificities. To overcome such reductions, it is necessary to articulate consolidated theoretical frameworks from digital education with recent contributions from the literature on AI in education.

Within the field of technology integration in teaching, the TPACK model proposed by Mishra and Koehler (2006) remains relevant because it argues that the educational use of technologies depends on the interrelationship among content knowledge, pedagogical knowledge, and technological knowledge. Its main merit lies in showing that the quality of technological incorporation into teaching does not result from isolated tool mastery, but from the teacher's capacity to combine technologies with curricular objectives, didactic strategies, and student characteristics. In other words, technology does not enter the curriculum as an appendix; it must be converted into pedagogically meaningful mediation.

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In dialogue with this perspective, DigCompEdu, proposed by Redecker (2017), offers a more detailed framework for teachers' digital competence. The model organises 22 competencies into six areas, ranging from professional engagement and the use of digital resources to assessment, learner empowerment, and the promotion of students' digital competence. Its contribution is decisive in shifting the discussion from the abstract plane of innovation to a more operational repertoire of practices, showing that teachers' digital competence involves planning, communication, resource selection, assessment, and professional reflection.

The emergence of artificial intelligence, however, introduces issues that exceed the scope of digital competencies in a broad sense. This is where the UNESCO AI Competency Framework for Teachers becomes central, defining competencies related to a human-centred mindset, AI ethics, the foundations and applications of the technology, AI-mediated pedagogy, and the use of AI for continuous professional learning (MIAO; CUKUROVA, 2024). The value of this framework lies in making explicit that teacher education for the AI era must integrate knowledge, skills, and values articulated across progressive levels of professional development.

From these frameworks, teaching competencies can be understood in this study as a multidimensional construct that combines technopedagogical integration, digital and AI literacy, critical judgement, ethical sensitivity, and professional decision-making in contexts of uncertainty. Such an understanding responds to the criticism that the term competencies, when used generically, tends to obscure its epistemological density. On the contrary, the concept becomes analytically fruitful when linked to frameworks that clarify which forms of knowledge, practice, and disposition are required for teaching in complex digital environments.

Another decisive theoretical point concerns the specificity of generative AI. Unlike educational technologies that organise content, store materials, or automate administrative routines, generative systems produce new linguistic and semiotic outputs based on probabilistic patterns identified in large-scale datasets. This means that they can offer plausible, but not necessarily true, responses; they can support creation, but also obscure authorship; they can personalise interactions, but also reinforce biases and asymmetries. UNESCO (2021) and Miao and Holmes (2023) stress that the educational use of AI must be guided by principles of human centrality,

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transparency, equity, and responsibility, otherwise operational gains may be converted into formative losses.

Recent literature on ChatGPT and other generative tools confirms this ambivalence. Reviews and empirical studies point to potentials related to rapid feedback, planning support, personalisation, and expanded access to resources; at the same time, they register vulnerabilities related to hallucination, algorithmic bias, superficial learning, assessment fragility, and the weakening of authorship when students do not develop sufficient critical competence to interact with these systems (MAI; DA; HANH, 2024; MOORHOUSE et al., 2024). Teaching in times of generative AI therefore requires not only use, but pedagogical discernment regarding when, why, for what purposes, and under which limits such tools should be employed.

In summary, the theoretical framework mobilised in this article is grounded on three premises. The first is that teacher competence for work with AI is relational and integrated, not additive. The second is that generative AI qualitatively changes the problem of pedagogical mediation by introducing systems that produce language and influence authorship. The third is that teacher education, in order to respond to this scenario, must be simultaneously technopedagogical, ethical, and institutional, since decisions about AI use do not fall solely on individuals, but also on curricula, policies, and school cultures.

3 METHODOLOGY

This study is characterised as a qualitative bibliographic review of a basic and exploratory-descriptive nature. This design was chosen because the objective is to interpret critically the literature on teacher education and generative artificial intelligence, seeking to identify analytical categories and conceptual tensions that are relevant for understanding the phenomenon (GIL, 2021). It is therefore neither a meta-analysis nor a systematic review in the strict sense, with an exhaustive protocol, quantitative measurement of the corpus, or application of a PRISMA flowchart; rather, the study explicitly assumes an interpretive design, guided by a structured search and thematic analysis.

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The bibliographic survey was conducted through widely used academic databases and repositories, especially SciELO, Google Scholar, Scopus, and scientific journals in the fields of education, educational technology, and computer science, according to the scope already present in the initial version of the manuscript. Search descriptors in Portuguese and English related to the object of investigation were considered, such as artificial intelligence in education, generative artificial intelligence, teacher education, teachers' digital competencies, digital competence, TPACK, DigCompEdu, and ChatGPT in education. The search did not aim at absolute exhaustiveness; thematic adherence and the capacity of the texts to contribute to the interpretive construction of the problem were prioritised.

The inclusion criteria comprised academic books, peer-reviewed scientific articles, and institutional documents directly related to AI use in education, teacher education, and educators' digital competence. Materials without clearly identified authorship, opinion pieces without academic grounding, thematic duplicates without additional analytical contribution, and publications without a direct link to the research problem were excluded. Corpus selection also considered the relevance of recent literature on generative AI in education, especially works published from 2023 onwards, without disregarding classical references indispensable for the theoretical framing.

After the corpus had been constituted, the material was subjected to analytical reading and thematic organisation, taking interpretive content analysis as the systematisation procedure. From this process, five structuring axes were identified: (i) technopedagogical integration of AI into the curriculum; (ii) curation and critical validation of outputs generated by automated systems; (iii) pedagogical mediation and assessment redesign; (iv) ethics, authorship, and governance of AI use; and (v) continuous professional development and institutional support policies.

This methodological pathway supports a critical synthesis coherent with the objective of the study, without attributing to the manuscript a level of systematicity that it does not empirically document. By making this choice explicit, the article strengthens its internal consistency and aligns the designation of the method with the real scope of the investigation, thus avoiding undue generalisations and favouring greater epistemological transparency.

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Table 1 presents a synthesis of the main sources mobilised in the article.

Reference	Type of source	Contribution to the analysis
Mishra and Koehler (2006)	Theoretical framework article	Supports the TPACK discussion and the integrated view of technological, pedagogical, and content knowledge.
Redecker (2017)	Institutional framework	Provides the DigCompEdu structure for teachers' digital competencies.
Miao and Holmes (2023)	UNESCO guidance document	Grounds the discussion on educational uses, risks, and safeguards for generative AI.
Miao and Cukurova (2024)	UNESCO competency framework	Supports the discussion of AI-specific teaching competencies and professional progression.
Mai, Da and Hanh (2024)	Systematic review	Supports the discussion of the potentials and risks of ChatGPT in teaching and learning.
Moorhouse et al. (2024)	Empirical intervention study	Provides evidence on guided training and the development of professional generative AI competence.
Prilop et al. (2025)	Empirical study	Supports the discussion of AI literacy, AI didactics, and AI assessment in teacher education.
Panday-Shukla (2025)	Teacher education study	Supports the discussion on preparedness gaps and the need for explicit training pathways.
UNESCO (2021); O'Neil (2016); Pasquale (2015)	Normative and critical references	Supports the analysis of ethics, opacity, accountability, bias, and governance in AI-mediated education.

Source: prepared by the authors based on the literature analysed.

4 RESULTS AND DISCUSSION

The analysis of the literature indicates that the incorporation of generative artificial intelligence into education cannot be understood as a simple instrumental update of teachers' digital repertoires. What is at stake is a qualitative shift in the conditions of pedagogical mediation, since teachers begin to interact with systems capable of producing language, suggesting answers, structuring activities, summarising content, and influencing writing, studying, and assessment. For this reason, the results of this study were organised into analytical categories that make it possible to highlight not only consensuses, but also tensions and displacements in the contemporary debate.

4.1 Technopedagogical competencies for curricular AI integration

The first axis concerns the technopedagogical integration of AI into the curriculum. The literature converges in indicating that teachers need to understand the tool beyond its superficial functioning, being able to decide when its use is pedagogically appropriate and when it compromises learning objectives. Through the lens of TPACK, this means that technological knowledge only becomes educationally

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relevant when articulated with content and pedagogy (MISHRA; KOEHLER, 2006). In this perspective, AI does not replace teacher judgement; it requires an even more sophisticated judgement regarding objectives, didactic sequences, student profiles, and the nature of proposed tasks.

DigCompEdu reinforces this reading by showing that educators' digital competence encompasses planning, resource selection, assessment, personalisation, and the promotion of learner autonomy. When this framework is brought closer to the specific demands of generative AI, curricular integration involves, at a minimum, knowing how to select appropriate uses, formulate prompts with didactic intentionality, evaluate the quality of generated responses, adapt outputs to class needs, and maintain alignment between technology and pedagogical purpose (REDECKER, 2017). Teachers thus cease to be mere tool users and begin to act as designers of learning experiences mediated by algorithmic systems.

Recent empirical studies reinforce this argument. In an intervention conducted within initial language teacher education, Moorhouse et al. (2024) identified more evident advances in pedagogical competence and critical awareness of AI use when training was explicit and guided. This suggests that the competence to work with AI does not emerge spontaneously from mere contact with the tool; it must become a direct object of education.

Table 2 summarises the analytical proposition of this study regarding the core teaching competencies required in generative AI contexts.

Competency axis	Analytical description	Training implications	Supporting references
Technopedagogical integration	Ability to articulate AI, curricular objectives, didactic strategies, and class characteristics in pedagogically meaningful ways.	Activity planning, prompt formulation with pedagogical intentionality, adaptation of outputs, and alignment between means and ends.	Mishra and Koehler (2006); Redecker (2017)
Curation and critical validation	Competence to examine the reliability, relevance, and limits of outputs generated by AI systems.	Source checking, version comparison, identification of hallucinations, biases, conceptual fragilities, and inappropriate simplifications.	Miao and Holmes (2023); Mai, Da and Hanh (2024)
Pedagogical mediation and assessment	Ability to guide legitimate AI uses and redesign assessment in contexts of automated response generation.	Process-based tasks, justification of choices, oral defence, metacognitive reflection,	Bates (2017); Prilop et al. (2025)

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Competency axis	Analytical description	Training implications	Supporting references
		and assessment less vulnerable to response outsourcing.	
Ethics, authorship, and governance	Understanding of the ethical, authorial, epistemic, and political impacts of AI in educational and academic work.	Discussion of academic integrity, data protection, limits of use, accountability, and critical reading of algorithmic infrastructures.	UNESCO (2021); O'Neil (2016); Paixão et al. (2026)
Continuous professional development	Disposition and capacity to update knowledge and participate in institutional ecosystems of experimentation and reflective learning.	Training pathways, workshops, communities of practice, use protocols, and ongoing revision of pedagogical strategies.	Miao and Cukurova (2024); Panday-Shukla (2025); Moorhouse et al. (2024)

Source: prepared by the authors based on the literature analysed.

4.2 Curation, critical validation, and epistemic risks

The second axis refers to the curation and critical validation of outputs produced by generative systems. Here lies one of the most significant differences between generative AI and previous digital technologies. Because such systems generate probabilistic responses, the fact that a text appears coherent does not guarantee factual accuracy, conceptual consistency, or pedagogical adequacy. This places critical competence back at the centre of teacher education. Teachers need to know how to examine the reliability of generated content, compare it with external sources, identify undue simplifications, biases, and hallucinations, and guide students to do the same.

This point is particularly relevant because pedagogical risk does not derive only from objective error, but also from the seduction of fluency. A text may be formally well written and still be conceptually fragile. Recent literature on ChatGPT in education warns of this ambivalence: benefits of speed and cognitive support coexist with threats of superficiality, misinformation, and excessive dependence (MAI; DA; HANH, 2024). From this perspective, teacher curation becomes an epistemic competence: it involves teaching students to interrogate answers, trace sources, compare versions, justify choices, and understand that language automation does not amount to valid knowledge production.

There is therefore an important tension between support potential and cognitive risk. On the one hand, AI may support study organisation and pedagogical

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differentiation; on the other, it may weaken formative processes when used as a permanent shortcut for reading, writing, and problem solving. Carr (2011) had already warned that intensive relations with digital environments may affect the depth of attention and reflection; in the current context, this warning becomes even sharper because students interact with tools that offer ready-made responses in persuasive language. Teacher competence, in this case, does not consist in generically prohibiting technology, but in constructing uses that preserve students' intellectual work.

4.3 Ethics, authorship, assessment, and pedagogical governance

The third axis brings together problems of ethics, authorship, assessment, and governance in AI use. The literature examined shows that the incorporation of generative AI shifts classical debates on plagiarism and academic integrity to a more complex level. It is no longer merely a matter of copying available texts, but of dealing with on-demand productions whose authorship, traceability, and pedagogical legitimacy become disputed. In this sense, teacher education must include criteria for distinguishing acceptable from improper uses, as well as strategies for making assessment less vulnerable to the simple outsourcing of responses.

Miao and Holmes (2023) emphasise that generative systems require clear use policies, data protection, institutional regulation, and the development of human capacities for ethical judgement. UNESCO's Recommendation on the Ethics of Artificial Intelligence (2021) reinforces the centrality of principles such as transparency, justice, responsibility, and human-centredness. In dialogue with these guidelines, Paixão et al. (2026) argue that the presence of AI in the academic field imposes epistemological and normative revisions related to intellectual production, authorial responsibility, and the status of algorithm-mediated knowledge.

From a pedagogical standpoint, this implies rethinking assessment. Tasks focused exclusively on the final product become more fragile in environments where automated text generation is widely accessible. In response, process-oriented, multimodal, and justificatory assessment strategies gain relevance, requiring the explanation of choices, comparison of versions, oral defence of arguments, process records, and metacognitive reflection. In this arrangement, the teacher acts not merely

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as a corrector of results, but as a mediator of processes and guarantor of conditions for academic legitimacy.

The literature also highlights that ethical risks are not limited to authorship. O'Neil (2016) and Pasquale (2015) show that algorithmic systems may reproduce opacity and social asymmetries that affect decision-making processes. In education, this requires attention to biases in examples, representations, classifications, and recommendations produced by automated systems. Teacher education must therefore encompass not only good practices of use, but also the ability to problematise the sociotechnical infrastructures that sustain AI.

4.4 Pre-service education, continuing professional development, and institutional implications

The fourth axis shows that teacher competence for work with AI is not an isolated individual acquisition, but a process supported by curricula, training time, infrastructure, institutional culture, and guidelines for use. When investigating the perceptions of teacher educators, Prilop et al. (2025) identified three recurring themes in preparation for AI: AI literacy, AI didactics, and AI assessment. These axes show that the issue does not boil down to teaching future teachers how to use tools, but to preparing them to understand AI as an object of teaching, a pedagogical resource, and a formative problem traversed by ethical and democratic values.

Convergently, Panday-Shukla (2025) observed that student teachers and teacher educators often display moderate familiarity with digital technologies but limited specific preparation to deal with generative AI in teaching. This finding reinforces the need for explicit training pathways. It is not enough to assume that teachers will develop competencies through spontaneous immersion in digital environments; it is necessary to plan curricular content, practical activities, use protocols, spaces for critical experimentation, and opportunities for continuous professional development.

In this direction, the AI Competency Framework for Teachers offers a fertile horizon by integrating technical knowledge, pedagogy, ethics, and professional learning. Its main merit is to reposition teacher education in terms of progression: teachers need to acquire, deepen, and create AI uses responsibly, always

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Pages: 1-17

subordinating technology to educational purposes that remain humanly meaningful (MIAO; CUKUROVA, 2024). Institutionally, this implies revising teacher education curricula, inserting modules on AI and academic integrity, promoting supervised experimentation workshops, developing local guidance for use, and fostering communities of practice among teachers.

Table 3 presents practical implications derived from the synthesis undertaken.

Dimension	Recommended content and actions	Observable competencies
Pre-service education	Inclusion of curricular components on generative AI, digital ethics, authorship, critical validation, and AI-supported teaching design.	Student teachers can justify when to use or not use AI, evaluate generated outputs, and align tools with pedagogical objectives.
Continuing education	Supervised experimentation workshops, case studies, communities of practice, and shared protocols for pedagogical AI use.	Teachers revise practices, share experiences, develop usage criteria, and expand reflective awareness of risks and possibilities.
Assessment	Emphasis on processes, version records, comparison of drafts, oral defence, and metacognitive reflection.	Teachers formulate assessments that are less vulnerable to response outsourcing and more sensitive to process, judgement, and authorship.
Institutional governance	Development of local use policies, privacy guidelines, authorship criteria, and structured training support.	Institutions provide normative security, formative support, and coherence between technological innovation, ethics, and pedagogy.

Source: prepared by the authors from the analytical synthesis of the study.

Taken together, the results indicate that teaching in generative AI contexts demands competencies broader than those traditionally associated with the inclusion of digital technologies in education. Effective AI integration depends on qualified pedagogical mediation, critical competence for content validation, ethical accountability, assessment redesign, and sustained institutional support. The teacher remains central, but this centrality takes on a renewed form: less as a transmitter of ready-made answers and more as a curator, mediator, pedagogical designer, and guarantor of legitimately human formative conditions.

5 FINAL CONSIDERATIONS

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Pages: 1-17

This study analysed the competencies required for teacher education in educational contexts mediated by generative artificial intelligence, based on a qualitative bibliographic review with a structured search and thematic analysis. The synthesis undertaken made it possible to conclude that the incorporation of AI into teaching requires a redefinition of the professional teaching repertoire, which now includes, in an articulated manner, technopedagogical integration, critical curation, assessment mediation, ethical responsibility, and continuous professional development.

First, it was found that competence for working with generative AI is not reducible to the functional use of tools. The literature examined indicates that teaching in this scenario depends on the ability to integrate technology into the curriculum according to clear pedagogical goals, in dialogue with frameworks such as TPACK, DigCompEdu, and the AI Competency Framework for Teachers. Second, it was observed that the specificity of generative AI shifts the formative problem toward the validation of generated outputs, the preservation of authorship, and the redesign of assessment practices. Third, the consolidation of these competencies requires institutional support, curricular revision, and continuing education policies.

The analytical contribution of the article lies in the systematisation of a five-axis framework for thinking about teacher competence in times of generative AI: technopedagogical integration; curation and critical validation; pedagogical mediation and assessment; ethics, authorship, and governance; and continuous professional development. This proposition does not intend to close the debate, but to offer a conceptual synthesis capable of guiding curricular discussions, training programmes, and future research.

From the standpoint of limitations, it is necessary to acknowledge that the study is based exclusively on literature selected for interpretive purposes, which implies possible selection biases and dependence on the approaches available in the analysed corpus. Moreover, recent production on generative AI is still strongly marked by conceptual texts, early reviews, and localised investigations, which restrict broader generalisations. Added to this is the absence of triangulation with empirical field data and of quantitative synthesis procedures, so the results presented here should be read

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Pages: 1-17

as an analytical proposition rather than as an exhaustive measurement of the state of the art.

As a research agenda, we recommend the development of empirical studies investigating how teachers and student teachers mobilise these competencies in real teaching contexts, which obstacles they encounter, which kinds of education prove more effective, and how institutional policies influence the critical and responsible adoption of AI. In a broader perspective, generative artificial intelligence represents less a threat of teacher obsolescence than a decisive test of the quality of pedagogical mediation, teacher education, and educational institutions' ethical commitment to human learning.

REFERENCES

BATES, Tony. **Educação a distância e tecnologias digitais na educação superior**. São Paulo: Artesanato Educacional, 2017.

CARR, Nicholas. **The shallows**: what the internet is doing to our brains. New York: W. W. Norton, 2011.

GIL, Antônio Carlos. **Métodos e técnicas de pesquisa social**. 7. ed. São Paulo: Atlas, 2021.

MAI, Duong Thi Thuy; DA, Can Van; HANH, Nguyen Van. The use of ChatGPT in teaching and learning: a systematic review through SWOT analysis approach. **Frontiers in Education**, [s. l.], v. 9, 1328769, 2024. DOI: 10.3389/feduc.2024.1328769.

MIAO, Fengchun; CUKUROVA, Mutlu. **AI competency framework for teachers**. Paris: UNESCO, 2024. DOI: 10.54675/ZJTE2084.

MIAO, Fengchun; HOLMES, Wayne. **Guidance for generative AI in education and research**. Paris: UNESCO, 2023. DOI: 10.54675/EWZM9535.

MISHRA, Punya; KOEHLER, Matthew J. Technological pedagogical content knowledge: a framework for teacher knowledge. **Teachers College Record**, [s. l.], v. 108, n. 6, p. 1017-1054, 2006. DOI: 10.1111/j.1467-9620.2006.00684.x.

MOORHOUSE, Benjamin Luke *et al*. Developing language teachers' professional generative AI competence: an intervention study in an initial language teacher education course. **System**, [s. l.], v. 125, 103399, 2024. DOI: 10.1016/j.system.2024.103399.

O'NEIL, Cathy. **Weapons of math destruction**. New York: Crown Publishing, 2016.

REMUNOM
ISSN 2178-6925

Received: 13/01/2026 - **Accepted:** 23/03/2026
Vol: 13.04
DOI: 10.66104/31jbey85
Pages: 1-17

PAIXÃO, Joelson Lopes *et al*. Inteligência artificial e autoria acadêmica: implicações éticas, epistemológicas e normativas para a produção científica contemporânea. **Revista OWL Journal**, v. 4, p. 1-19, 2026.

PANDAY-SHUKLA, Priya. Exploring generative artificial intelligence in teacher education. **Teaching and Teacher Education**, [s. l.], v. 165, 105088, 2025. DOI: 10.1016/j.tate.2025.105088.

PASQUALE, Frank. **The black box society**. Cambridge: Harvard University Press, 2015.

PRILOP, Christopher Neil *et al*. Generative AI in teacher education: educators' perceptions of transformative potentials and the triadic nature of AI literacy explored through AI-enhanced methods. **Computers and Education: Artificial Intelligence**, [s. l.], v. 9, 100471, 2025. DOI: 10.1016/j.caeai.2025.100471.

REDECKER, Christine. **European framework for the digital competence of educators**: DigCompEdu. Luxembourg: Publications Office of the European Union, 2017. DOI: 10.2760/159770.

UNESCO. **Recommendation on the ethics of artificial intelligence**. Paris: UNESCO, 2021.