

AI in Teaching and in Teaching Research: challenges, potentialities and perspectives

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Abstract

The intensification of the use of Artificial Intelligence (AI) in education, especially following the dissemination of generative AI tools, poses new pedagogical, epistemological, and ethical challenges for research and teaching. In this context, the thematic dossier “AI in Teaching and in Teaching Research: challenges, potentialities and perspectives” brings together 23 articles organized into four thematic axes, ranging from teacher education and the development of AI competencies to critical discussions on algorithmic biases, institutional policy and the democratization of knowledge. The studies highlight AI’s potential for learning personalization, pedagogical innovation, and research support, while also problematizing risks related to technological dependence, the reproduction of inequalities, and the precarization of teaching work. The contributions converge in advocating for critical, ethical, and contextualized teacher education, as well as public policies and institutional guidelines that ensure transparency, equity, and social justice. The dossier reaffirms the vitality of Brazilian research in the field and underscores the need to understand AI as a phenomenon whose integration into teaching and research must serve human emancipation, social justice, and the democratization of knowledge.

Keywords: artificial intelligence in teaching; artificial intelligence in research; generative AI.

Introduction

Artificial Intelligence (AI) has established itself as a concrete presence in various social domains. In the educational field, this presence has intensified following the popularization of generative AI tools, challenging the academic community to critically understand their pedagogical, epistemological, and ethical implications.

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It is in this context that Educitec presents the thematic dossier “AI in Teaching and in Teaching Research: challenges, potentialities and perspectives,” resulting from a call for papers that sought to gather manuscripts presenting research results and academic-scientific productions grounded in national and international theoretical-methodological frameworks, capable of promoting critical reflection, conceptual deepening, and the socialization of knowledge on the topic.

The response from the academic community confirmed our rationale and expectations for the dossier: 60 submissions were received from all regions of Brazil, affiliated with various universities and higher education institutes, confirming the vigor and urgency of the debate on AI in research and teaching. This substantial volume of manuscripts demonstrates not only the growing interest in the topic but also the pressing need for qualified spaces for interdisciplinary dialogue and the collective construction of knowledge about the multiple dimensions that AI assumes in the educational context.

The selection and evaluation process required intensive, integrated efforts with the Educitec team, particularly in mobilizing qualified reviewers. The collaborative nature of the peer review process, based on the voluntary contributions of specialists in the field, posed logistical challenges that required judicious decisions while fully preserving the journal's scientific rigor and editorial standards.

Bringing together investigations from researchers at various Brazilian educational institutions across the North and Northeast, Central-West, Southeast, and South regions, we present in this dossier 23 articles organized into four thematic axes.

The articles range from investigations into the use of AI tools across different levels and modalities of education to epistemological reflections on the implications of these technologies for educational research, including critical analyses of the ethical, pedagogical, and methodological challenges that emerge in this context.

Teacher Education and the Development of AI Competencies

This axis brings together studies on teacher education for the critical use of AI.

The article Initial teacher education in the era of generative artificial intelligence: meanings, challenges and ethical implications in a scoping review, by Andressa Silveira da Silva and Suzi Samá, presents a scoping review of 69 studies, revealing a tension between enthusiasm for the potential of GAI in personalization and

pedagogical innovation and concerns about formative gaps, technological dependence, and ethical issues. It concludes that initial teacher education must go beyond the instrumental use of GAI, incorporating it in critical, ethical, and contextual ways, and that the scoping review contributes by demonstrating how GAI redefines formative processes, pedagogical practices, and the ethical commitments of teaching.

The study *Artificial intelligence and the education of mathematics teachers: a literature review*, by Renata Aparecida da Silva, Marta Maria Pontin Darsie and Michele Marta Moraes Castro, maps research conducted between 2019 and 2025, revealing two central categories: AI and pedagogical innovation, focused on the creation of resources and formative proposals, and AI and education, focusing on challenges and ethical issues, which point to AI's potential for innovative practices in Mathematics Education. The scarcity of studies on early years teacher education is highlighted, indicating the need for research on the ethical and responsible use of AI in continuing education.

In the article *When artificial intelligence enters the classroom: formative practices and challenges in contemporary teacher education*, Erica da Silva Schardosim, Juliano Tonezer da Silva and Maria Cecília Pereira Santarosa analyze educational products from professional master's and doctoral programs, revealing that although AI appears in formative proposals for learning personalization, in the use of generative technologies and for the development of digital teaching competencies, its approach is predominantly technical. A scarcity of in-depth discussion of ethical, epistemological, and pedagogical dimensions is noted, as is the lack of consistent validation strategies for educational proposals.

In the study *Unplugged AI in teacher education: a conversational agent as a pedagogical mediator for Artificial Intelligence literacy*, Luciana do Amaral Teixeira, Aline Silvestre Rosa Serrão, and Gabriel de Mello Pereira Serrão demonstrate the potential of conversational agents as mediators of AI literacy in the early years. The results indicate that AI, used with pedagogical intentionality, acts as an ally in strengthening teacher autonomy and creativity, favoring inclusive, accessible, and contextualized practices. The application of the tool in real-world continuing education contexts is recommended, along with further investigation through empirical data on its reception and impact on teaching practice.

The study *Prompt engineering in teacher education: implications of a pedagogical intervention for integrating AI and TPACK in teacher licensure*, by Mayara

de Carvalho Santos, Murilo Nicolás Mombelli, Wilton José Diolindo do Nascimento Júnior, and Gildo Giroto Júnior, is grounded in the TPACK knowledge base. A recurring limitation was observed in the elaboration of input data, especially in the portion of the prompt that explicitly specifies the content to be addressed, suggesting that the difficulty of interacting with AI is related to the complexity of organizing and expressing one's pedagogical reasoning. It demonstrates that teacher education for AI use should not be restricted to the technical mastery of tools, and that it is fundamental to include prompt engineering as a resource that favors the structuring of teaching thought, requiring the mobilization and explicitation of professional knowledge.

The article *Perceptions of Artificial Intelligence in Education: a perspective from basic education teachers*, by Zenildo Santos and Ricardo Scucuglia Rodrigues da Silva, examines basic education teachers' perceptions of the use of AI in pedagogical practice, identifying conceptions, potentialities, and challenges, and the predominance of an instrumental vision, accompanied by insecurities and resistance. It finds that AI adoption lies between moderate enthusiasm and skepticism, reflecting a scenario of technological transition.

The study *Teacher education models for the era of Artificial Intelligence: between the instrumental and the critical-reflective*, by Roberto Milman Azambuja, Sandro José Rigo and Caroline Medeiros Martins de Almeida, analyzes paradigmatic models of teacher education in the face of the emergence of generative AI in education, contrasting the Instrumental Model and the Critical-Reflective Model and discussing the impacts of AI on professional teaching identity. It signals the most promising path to the synthesis between the efficient use of Artificial Intelligence and critical reflection on its impacts on education and teaching identity.

In "Will I become dumb?" *Emotions and the use of Artificial Intelligence in teaching*, Raquel Barbosa Galvão and Nair Floresta Andrade Neta analyze the symbolic meanings of the fear of "becoming dumb" expressed by university professors in the face of AI, investigating the relationship between teaching emotions, technology, and professional identity. The results reveal tensions between AI as both a support and a threat to teaching and indicate the need for affective, critical, and ethically oriented teacher education.

AI as a Support Tool for Teaching and Research

This axis explores practical applications of AI.

The article *Design and implementation of a computerized adaptive test using ENEM data*, by Erika Tiemi Anabuki, Tufi Machado Soares, and Rafaela Reis Azevedo de Oliveira, presents the development and experimental design of a Computerized Adaptive Test (CAT), using the R platform and its statistical and computational models for psychometric modeling and test simulation based on Item Response Theory (IRT). It demonstrates that the CAT is sensitive to individual proficiency characteristics, as it allows the identification of distinct performance profiles among respondents. Furthermore, it highlights the CAT as an adaptive assessment instrument, reinforcing its potential for evidence-based educational analyses and for supporting targeted and individualized pedagogical interventions.

The study *Artificial intelligence in Science education: a systematic mapping of productions in the Brazilian context*, by Keissy Carla Oliveira Martins, Suziele Galdino Batista and Maria Inês de Affonseca Jardim, identifies that investigations focus primarily on generative AIs, especially ChatGPT, applied to both assessment and didactic proposals, with predominant expansion of the field in Chemistry, followed by Physics and a significant absence in Biology. Although possibilities for personalization, engagement, and pedagogical innovation are highlighted, the need for critical and ethical teacher education to address technological dependence and access inequalities is reinforced.

The article *Humans vs. artificial intelligences in systematic reviews: evaluation in the stages of selection by titles and abstracts*, by Fernando Emilio Puntel, Muriel Belo, Bruna Adriane Fary and Gerson Geraldo Homrich Cavalheiro, analyzes ChatGPT and Gemini in article screening, demonstrating that for titles, they generated many false positives, while for abstracts they showed greater precision, identifying articles not selected by human reviewers. It argues that, even with initial limitations, ChatGPT and Gemini can serve as effective complementary support in study screening, with the potential to accelerate the initial stages of Systematic Literature Reviews.

The study *"Insects in the webs of children's narratives generated by GenAI: How conceptual errors can sow obstacles in children's learning,"* by Andréa Inês Goldschmidt and Fernando José Fraga de Azevedo, analyzes the use of generative AI in the production of children's literature with scientific content about insects. They compare narratives generated by different chatbots from specific prompts, identifying

limitations in meeting commands and recurrent conceptual errors. The study points to the need for careful attention and judicious use of generative AI in the context of producing children's literature.

The article *AI in Mathematics Education: Analyzing the Comprehension of Explanations Generated by ChatGPT for the Sixth Grade*, by Letícia Carla Carvalho, Anne Maiara Seidel Luciano, Rafael Strogenski Silva Soares, and Marco Aurélio Kalinke, presents a study with sixth-grade students who had difficulties understanding, without teacher mediation, mathematical explanations generated by ChatGPT. It identified that the textual complexity of the responses created barriers to reading and comprehension, and recognized the educational potential of AI, though it indicated that its effective use requires pedagogical interventions appropriate to students' developmental levels.

In the article "Analysis of the performance of chatbots in solving Chemistry questions in ENEM exams," Janaina Batista Cazuzza da Silva and Bruno Silva Leite analyze the performance of generative AI chatbots in solving Chemistry questions in ENEM exams between 2014 and 2024. Using a qualitative approach, they compare responses generated by different GenAI systems (ChatGPT, Gemini, LuzIA, and Copilot). The results indicate good performance on low-complexity questions and limitations on items requiring greater conceptual interpretation. The article highlights the pedagogical potential of these tools, provided they are critically mediated by teachers.

The article *The integration of artificial intelligence with active methodologies in higher education: implications for the teaching-learning process*, by Leandro Blass and Isadora Sides Camargo, presents results showing that the integration of AI with active methodologies enhances learning personalization and student engagement, while also identifying challenges for this integration, such as the need for teacher training and adequate technological infrastructure.

The article *Artificial intelligence in Geography teaching: a systematic review on paths toward ethical and meaningful learning*, by Marcos Farias de Holanda, Carlos Fernando da Silva Ramos and José Pinheiro de Queiroz Neto, indicates that although AI is not yet at the center of pedagogical practices in the various experiences analyzed, its integration into teaching demands the overcoming of technicist approaches and requires critical pedagogical mediation.

Critical and Epistemological Perspectives on AI in Education

This axis problematizes conceptions of technology and algorithmic biases.

In the article *Artificial Intelligences in Education: an epistemological analysis of academic productions*, Jackeline Império Soares, Natalia Carvalhaes de Oliveira, and Adda Daniela Lima Figueiredo Echalar critically analyze, based on historical materialism, academic productions in the field of Education concerning AI, drawing from the conceptions of technology that underpin them. They criticize the predominance of a technical logic that reduces education to automated, fragmented responses, thereby emptying pedagogical praxis. They propose a dialectical understanding of technology, including AI, guided by ethical and formative principles, reaffirming education as a human, political, and collective practice, critically mediated by teachers and students in dialogue with historical reality.

The study *Artificial intelligence and school assessment: a critical analysis of algorithmic biases*, by Márcio Silveira Nascimento, Sidney Pires Martins, Aline Santos Mossette, and Éber José dos Santos, examines distortions arising from unbalanced historical data. The results indicate that AI requires qualified human mediation, with the teacher serving as a critical agent in the process. It indicates that, despite favoring personalized teaching, its adoption must consider social justice, diversity, and equity, guiding the development of inclusive and reflective pedagogical practices in the use of intelligent systems.

In *Representations of gender and race in Mathematics Education mediated by ChatGPT: algorithmic biases and pedagogical implications*, Raylla Araújo da Rocha and Helber Rangel Leite Formiga Leite de Almeida demonstrate that AI reproduces social stereotypes, associating higher-prestige roles with white men and relegating women and Black people to less valued occupations. They indicate that, when used critically, AIs can become relevant pedagogical resources for algorithmic literacy, the problematization of mathematical neutrality, and the broadening of perspectives in teacher education.

In the article *Reconfigurations of teaching in the AI era: meanings, tensions and possibilities in the pedagogical triangle*, by Darleni Catarina Barbosa Lima Ribeiro de Castro and Savio Gonçalves dos Santos, transformations in the teacher-student-knowledge triangle are analyzed, highlighting challenges to teacher autonomy and identity, as well as the need for critical teaching practice. It suggests that the

responsible incorporation of technology can strengthen teacher education and foster reflective pedagogical practices, underscoring the urgency of future research to monitor these changes in real teaching contexts and ensure an ethically and pedagogically sound integration.

The research *Artificial Intelligence and the Question of Representation: an analysis of the image of the scientist in the 21st century*, conducted by John Wesley Grando, Everton Bedin and Lucas Eduardo de Siqueira, analyzes the representation of the scientist's image based on cultural stereotypes and AI-generated images, discussing how AI systems, trained on historical data, tend to reproduce and reinforce already consolidated cultural patterns. The comparison between human perceptions and generated images reveals the persistence of stereotypes. The study advocates revising these stereotyped representations to broaden diversity and bring science and society closer together.

4 Guidelines, Policies, and Regulatory Frameworks

This axis analyzes institutional documents and AI policies in education/teaching.

The article *Guidelines for the use of generative artificial intelligence in higher education: orientations from documents of Brazilian universities*, by Aline Amaral Paz, examines documents from SENAI CIMATEC, UFMG, PUC Minas, and UFBA, identifying guiding ethical principles and the concern for balancing technological innovation with methodological rigor. The findings reveal alignment among the guidelines regarding the valorization of human authorship, transparency in AI use, data protection, and the encouragement of critical thinking. The results indicate that addressing the challenges of GAI technologies requires more than technical rules from universities; it also demands institutional positioning and formative actions.

In the article *From digital competence to AI fluency: Global references, National Policies and challenges of teacher education*, Guiulllianna Bot, Raquel Pasternak Glitz Kowalski, and Katia Ethienne Esteves dos Santos analyze global and national frameworks that guide digital competencies and AI fluency in education. They discuss ethical foundations, pedagogical implications, and implementation challenges in Brazil, and observe the transition from digital competence to AI fluency, highlighting the need to reformulate curriculum and assessment models focused on the process of knowledge construction, as well as to invest in policies that prepare educators to develop critical AI fluency in students.

Convergences and Tensions

The studies converge in pointing out: (a) the need for teacher education that goes beyond instrumental use, incorporating critical and ethical dimensions; (b) concern with algorithmic biases and transparency in automated processes; (c) the need for public policies that guarantee equitable access and data protection.

On the other hand, important tensions emerge: the opposition between the instrumental vision (AI as an optimization tool) and the critical vision (AI as a social phenomenon traversed by power relations); and the balance between innovative potential and the risks of technological dependence and the precarization of teaching work.

Final Considerations

The dossier contributes to the debate on AI in teaching and in teaching research, demonstrating the vitality of Brazilian research. The methodological richness of the articles – systematic and scoping reviews, mappings, document analyses, case studies, experimental approaches, content analysis, Item Response Theory, and thematic analysis – attests to the consolidation of a plural and rigorous field.

Educitec reaffirms its commitment to producing qualified knowledge in technological education. We invite readers to engage with the articles with a critical eye, recognizing the potentialities and challenges that AI imposes on the educational field. Our expectation is that the reflections presented herein will contribute to the use of technology in the service of human emancipation, social justice, and the democratization of knowledge.

Happy reading!

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