



Generative AI in Education: A Systematic Analysis of its Ethical Implications, Pedagogical and Evaluative Measures in Teaching Processes

IA Generativa en Educación: Un Análisis Sistemático de sus Implicaciones Éticas, Pedagógicas y Evaluativas en los Procesos de Enseñanza

Leonel Alexander Burgos Martínez¹ 

¹ Universidad de Nariño. Nariño, Colombia.

Submitted: 01-07-2026 | Revised: 05-09-2026 | Accepted: 08-10-2026 | Published: 09-10-2026

ABSTRACT

Generative artificial intelligence has managed to transform educational processes, generating new possibilities in teaching, learning, and assessment, but also important challenges at the academic level. This article presents a systematic review with the aim of analyzing its main implications in educational contexts. Therefore, six research questions were formulated aimed at the redesign of assessments, the implementation of institutional strategies, digital sustainability, the mitigation of algorithmic biases, AI literacy, and its use as an artificial evaluator. The methodological process was based on a structured search in academic databases, then a selection and quality evaluation of the studies. The results show that generative AI can strengthen feedback, personalization of learning, and pedagogical decision-making, as long as it is integrated in a responsible and transparent manner. However, risks associated with academic integrity, bias, and technological dependence are also identified. In conclusion, the incorporation of generative AI in education requires a critical approach, accompanied by institutional frameworks and digital literacy processes that allow its benefits to be harnessed without affecting the quality of learning.

Keywords: artificial intelligence; education assessment; science ethics; digital literacy; learning.

RESUMEN

La inteligencia artificial generativa ha logrado transformar los procesos educativos, generando nuevas posibilidades en la enseñanza, el aprendizaje y la evaluación, pero también desafíos importantes a nivel académico. Este artículo presenta una revisión sistemática con el objetivo de analizar sus principales implicaciones en los contextos educativos. Por lo tanto, se formularon seis preguntas de investigación orientadas al rediseño de las evaluaciones, la implementación de estrategias institucionales, la sostenibilidad digital, la mitigación de sesgos algorítmicos, la alfabetización en IA y su uso como evaluador artificial. El proceso metodológico se basó en una búsqueda estructurada en bases de datos académicas, después una selección y evaluación de calidad de los estudios. Los resultados evidencian que la IA generativa puede fortalecer la retroalimentación, la personalización del aprendizaje y la toma de decisiones pedagógicas, siempre que se integre de manera responsable y transparente. No obstante, también se identifican riesgos asociados a la integridad académica, los sesgos y la dependencia tecnológica. En conclusión, la incorporación de la IA generativa en la educación requiere un enfoque crítico, acompañado de marcos institucionales y procesos de alfabetización digital que permitan aprovechar sus beneficios sin afectar la calidad del aprendizaje.

Palabras clave: inteligencia artificial; evaluación de la educación; ética de la ciencia; alfabetización digital; aprendizaje.

INTRODUCTION

Generative artificial intelligence (GAI) has become increasingly relevant in education because of its potential to transform teaching, learning, and assessment processes. Its incorporation into academic practices enables the exploration of new forms of personalized learning, content generation, formative feedback, and support for pedagogical decision-making. However, these opportunities also pose challenges related to academic integrity, authorship, the reliability of generated information, and technological dependence. In this context, integrating GAI requires rethinking didactic strategies and traditional assessment mechanisms, prioritizing the development of critical thinking, student autonomy, and the active participation of the teacher in knowledge construction.

Beyond its pedagogical applications, the use of generative artificial intelligence in educational institutions raises ethical, technological, and organizational questions that require comprehensive analysis. Among the main challenges are the protection of personal data, transparency in the use of generative tools, the reproduction of algorithmic biases, and their possible consequences for educational equity and inclusion. Likewise, the growing use of these systems introduces considerations related to digital sustainability, particularly because of the energy consumption and computational resources required for their operation. These issues demonstrate the need to establish institutional policies, oversight mechanisms, and artificial intelligence literacy programs that enable the development of digital competencies and promote critical, safe, and responsible use of these technologies.

Given this scenario, it is necessary to systematize the available scientific evidence to understand the implications of generative artificial intelligence in educational processes from an ethical, pedagogical, and evaluative perspective. Therefore, the objective of this research is to analyze, through a systematic literature review, the main ethical, pedagogical, and evaluative implications of generative artificial intelligence in teaching and learning processes. Specifically, 6 dimensions are examined: redesigning assessments to promote authentic learning, institutional strategies to guarantee safe and reliable use, incorporating digital sustainability principles, mitigating algorithmic biases, strengthening artificial intelligence literacy, and its use as an artificial evaluator to support pedagogical and academic decisions. In this way, the study seeks to integrate contributions from the existing literature and provide elements that help guide the responsible incorporation of these tools in educational contexts.

METHODS

This research was developed through a systematic literature review, understood as a structured method for identifying, analyzing, and interpreting the available evidence on a research question. The procedure followed the guidelines proposed by Kitchenham and Charters[40], which organize the review into planning, conducting, and reporting stages and include activities such as identifying studies, selecting primary studies, quality assessment, data extraction, and evidence synthesis.

Initially, a broad search of the literature related to generative artificial intelligence in education was conducted. Subsequently, inclusion and exclusion criteria were applied to filter out irrelevant studies. Then, the quality of the selected publications was assessed, and finally, the information was extracted, organized, and synthesized based on the research questions in order to classify the findings into ethical, pedagogical, and evaluative dimensions.

Research Questions

To guide the systematic literature review and delimit the analysis of the study, 6 research questions were formulated focused on the ethical, pedagogical, and evaluative implications of generative artificial intelligence in education. These questions allow structuring the search, selection, and analysis of the collected information.

- RQ1: How should assessments in educational contexts be redesigned to mitigate the misuse of generative AI and promote authentic learning?
- RQ2: What institutional strategies can be implemented in educational settings to guarantee the safe and reliable use of generative AI tools?
- RQ3: How can educational institutions integrate digital sustainability principles (Green AI) into the adoption of generative AI tools?
- RQ4: How can algorithmic biases be mitigated in the implementation of generative AI to ensure equity and inclusion in educational processes?

- RQ5: How can generative AI literacy be promoted to strengthen critical thinking, autonomy, and digital ethics in students and teachers?
- RQ6: How can generative AI, used as an artificial evaluator, support pedagogical and academic decision-making in educational institutions?

Table 1. Definition of general concepts with PIPOH.

Criterion	Description
Population	Teaching and learning processes mediated by generative artificial intelligence in education.
Intervention	Use of generative AI tools to support assessments, feedback, pedagogical decision-making, digital literacy, inclusion, and ethical analysis in educational contexts.
Results	Studies, articles, and reviews that analyze the ethical, pedagogical, and assessment implications of generative AI in teaching processes.
Professionals	Teachers, students, researchers, and institutional actors associated with the educational field.
Context	Educational and academic environments, especially in higher education.

Source: Own elaboration.

Search

To precisely structure the bibliographic search process, the main terms of the study were defined in Table 2, along with their synonyms and conceptual filters associated with each dimension of analysis. On this basis, the databases selected for the review were consolidated in Table 3, while Table 4 presents the search string used to identify the relevant documents. This procedure guided the literature exploration toward studies related to generative artificial intelligence in education and its ethical, pedagogical, and evaluative implications.

Table 2. Terms, synonyms, and filters for composing the search string.

Main term	Synonyms / related terms	Conceptual filters
Generative artificial intelligence	generative AI, IAG, generative AI, GenAI, generative models, generative tools, chatbots	Education, teaching, learning, evaluation
Teaching-learning processes	teaching, learning, pedagogical practices, educational processes, training, didactics	Academic context, higher education, classroom
Educational evaluation	assessment, authentic assessment, formative assessment, assessment of learning, feedback	Evaluative redesign, ethical use, authentic learning
Digital ethics	ethics, responsible use, transparency, authorship, academic honesty, privacy, integrity	Safe, reliable, and responsible use of AI
Digital sustainability	Green AI, green AI, energy efficiency, carbon footprint, technological sustainability	Environmental impact, institutional responsibility
Algorithmic biases	algorithmic discrimination, equity, inclusion, algorithmic justice	Diversity, accessibility, non-discrimination
AI Literacy	digital literacy, AI literacy, critical thinking, autonomy, digital ethics, digital competencies	Students, faculty, institutional training
Artificial evaluator	automated assessment, learning analytics, automatic feedback	Academic decision-making, teaching support

Source: own elaboration.

Table 3. Main term and databases.

Main term	Database
Generative artificial intelligence in education	IEEE Xplore
	Redalyc
	DOAJ
	ResearchRabbit

Source: own elaboration.

Selection

The studies identified during the search process were subjected to a selection process to ensure their relevance to the research objectives. For this purpose, a progressive review of the documents was carried out, considering elements such as the title, keywords, abstract, and general content, to identify those that addressed artificial intelligence in the educational context, especially from a generative AI perspective.

Table 4. Search string used to obtain the documents.

Main term	Search string
Generative artificial intelligence in education	("generative AI" OR "generative artificial intelligence" OR "generative AI in education" OR "use of generative AI" OR "generative AI applications" OR "generative AI" OR "generative artificial intelligence" OR "AI in education") AND (2021-2026) AND (open access)

Source: own elaboration.

The selection process involved a gradual refinement of the results obtained in the initial search. In the first phase, duplicate documents or those not available in open access were eliminated. Subsequently, studies that were not directly related to the use of artificial intelligence in education or that did not provide relevant information to answer the research questions were excluded. Finally, documents that met the defined criteria and supported the analysis of the ethical, pedagogical, and evaluative implications of generative AI were selected.

Table 5. Dates of consultation and file download.

Database	Search date
Redalyc	23/02/2026
DOAJ	22/02/2026
ResearchRabbit	23/02/2026
IEEE Xplore	18/02/2026

Source: own elaboration.

Data extraction and synthesis of results

To guarantee the quality of the selected studies, an evaluation process was carried out based on the review of the results obtained in each of the databases consulted. This process included the identification of initial documents, the elimination of duplicate records, and the exclusion of studies that did not meet the defined criteria, such as thematic relevance, the relationship with generative artificial intelligence in education, availability in open access, and the recency of the publications.

Table 6. Quality assessment in search and selection processes.

Main term	Search results	Duplicate files	Excluded files	Relevant files	Database
Generative artificial intelligence in education	30	2	5	23	Redalyc
	30	3	10	17	ResearchRabbit
	30	4	8	18	DOAJ
	30	2	5	23	IEEE Xplore
Total	120	11	28	81	

Source: own elaboration.

Table 7. Studies included in the systematic review.

Year	Quantity	Referencias
2023	12	[1], [2], [7], [8], [14], [17], [18], [19], [21], [27], [28], [33]
2024	15	[3], [4], [5], [6], [9], [11], [12], [13], [20], [22], [25], [30], [32], [35], [36]
2025	10	[16], [23], [24], [29], [31], [34], [37], [38], [39], [15]
2026	2	[10], [26]

Source: own elaboration.

RESULTS

The results obtained from the systematic literature review are presented below, organized according to the dimensions addressed in the research questions. This analysis allowed the identification of the main approaches, trends, and contributions related to the use of generative artificial intelligence in educational processes, particularly regarding its ethical, pedagogical, and evaluative implications. Based on the selection and synthesis of the relevant studies, the findings that allow an understanding of the impact of these technologies on teaching and learning are consolidated, as well as the challenges and opportunities they represent in the current academic context.

The redesign of assessments in educational contexts can mitigate the misuse of generative AI and promote authentic learning.

The redesign of assessments in the context of generative artificial intelligence use must focus on the learning process and the development of critical thinking, rather than evaluating only final products. This implies transforming assessment methods, integrating AI transparently into academic activities, and promoting continuous and formative approaches that validate learning more authentically[1], [2], [3], [4].

Priority should be given to assessing skills that AI does not yet replicate accurately, such as reflective judgment, creativity, and the application of knowledge to local contexts or real and current problems that fall outside the training base of models[2],[4],[5],[6]. In this regard, it is recommended to replace short-answer theoretical questions or generic essays with case-development tasks and complex problem-solving[2],[3],[7].

Similarly, it is proposed to reaffirm the value of supervised in-person assessments and the use of oral exams, recorded presentations, or project defenses to verify the student's actual internalization of the concepts[1],[2],[3],[4],[5],[8].

Likewise, instead of prohibiting technology, it should be integrated through didactic protocols where the student declares the use of IAG, attaches the prompts used, and performs a critical analysis of the generated results (identifying biases or "hallucinations"), providing personal contributions that go beyond the automatic result[3],[5],[8].

Finally, it is essential to move toward a model of continuous assessment with frequent lower-weight tasks (low-stakes) that allow monitoring of student progress and self-regulation, using IAG as a tutor or personalized feedback assistant rather than only as a final control tool[1],[3],[6].

The implementation of institutional strategies in educational environments guarantees the safe and reliable use of generative AI tools.

The institutional response must focus on proactive adaptation that updates regulatory frameworks concerning AI, incorporating rules on authorship simulation and avoiding legal gaps that affect academic integrity. In addition, it is necessary to implement digital literacy and training programs for faculty and students, oriented toward both the technical and ethical use of these tools, in line with institutional guidelines[2],[1],[9],[8].

To ensure the reliability of results generated by AI, institutions must require transparency in its use, requesting that students declare the tools used, include the prompts, and justify their personal contribution. Likewise, it is necessary to strengthen critical thinking, redesign assessments with fraud-resistant questions, and establish internal verification systems to mitigate risks such as disinformation and model hallucinations[5],[2],[5],[10].

From an ethical and security perspective, institutional strategies must include the creation

of clear guidelines that protect personal data privacy and ensure compliance with intellectual property and copyright laws, which implies establishing robust security policies and informed consent mechanisms for data handling within AI platforms[11],[12].

In addition, the formation of communities of practice and specialized subcommittees is recommended to continuously review assessment design and share experiences on the educational use of technology[1],[8]. The literature also highlights the importance of implementing pilot programs to evaluate the impact of AI on critical skills before its massive adoption, ensuring that technological integration is scientific and professional[10],[11].

Finally, the success of these strategies depends on an approach of distributed responsibility, in which institutional governance, teachers, and students share a commitment to academic honesty and transparency in the use of generative tools[1].

The integration of digital sustainability principles (Green AI) in educational institutions enables the responsible adoption of generative AI tools.

The integration of digital sustainability begins with the recognition that these large language models require intensive processing power both for training and for inference, which entails considerable energy consumption and a carbon footprint that institutions must not ignore when incorporating these applications into their teaching practices[1],[13],[14],[15].

Another key pathway for incorporating these principles consists of fostering digital literacy and critical thinking within the curriculum, training teachers and students to understand the limitations and ecological cost of the tools. Likewise, institutions must adopt international recommendations that promote ethical and transparent use of technology, protecting the environment. In this context, teaching work must guide responsible use of AI, prioritizing critical analysis and avoiding excessive dependence that ignores its environmental impact[5],[1],[17].

From a technical perspective, institutions can adopt Green AI models, characterized by a low carbon footprint, lower computational complexity, and greater efficiency, which enables their use on local devices and reduces dependence on large data centers[15],[18],[19]. Furthermore, it is necessary to manage the life cycle of educational hardware, addressing electronic waste through circular economy principles and strengthening technological resilience[13].

Finally, digital sustainability implies that AI should not be seen as absolute truth, but rather as a tool that requires human validation to avoid superficial learning without pedagogical value. Therefore, institutions must implement policies and governance frameworks that align the use of AI with the Sustainable Development Goals, promoting responsibility and academic integrity[1],[6],[16].

The mitigation of algorithmic biases in the implementation of generative AI guarantees equity and inclusion in educational processes.

Technology is not neutral, since generative systems can inherit biases present in their training data, affecting marginalized populations. Their mitigation requires identifying and correcting these biases through representative data, rebalancing, and proper curation, considering that information taken from the internet does not always guarantee quality. Therefore, developers must treat bias as a critical factor before implementing these systems in educational contexts[1],[2],[6],[20],[21].

From a technical perspective, strategies such as fine-tuning with human feedback (RLHF) are proposed, which allow aligning the model's responses with ethical criteria. Equity-oriented approaches, such as FairGAN, and bias-removal techniques also stand out, together with the use of explainable AI (XAI) to ensure transparency, traceability, and detection of possible discrimination in the results[6],[14],[19],[22],[23],[24],[25].

At the institutional level, bias mitigation requires an educational approach that prioritizes AI literacy and the development of critical thinking. Rather than prohibiting these tools, teachers and students should be trained to evaluate their outputs in an ethical and contextual manner, teacher training in bias detection should be strengthened, and good practices should be promoted that turn students into critical verifiers of generated content[4],[8],[11],[14],[25],[26].

Governance and regulatory frameworks are key to preventing generative AI from reproducing racial, gender, or socioeconomic biases. Educational policies should include periodic audits; compliance with data protection regulations and fundamental rights; and the creation of ethical codes, validation committees, and university frameworks that regulate the use of these tools and prevent academic dishonesty[6],[11],[14]. Transparency and accountability are essential for ensuring that institutions oversee these tools and promote fairness and impartiality[20],[25],[27].

Finally, to guarantee equity and inclusion, it is necessary to address the digital divide and biases directed toward non-English-speaking populations or people with disabilities.

Since many models are trained primarily in English, solutions must be developed for diverse languages, and accessibility must be improved through tools such as text-to-speech and simplified interfaces. Under principles of universal design, AI can support inclusion without replacing human judgment or empathy in education[8],[20],[23],[28],[29].

The promotion of generative AI literacy strengthens critical thinking, autonomy, and digital ethics among students and teachers.

Digital literacy should be understood as part of students' comprehensive development, not only as a technical skill. It includes effective information search, security and privacy, ethical and empathetic use, and awareness of data collection and terms of service[30].

Strengthening critical thinking entails understanding that language models are not sources of truth but probabilistic systems that can generate coherent yet incorrect information[1],[9]. To prevent overconfidence in their outputs, the EIPP-CT model is proposed, which promotes interpretive judgment and critical reflection. This approach promotes a pedagogy that questions algorithmic assumptions and encourages source verification to preserve human agency [31], [32].

Student autonomy is strengthened by using AI as an assistant that facilitates adaptive learning and self-regulation. Strategies such as interactive example machines allow the analysis and correction of AI responses, promoting learning from errors. In this process, teacher training is essential for integrating these tools into pedagogical design and avoiding restrictive approaches[5],[1],[32].

Regarding digital ethics, the proposal is to move toward a post-plagiarism era that recognizes hybrid human-AI writing and redefines authorship. To this end, transparency-based protocols are proposed in which the use of AI is declared and results are verified with reliable sources. In addition, institutions must implement flexible regulatory frameworks and promote ethical training and originality in the educational process[5],[8],[1],[11],[30].

The use of generative AI as an artificial evaluator supports pedagogical and academic decision-making in educational institutions.

The integration of these systems makes it possible to automate the assessment of essays, exams, and written assignments, optimizing teaching time and enabling faculty to focus on higher-order cognitive activities. In addition, generative models trained on human-evaluated data can achieve high accuracy in identifying characteristics of well-written texts, yielding results comparable to those of human experts[2],[29],[21],[34].

The use of generative artificial intelligence as a dynamic evaluator makes it possible to offer formative and personalized feedback tailored to students' needs. This supports continuous monitoring and self-regulation of learning, identifying deficiencies and suggesting improvements. Furthermore, it acts as a writing assistant, facilitating the comparison and correction of texts to iteratively strengthen learning[17],[21],[36],[31],[32].

Learning analytics based on these technologies enables the detection of trends and the prediction of academic performance, facilitating early identification of areas for improvement. Furthermore, it acts as an artificial evaluator by analyzing specific skills and proposing adaptive lessons centered on students' needs, promoting more inclusive and effective learning[37],[38],[1],[39].

Despite their advantages, instructors must maintain an expert role to validate the results of these systems, since they are based on probabilities and may generate errors or inconsistencies. Although they can serve as dynamic evaluators, their use requires adjusting academic integrity policies and strengthening digital literacy to critically interpret the information generated by AI[31],[1],[8],[16].

CONCLUSIONS

The systematic review was important because it made it possible to organize the evidence on generative artificial intelligence in education clearly and rigorously, avoiding a focus solely on the novelty of the tool and showing that its analysis must encompass ethical, pedagogical, and assessment dimensions. Furthermore, this type of work helps integrate scattered findings and build a more robust vision to guide better-founded academic decisions.

In this work, a particularly relevant review is that by Abdelgadir Mohamed et al.[6], as it broadly analyzes AI-based text generation tools from ethical, social, and technical perspectives, incorporating topics such as academic integrity, privacy, biases, and misuse. Its contribution is relevant to this research because it also considers the educational domain among the application

scenarios, showing that the integration of these technologies requires human supervision, clear criteria, and responsible use.

Regarding assessment redesign, the review led to the conclusion that measuring final products is not enough; rather, it is necessary to assess processes, critical thinking, and the actual application of knowledge. Therefore, the most appropriate assessments are those that incorporate authentic activities, continuous monitoring, oral defenses, and transparent use of generative AI, so that learning is not reduced to an automatic response.

Regarding institutional strategies, it is concluded that educational institutions must assume a more active role in regulating the use of these tools. This entails updating regulations, training teachers and students, strengthening academic integrity, protecting personal data, and creating verification mechanisms that enable the safe and reliable use of generative AI.

Regarding digital sustainability, the review makes clear that the adoption of generative AI also has an environmental dimension that cannot be ignored. The responsible use of these technologies requires considering computational efficiency, carbon footprint reduction, hardware lifecycle management, and an academic culture that does not view AI as an automatic solution without ecological cost.

Regarding algorithmic biases, it is concluded that generative AI can reproduce inequalities if the quality of the data and the manner in which models were trained are not carefully reviewed. Therefore, its implementation must be accompanied by representative data, technical adjustments, periodic audits, explainable tools, and training that enables teachers and students to recognize biases and demand greater equity.

Generative AI literacy also emerges as a central need. Beyond teaching how to use a tool, it involves strengthening critical thinking, autonomy, and digital ethics so that students and teachers understand that these systems can support learning, but they do not replace verification, reflection, or human judgment.

Finally, the use of generative AI as an artificial evaluator can support pedagogical and academic decision-making, especially in tasks such as feedback, performance analysis, and learning monitoring. However, the review shows that its usefulness depends on the teacher maintaining expert control over the process, because AI can guide but cannot replace human assessment or academic responsibility.

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FUNDING

No financing

CONFLICT OF INTEREST

None

AUTHORSHIP CONTRIBUTIONS

Drafting – original draft: Leonel Alexander Burgos Martínez.
Writing–review and editing: Leonel Alexander Burgos Martínez.