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BETWEEN THE CLASSROOM AND THE ALGORITHM: A REVIEW OF ARTIFICIAL INTELLIGENCE AND TEACHER TRANSFORMATION

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ABSTRACT

This article analyzes the role of artificial intelligence (AI) as a bridge between pedagogy and teaching. It identifies the technology's potential, challenges, and repercussions regarding the transformation of teaching-learning processes and teacher training in contemporary education. A qualitative, documentary-based approach was employed through an integrative literature review. The study analyzed twenty scientific articles published between 2019 and 2025 in indexed databases such as Scopus, SciELO, Dialnet, and ERIC. Findings were categorized into pedagogical, formative, and ethical-humanistic dimensions using thematic coding. The results reveal that AI facilitates personalized learning through cognitive and didactic mediation, such as adaptive scaffolding and immediate feedback. In the formative dimension, teacher AI literacy is identified as essential, moving beyond technical use toward reflective and ethical competencies. Finally, the ethical-humanistic dimension emphasizes algorithmic governance and the preservation of teacher autonomy to ensure educational equity and transparency. This study provides an integrative vision of AI not merely as a tool for automation, but as an epistemological mediator. It contributes to the field by proposing a humanized algorithmic pedagogy where the teacher remains an irreplaceable ethical and creative mediator of knowledge.

KEYWORDS: Ethical artificial intelligence; algorithmic governance; educational equity; teacher autonomy; digital humanism.

1. INTRODUCTION

The Integration of artificial intelligence (AI) into contemporary education has sparked profound changes in teaching, learning, and the role of educators. The progressive integration of AI into educational systems responds not only to a technological trend but also to an epistemological transformation that invites us to rethink pedagogical practices, evaluation processes, and the professional training of educators (Bustamante & Camacho, 2024, p. 62). This phenomenon has been accentuated by the emergence of generative and natural language processing models, which have promoted the automation of tasks, virtual tutoring, and learning analytics at different levels of education (Eyal, 2025; Conde-Carmona & Padilla-Escorcia, 2025).

AI has evolved from an instrumental tool to a mediator of educational processes by enabling personalized learning, monitoring training trajectories, and diversifying didactic strategies (Parra-Taboada et al., 2024). However, this transition is not without tension because the uncritical adoption of automated systems can obscure the ethical and humanistic purpose of education. Several authors emphasize that the real challenge is not replacing teacher intervention but strengthening their capacity to interpret, guide, and humanize the use of AI within solid pedagogical frameworks (Valencia Tafur & Figueroa Molina, 2023; Alonso-Rodríguez, 2024).

In this context, teacher literacy in artificial intelligence is essential for educational innovation. It is defined as the knowledge, skills, and attitudes that enable teachers to comprehend how intelligent systems work, analyze their ethical implications, and leverage their instructional potential (Pineda Sánchez, 2025; Wu et al., 2023). According to Pérez-Velasco and Álvarez-Hernández (2025), teacher AI literacy goes beyond technical use and requires an examination of the social, cognitive, and formative effects of automation. UNESCO (2023) states that in the AI era, the role of the teacher should be to ensure that technology promotes equity, creativity, and reflective thinking rather than reproduce inequalities or replace human mediation.

From a pedagogical perspective, Parra-Taboada et al. (2024) and Bustamante and Camacho (2024) have shown that AI can contribute to reconfiguring teaching models by facilitating personalized learning and providing immediate feedback. These transformations are associated with active pedagogical approaches and the shift to hybrid and adaptive models where technology is integrated as a mediator of the educational process, not an end in itself (Valencia Tafur & Figueroa Molina, 2023). However, the authors caution that the effectiveness of these models hinges on didactic intentionality and the capacity to design contextualized learning experiences (Carballo Reina, 2025; Diego Olite et al., 2023).

In terms of teacher training, there is a shared concern about the need to strengthen teachers' professional skills considering the changes imposed by artificial intelligence. Eyal (2025) proposes a teacher literacy model that integrates technical, ethical, and pedagogical dimensions to promote a critical understanding of algorithms and their educational implications. Pineda Sánchez (2025) emphasizes that the primary obstacle to integrating AI in the classroom is pedagogical rather than technological, as many educators lack the preparation necessary to apply these resources reflectively. Similarly, Pérez-Velasco and Álvarez-Hernández (2025) emphasize the importance of continuous training based on reflection and professional ethics. This training enables educators to act as conscious mediators rather than mechanical executors of automated decisions.

Finally, the ethical-humanistic dimension emphasizes the importance of transparency, equity, and accountability in the use of AI in education. Alonso-Rodríguez (2024) emphasizes the need for clear regulatory frameworks governing data processing and accountability in digital environments. Gallent-Torres et al. (2023) and UNESCO (2023) complement this vision, insisting that algorithmic governance incorporate cultural diversity, privacy protection, and educational justice as guiding principles. From this perspective, AI ethics is not reduced to a technical issue but is rather understood as an ethics of mediation where technology strengthens the autonomy and critical thinking of teachers and students (Parra-Taboada et al., 2024).

Based on these considerations, this article aims to analyze the role of AI as a bridge between pedagogy and teaching. It identifies technology's potential, challenges, and repercussions in transforming teaching and learning processes and teacher training in contemporary education. To this end, a documentary review of twenty articles published between 2019 and 2025 was conducted. The articles were selected based on their relevance to three dimensions: pedagogical, formative, and ethical-humanistic. This approach critically examines the integration of AI into educational practices, emphasizing the importance of pedagogical

judgment, ethical reflection, and teacher autonomy amidst technological expansion.

2. METHODOLOGY

This study employed a qualitative, documentary-based approach to analyze trends, approaches, and issues related to incorporating artificial intelligence (AI) into teaching and contemporary pedagogy. The study adopted an integrative literature review design, which allowed for the systematization of information from academic sources published between 2019 and 2025 in indexed databases, such as Scopus, SciELO, and Dialnet, as well as open-access institutional repositories. This approach enabled the interpretation of theoretical and empirical discourses on educational AI and its implications in pedagogical, formative, and ethical-humanistic fields (Parra-Taboada et al., 2024; Eyal, 2025).

The sample consisted of twenty scientific articles selected based on relevance, timeliness, and thematic relevance. Publications addressing the relationship between AI and teaching, teacher training, and digital literacy, as well as ethical debates on the use of algorithms in education, were prioritized.

2.1 Collection and analysis procedure

The methodological process was developed in three complementary phases. First, a search was conducted, and documents were selected from specialized databases, including Scopus, Scielo, Dialnet, and ERIC. Search equations combining English and Spanish descriptors were used, such as "artificial intelligence," "teacher education," "pedagogical innovation," "AI literacy," "teaching," and "teacher training." To ensure the quality and relevance of the sources, the following inclusion criteria were established: (a) publications between 2019 and 2025, (b) articles in Spanish or English with full text available, (c) a direct relationship with the research objectives, and (d) academic peer review. Dissemination texts, institutional reports, and technical documents without an explicit pedagogical analysis were excluded.

Next, the information was organized using an analysis matrix that classified the findings into four categories: (a) theoretical contributions on the relationship between AI and education, (b) methodologies for application in teaching contexts, (c) teachers' competencies and perceptions, and (d) ethical and formative considerations. This categorization process revealed patterns of convergence and divergence among the reviewed studies, as well as emerging trends regarding the role of AI in contemporary teaching (Bustamante & Camacho, 2024; Parra-Taboada et al., 2024).

2.2 Analysis and interpretation

A thematic coding process was applied that grouped the findings into three emerging categories: a) Pedagogical dimension: linked to the reconfiguration of teaching and learning models mediated by AI, b) Formative dimension: focused on teacher literacy and professional competencies for the ethical and reflective use of technology; and c) Ethical-humanistic dimension: related to algorithmic governance, teacher autonomy, and the preservation of educational values (Alonso-Rodríguez, 2024; Gallent-Torres et al., 2023).

3. RESULTS

Analyzing twenty scientific publications from 2019 to 2025 revealed three central dimensions of artificial intelligence (AI) in education: pedagogical, formative, and ethical-humanistic. Together, these dimensions demonstrate the progressive integration of AI into educational systems and its transformative impact on teaching-learning dynamics, teaching practices, and ethical considerations of knowledge.

3.1 Analysis and interpretation

3.1.1 Reconfiguration of pedagogical models.

The integration of AI into educational processes has prompted a significant reevaluation of traditional pedagogical models, shifting the emphasis from knowledge transmission to learning mediation, personalization, and co-construction. This incorporation is more than an instrumental innovation; it is an epistemological transformation that redefines teaching, learning, and assessment. In this sense, AI consolidates its role as a mediator of the educational process, capable of broadening teaching methods and fostering more interactive and adaptive learning environments.

According to Bustamante and Camacho (2024), AI "has great potential to transform education and address challenges such as personalizing teaching and evaluating performance" (p. 77). This statement encapsulates the shift towards data-driven and adaptive intelligence models, where platforms dynamically adjust pedagogical strategies. Parra-Taboada et al. (2024) point out that AI improves cognitive processes, such as attention, memory, problem-solving, and critical thinking, for both students and teachers (p. 170), thereby highlighting its cognitive and metacognitive potential when integrated with active methodologies.

Carballo Reina (2025) states that AI redefines the roles of educational stakeholders, positioning teachers as designers of learning experiences rather than information transmitters. This change reinforces the teacher's role as a curator of knowledge who is responsible for contextualizing the data generated by intelligent systems and preserving pedagogical intentionality. This transition is supported by hybrid and adaptive models, learning analytics, automated tutoring, and collaboration between humans and intelligent systems (Diego Olite et al., 2023; Valencia Tafur & Figueroa Molina, 2023). However, García-Peñalvo, Llorens-Largo, and Vidal (2024) warn that "generative artificial intelligence is extremely powerful, yet it lacks reasoning and comprehension abilities. Consequently, it is susceptible to flaws that must be identified" (p. 7).

Other authors, such as Alonso-Rodríguez (2024) and Tramallino and Zeni (2024), caution that fascination with algorithmic efficiency can lead to technocentric pedagogy, diluting the purpose of training. For this reason, teachers' roles are reconfigured from technifying teaching to ethical and reflective mediation. In this role, teachers act as critical interpreters of data, selecting and contextualizing information according to their students' learning trajectories (Valencia Tafur & Figueroa Molina, 2023). Thus, educational innovation is not measured by technical sophistication but by coherence between pedagogical principles and technology use, ensuring didactic decisions maintain a humanistic orientation. Parra-Taboada et al. (2024) state that when applied from a critical pedagogy perspective, AI can strengthen teacher autonomy by expanding their analytical capacity, provided that "human mediation retains its place as a guarantor of the educational sense" (p. 172). Consequently, innovation should not be conceived as a substitute for pedagogical judgment but rather as an expansion of the teacher's professional scope, shifting the role from executor of prescribed methodologies to designer of reflective experiences in which AI serves as a cognitive ally. This vision aligns with Tramallino and Zeni's (2024) humanized algorithmic pedagogy, in which data analysis is combined with ethical deliberation to promote personalized, inclusive, and meaningful learning. Ultimately, AI becomes an instrument of human empowerment, not a dehumanizing force in education.

3.1.2 Didactic mediation and personalization of learning.

The didactic mediation of AI can be understood as a synthesis on several levels. At the cognitive level, tutors and intelligent systems can detect conceptual errors early on, provide hints or intermediate steps, and adjust task difficulty according to a student's recent performance. This sustains adaptive scaffolding processes and promotes progressive understanding (Parra-Taboada et al., 2024, p. 171). At the metacognitive level, AI provides immediate feedback and performance data (e.g., time, attempts, and response patterns) that facilitate student self-regulation and teacher-led, data-informed decision-making (Bustamante & Camacho, 2024).

At the didactic level, personalization is expressed in four aspects that systems can support: (1) content, by recommending alternative resources or exercises that address identified gaps; (2) process, by offering differentiated routes and varying the sequence of activities; (3) rhythm, by adapting times, repetitions, and recovery practices when difficulties are observed; and (4) evaluation, by proposing tasks with progressive criteria and providing specific, improvement-focused feedback (Diego Olite et al., 2023; Bustamante & Camacho, 2024). These functions promote autonomous and reflective learning as long as teachers maintain pedagogical oversight and an ethical framework for their use (Valencia Tafur & Figueroa Molina, 2023).

In work involving written production and academic tasks, mediation takes the form of specific support for planning, revising, and improving drafts (e.g., suggestions regarding structure, clarity, and references), amplifying the practice of formative feedback without substituting authorship or pedagogical judgment. Hence, there is an emphasis on incorporating integrity guidelines and reflecting on the use of AI in activities (Martinez Domingo et al., 2023). Additionally, in university settings, teachers have reported finding conversational support useful for resolving doubts, clarifying instructions, and organizing study plans. However, they have also expressed reservations about the ethical implications and preservation of professional autonomy. This confirms the need for clear frameworks and rules of use (Conde-Carmona & Padilla-Escorcia, 2025).

However, the effectiveness of personalization depends on the intentionality of the design. The same adaptive mechanisms can be powerful or superficial, depending on how the objectives, success criteria, and moments of teacher intervention are defined (Bustamante & Camacho, 2024). For this reason, Eyal (2025) emphasizes that the educational value of AI lies in its ability to expand opportunities for cognitive mediation, such as fine diagnosis, situated support, and timely feedback.

In summary, the types of mediation documented in your corpus include cognitive mediation (error detection, providing clues, and adjusting difficulty levels), metacognitive mediation (providing immediate feedback and traces for self-regulation), and didactic mediation (sequencing, recommending, and adaptive evaluation). The types of personalization, on the other hand, are specified by what is learned (content), how it is learned (process), the pace at which it is learned (time and practice), and how it is evaluated (criteria and feedback). The teacher must always be in charge to ensure pedagogical relevance, academic integrity, and a humanistic orientation.

3.2 Training dimension: teaching skills and literacy in artificial intelligence

3.2.1 Teacher literacy in AI.

Teacher literacy in AI is essential for the critical and sustainable integration of technology into pedagogy. Eyal (2025) proposes an adaptive literacy model that encompasses technical, ethical, and pedagogical aspects. This model enables teachers to comprehend algorithms, recognize their biases, and develop AI-mediated strategies. Wu et al. (2023) emphasize the importance of incorporating this literacy into professional development programs that integrate ethical reflection with didactic practice.

Pineda Sánchez (2025), on the other hand, stresses that the main barrier to the critical integration of AI in public teaching is pedagogical rather than technological, as "the lack of pedagogical preparation, rather than technological preparation, is the main barrier to its critical integration" (p. 811). Similarly, Pérez-Velasco and Álvarez-Hernández (2025) argue that developing AI competencies requires reflective pedagogy that fosters teacher autonomy. Thus, strengthening initial and continuing education programs is presented as an indispensable condition for achieving technologically competent and ethically responsible teaching (Conde-Carmona & Padilla-Escorcia, 2025; Bustamante & Camacho, 2024).

3.2.2 Teacher perceptions and attitudes.

Teachers' perceptions of AI reflect a tension between enthusiasm and critical prudence. Eyal (2025) found that teachers value AI's potential to reduce administrative tasks and personalize teaching. However, they also expressed concern about losing professional autonomy. Martinez Domingo et al. (2023) acknowledge the advantages of generative tools but note the risk of dehumanizing the pedagogical relationship. Conde-Carmona and Padilla-Escorcia (2025), on the other hand, argue that this skepticism stems not from technological resistance but from an ethical awareness of the epistemological impacts of automation. These perceptions reaffirm the need for formative support that enables teachers to retain deliberative control over pedagogical decisions and the educational implications of AI.

3.3 Ethical-humanistic dimension: responsibility, equity and professional autonomy

3.3.1 Ethical principles and algorithmic governance.

Integrating AI into education requires ethical principles and algorithmic governance mechanisms that ensure transparency, fairness, and respect for human dignity. Alonso-Rodríguez (2024) proposes a five-principle framework beneficence, nonmaleficence, autonomy, justice, and explainability — to guide the design and responsible use of educational AI. Gallent-Torres et al. (2023) add that transparent and traceable algorithms are essential to building public trust and ensuring accountability.

UNESCO (2023) reinforces this idea, emphasizing the need for policies that promote the inclusive and responsible use of AI while ensuring data protection and bias mitigation. From this perspective, AI ethics is not merely a technical issue, but an ethics of mediation aimed at fostering critical thinking and cognitive justice (Parra-Taboada et al., 2024; Tramallino & Zeni, 2024). This approach places teacher deliberation at the core of any technology-mediated pedagogical decision.

3.3.2 Digital humanism and teacher autonomy.

Digital humanism is a pedagogical approach that uses technology to promote comprehensive human development. In this framework, AI is valued not for its ability to automate tasks but rather for its potential to stimulate creativity, ethical reflection, and critical thinking among teachers and students. Valencia Tafur and Figueroa Molina (2023) argue that the contemporary educational challenge is to "preserve the critical capacity of the teacher in the face of the automation of pedagogical processes" (p. 241). Meanwhile, Martínez Domingo et al. (2023) contend that AI should be considered a tool for cognitive expansion, guided by responsibility and educational purpose.

This humanism is expressed through three common teaching practices: critically curating AI-generated content, pedagogically co-creating with algorithms, and using intelligent systems for formative

assessment, all under the ethical judgment of the teacher (Eyal, 2025). Tramallino and Zeni (2024) stress that "the treatment of AI in the educational context does not merely respond to a technological question involving the study of hardware and software but must also comprehensively address ethics" (p. 50). Alonso-Rodríguez (2024), on the other hand, emphasizes that professional autonomy implies critically deciding when, how, and why to use technology. Thus, even in highly digitalized contexts, teachers reaffirm themselves as guarantors of the pedagogical and ethical sense of education, where their reflexive mediation remains irreplaceable.

4. DISCUSSION

The accelerated integration of AI into education challenges traditional notions of teaching, learning, and teacher training. Results show that AI is an epistemological mediator that redefines the relationship between pedagogy and teaching, not just a technological tool. Critically incorporating AI requires balancing innovation with the humanistic dimension of education (Valencia Tafur & Figueroa Molina, 2023).

From a pedagogical perspective, AI enhances learning mediation and personalization when articulated with active, contextualized models. Parra-Taboada et al. (2024) state that AI improves cognitive processes such as attention, memory, and conceptual comprehension (p. 170). However, Bustamante and Camacho (2024) caution that indiscriminately using AI can reduce teaching to mere automation. The balance lies in teachers assuming critical, contextualizing roles and orienting technology according to the characteristics and needs of educational environments (Carballo Reina, 2025; Tramallino & Zeni, 2024).

In terms of training, AI literacy emerges as the foundation of reflective teaching. Eyal (2025) defines AI literacy as "the ability to understand, apply, and question the algorithms that mediate teaching" (p. 12), and Pineda Sánchez (2025) reaffirms that the main obstacle is pedagogical, not technical. This critical literacy involves training teachers to interpret the results of intelligent systems autonomously and with ethical criteria (Pérez-Velasco & Álvarez-Hernández, 2025; Wu et al., 2023).

From an ethical and humanistic perspective, Alonso-Rodríguez (2024) and Gallent-Torres et al. (2023) highlight the risks related to data privacy and algorithmic opacity. In light of these concerns, UNESCO (2023) has proposed governance and transparency policies to ensure the responsible and inclusive use of AI. Martinez Domingo et al. (2023) summarize this challenge, stating that "Teaching with artificial intelligence also implies teaching about artificial intelligence" (p. 147). This emphasizes the necessity of integrating digital ethics into the curriculum.

Overall, the findings encourage us to view AI as a bridge between pedagogy and teaching. This bridge's potential is realized when AI is combined with critical mediation, reflective training, and ethical responsibility. Only an education that maintains human centrality in the face of automation can guarantee that AI contributes to students' integral development and renews educational practice in the 21st century.

5. CONLUSION

Artificial intelligence (AI) is a complex pedagogical phenomenon that reshapes the relationship between teaching, learning, and teacher training. Its role cannot be reduced to that of an instrumental tool; rather, it must be understood as a new epistemological and cultural mediator that calls into question the foundations of educational practice (Parra-Taboada et al., 2024). AI acts as a bridge between pedagogy and teaching not by replacing teachers but by expanding their possibilities for action, reflection, and didactic design.

From a pedagogical perspective, the results demonstrate that AI has facilitated the development of more flexible and adaptive models based on learning analytics and personalized feedback. However, the literature agrees that the innovation lies not in the automation of processes but in teachers' capacity to integrate technology into well-founded didactic frameworks. As Bustamante and Camacho (2024) caution, the transformative potential of AI hinges on the pedagogical intention behind its use. They assert that "an intelligent tool with no educational purpose ultimately reinforces traditional practices" (p. 77). Therefore, the central challenge is to maintain coherence between technological mediation and the formative purposes of education.

Regarding the formative dimension, the reviewed studies confirm that teacher literacy in artificial intelligence is indispensable for critically and ethically integrating these technologies (Eyal, 2025; Wu et al., 2023). Understanding the technical workings of algorithms is not enough; a thoughtful understanding of their social and epistemological implications is necessary. Pineda Sánchez (2025) emphasizes that the primary gap is pedagogical, not technological. He demonstrates that many educators lack the systematic training necessary to

contextualize the use of AI in meaningful teaching processes. Consequently, initial and continuing education programs must promote critical, ethical, and creative skills that strengthen teachers' autonomy in the face of automation.

In the ethical-humanistic dimension, the review reveals a shared concern about establishing algorithmic governance principles that ensure transparency, equity, and the protection of educational data (Alonso-Rodríguez, 2024; Gallent-Torres et al., 2023). UNESCO (2023) warns that institutional policies must promote the inclusive and responsible use of AI within a digital humanism framework that prioritizes dignity and integral development over technical efficiency. Along these lines, Parra-Taboada et al. (2024) propose an "ethics of mediation," in which teachers act as guarantors of educational meaning and critical thinking in the face of growing teaching automation.

The findings allow us to conclude that true educational innovation does not lie in the widespread use of intelligent tools but rather in teachers' ability to redefine their practice through critical, contextual, and humanistic pedagogy (Tramallino & Zeni, 2024). Twenty-first-century teachers are not defined by their technological mastery but by their ability to deliberate ethically, design meaningful experiences, and guide learning in algorithm-mediated environments. In this framework, AI becomes a tool for cognitive empowerment rather than human replacement, provided its use strengthens cognitive justice, inclusion, and reflection on knowledge.

Finally, this review provides an integrative vision: AI can consolidate itself as a bridge between pedagogy and teaching when integrated with educational projects that promote critical thinking, digital literacy, ethical mediation and professional autonomy. Teacher training must shift towards a model of increased pedagogical competence in which technology serves educational purposes and humanism remains the foundation of all didactic transformation.

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