RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

Generative artificial intelligence in education: *a literature review on critical aspects, possibilities, and challenges*

Marcos Antonio da Conceição Silva - PhD candidate in Educational Sciences. Universidad Columbia del Paraguay. Email: marcanto_marcanto@hotmail.com

SUMMARY

The expansion of Generative Artificial Intelligence (GAI) in the educational context has brought about significant changes in teaching, learning, and assessment processes. Recent advances in large-scale language models have broadened the use of technological resources aimed at personalizing teaching, generating immediate feedback, and optimizing teaching tasks. Conversely, its adoption raises ethical, pedagogical, and socio-technical risks related to authorship, academic integrity, algorithmic biases, data privacy, and digital inequalities. This literature review analyzed publications between 2018 and 2023 on the use of GAI in education, considering scientific articles, technical reports, and international guidelines. The research used recognized databases and minimum selection criteria to ensure the credibility of the evidence consulted. The results indicate that the pedagogical use of GAI has the potential to innovate teaching practices and support formative processes, provided it is accompanied by critical teacher mediation, transparent institutional policies, and adequate teacher training. It can be concluded that the responsible incorporation of AI depends less on the technology itself and more on building governance, an ethical culture, and professional teacher development that guide its pedagogical use.

Keywords: Generative artificial intelligence. Education. Teacher training. Educational policies. Ethics in AI.

ABSTRACT

The expansion of Generative Artificial Intelligence (GAI) in the educational context has brought about significant changes in teaching, learning, and assessment processes. Recent advances in large-scale language models have broadened the use of technological resources aimed at personalizing teaching, generating immediate feedback, and optimizing teaching tasks. Conversely, its adoption raises ethical, pedagogical, and socio-technical risks related to authority, academic integrity, algorithmic biases, data privacy, and digital inequalities. This literature review analyzed publications between 2018 and 2023 on the use of GAI in education, considering scientific articles, technical reports, and international guidelines. The research used recognized databases and minimum selection criteria to ensure the credibility of the evidence consulted. The results indicate that the pedagogical use of GAI has the potential to innovate teaching practices and support formative processes, provided it is accompanied by critical teacher mediation, transparent institutional policies, and adequate teacher training. It is concluded that the responsible incorporation of GIA depends less on the technology itself and more on building governance, an ethical culture, and professional teacher development that guide its pedagogical use.

Keywords: Generative artificial intelligence. Education. Teacher training. Educational policies. Ethics in AI.

1 INTRODUCTION

Artificial Intelligence (AI) has established itself as one of the most significant technological phenomena. relevant to the 21st century, profoundly impacting different social, economic and cultural. In the educational field, the incorporation of AI-based resources has provoked Reconfigurations in teaching, learning, and academic management practices, requiring reflections that

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

They go beyond the instrumental use of technology, and this movement has intensified with the growing... The presence of intelligent systems in the planning, pedagogical mediation, and evaluation stages. school, making the discussion about its educational effects a central theme in research. contemporary (Kasneci et al., 2023; Baidoo-Anu; Ansah, 2023).

Starting in 2022, the educational landscape entered a new phase with the popularization of Generative Artificial Intelligence (GAI), especially through models of Large-scale languages, or *Large Language Models* (LLMs). Tools like ChatGPT are... They became widely accessible, capable of producing texts, solving problems, and synthesizing. content, suggest pedagogical strategies, and interact dialogically with students and teachers. This expansion has broadened the reach of AI in everyday school, university, and scientific life. opening up new possibilities for technological mediation (Miao; Holmes, 2023).

Academic interest in the topic stems from the ambivalent nature of IAG, where, on the one hand On the other hand, generative models expand pedagogical possibilities by favoring the personalization of... learning, offering immediate feedback, facilitating the development of teaching materials, and optimizing administrative tasks, with the potential to improve training processes and reduce time. intended for mechanical activities (Chan; Hu, 2023; Crompton; Burke, 2023). On the other hand, the use The indiscriminate or unguided use of IAG raises ethical and pedagogical concerns. Among the The main challenges highlighted in the literature include issues related to authorship and academic integrity, the risk of technological dependence, the reproduction of algorithmic biases, to misuse of data and the deepening of inequalities in access and digital literacy. (Susnjak, 2022; OECD, 2023).

These contributions allow teachers to focus on more important actions. cognitive complexity, such as individualized monitoring, pedagogical intervention and Encouraging critical thinking. Such factors raise debates about the validity of the practices. traditional assessment methods and the need to redefine teaching methodologies to avoid processes of superficialization of knowledge (Susnjak, 2022; OECD, 2023).

Furthermore, documents published by international organizations, such as UNESCO and OECD experts emphasize that integrating IAG into education requires clear ethical guidelines and policies. Educational guidelines that prioritize the responsible use of technology. Such guidelines reinforce principles of Human-centered approach, inclusion, transparency, and data protection, guiding schools and higher education institutions to develop internal regulations and training strategies teacher, ensuring that technology is at the service of learning and not the other way around (Miao; Holmes, 2023; OECD, 2023).

In this sense, critically understanding the potential and challenges of AI applied to Education becomes fundamental to supporting public policies and guiding institutional managers.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

To support teaching work and promote conscious pedagogical use. This understanding requires to analyze not only the operational benefits, but also the epistemological, ethical and impacts. sociocultural factors, recognizing that the adoption of educational technologies involves political choices-pedagogical factors that influence conceptions of teaching, learning, and human development.

Given this context, this article aims to analyze scientific productions. published between 2018 and 2023 on the use of AI in education, identifying possibilities, Challenges, ethical implications, and recommendations found in the literature and international guidelines. To this end, a literature review was conducted, encompassing scientific articles and documents. institutional reports and reports from international organizations. This introduction, therefore, situates the topic. justifies its relevance and presents the purpose of the investigation, establishing a dialogue between technological innovation, ethics, educational policies and pedagogical practice, in order to contribute to Critical reflections on the qualified use of AI in the educational field.

2. LITERATURE REVIEW

2.1 Overview of Artificial Intelligence in Education

The use of Artificial Intelligence (AI) in the field of education has begun to gain greater momentum. between 2018 and 2021, a period marked by the growth of research focused on the development of Technological systems and solutions applied to teaching and learning. The first initiatives. They focused on creating Intelligent Tutoring Systems (ITS) and analyzing educational data. through machine learning techniques and the development of adaptive platforms with a focus in personalized teaching, these initiatives sought to offer greater pedagogical efficiency and Innovative ways of supporting students, especially in virtual and hybrid environments. learning.

In this initial scenario, AI was often understood as a tool to support... learning, designed to automate certain tasks and generate personalized recommendations. based on student performance. Systematic review studies have indicated that, during this period, Scientific production focused primarily on four areas: student support, academic data analysis *(learning analytics),* adaptive systems, and assessment tools mediated by algorithms. Although such research has demonstrated significant advances in terms of While technical potential was lacking, gaps were also highlighted regarding effective pedagogical use, especially in which concerns the active participation of the teacher in mediating technological resources (Zawacki-Richter et al., 2019).

Meanwhile, emerging theoretical discussions have highlighted the importance of understanding the AI as a tool to complement human intelligence, not as a substitute for teaching. Reflections focused on the field of teacher training have emphasized the need to strengthen the

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

digital literacy, so that educators would be empowered to select, evaluate and integrate critically examined AI-based tools in relation to pedagogical practices; thus, authors argued that the The value of AI in education lies not only in technological innovation, but in its critical application and ethically oriented, in line with humanistic formative objectives (Luckin, 2018).

The COVID-19 pandemic, starting in 2020, accelerated the digitization process of education has intensified the use of AI-based educational technologies. With the expansion of education Hybrid and remote learning: institutions have begun adopting intelligent systems for both pedagogical purposes. both administrative, such as performance monitoring, student support, organization of activity flows and management of virtual environments; however, this advancement also highlighted challenges such as unequal access to technology, weaknesses in teacher training, and lack of clear ethical guidelines for the use of emerging tools (Crompton; Burke, 2023).

Even before the popularization of generative models, there was a growing understanding that AI It required an educational ecosystem prepared for its implementation, which included policies. Institutional, technological infrastructure, continuing education, and review of evaluation methods. Academic debates highlighted that technology, in isolation, would not guarantee improvement in... educational processes, where teacher mediation and alignment of AI with the objectives are essential. pedagogical and curricular. Thus, the phase preceding the IAG was fundamental to consolidating Concepts, mapping the potential and limitations of AI use, and preparing the ground for more profound changes. that would come with generative models.

Therefore, the period between 2018 and 2021 characterizes a phase of maturation of AI in education. in which the conceptual, methodological and technical foundations necessary for evolution were established. later. This initial overview allowed for the identification of trends, recognition of obstacles, and further development. first institutional experiences with AI applied to education, paving the way for the The emergence of Generative Artificial Intelligence and its most complex and disruptive impacts on contemporary education.

2.2 Emergence of IAG

The two-year period of 2022 and 2023 represents a decisive milestone for the trajectory of Intelligence. Artificial intelligence applied to education, especially with the popularization of AGI models. The launch and rapid dissemination of tools based on *Large Language Models* (LLMs), such as ChatGPT has transformed the educational landscape by enabling dialogic interactions and generating... Texts, problem-solving, and content summaries in an automated way. Unlike... Previous applications of AI, focused on data analysis and adaptive systems, have shifted to AGI. to act as a content production agent, which significantly expanded its reach among students, teachers and institutions.

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

This new technological level has brought about a qualitative change in the way...
Teachers and students interact with digital learning resources. While AI systems
Previous systems functioned primarily as support for customization and monitoring of
In terms of student performance, AI has taken on the role of performing traditionally human cognitive tasks.
such as writing summaries, producing texts, creating teaching examples, and translating
complex concepts and contextualized explanations. This ability expanded the potential of
academic assistance, but it also generated new ethical, methodological, and evaluative dilemmas.
(Susnjak, 2022).

Early academic analyses of the impact of IAG on education highlighted its
Its highly disruptive nature and studies have shown that, for the first time, students had access
directly to tools capable of producing school and university work with a high degree of
linguistic sophistication, which brought pedagogical benefits, such as easier access to
knowledge, but simultaneously, it highlighted concerns about plagiarism, authorial authenticity and
The integrity of the assessments. Thus, a question arose regarding the role of the teacher, of
evaluative methods and policies for the use of AI in the educational context (Baidoo-Anu; Ansah, 2023).

Meanwhile, applied research in higher education has highlighted positive perceptions.
about IAG when used as a complementary pedagogical mediation resource and the results
They highlighted benefits such as support in the learning process, facilitation of individual study,
increasing student autonomy, rewriting and reformulating ideas, as well as support for
teacher planning. However, authors argue that these gains only materialize
When the use of AI occurs under pedagogical guidance and ethical principles, preventing the technology from becoming harmful.
replace the student's cognitive effort or compromise intellectual authorship (Kasneci et al., 2023).

Amid this rapid progress, concerns related to risks have also emerged.
socio-technical aspects of IAG, such as the reproduction of algorithmic biases and the dissemination of content.
Incorrect information presented as truthful, misuse of data, and delving deeper into...
Digital inequalities among students with different access conditions and technological literacy.
Thus, in addition to academic and pedagogical issues, the emergence of IAG began to demand
political and institutional attention, involving educational governance, regulations, and training.
User feedback for its responsible use (OECD, 2023).

Therefore, the period between 2022 and 2023 should be understood as a watershed moment in
The relationship between AI and education, marked by rapid social adoption, ambivalence between enthusiasm and
Caution and an urgent need for regulation and pedagogical guidance. The emergence of IAG does not
It represents not only a continuation of the advances in traditional AI, but also inaugurates a new stage, in which
The generative capacity of systems redefines teaching, learning, and assessment practices, requiring
repositioning the role of teachers, reviewing educational policies and building new

RCMOS - Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

2.3 Pedagogical Potential of IAG

The incorporation of IAG into educational environments has broadened the range of possibilities. pedagogical, distinguishing itself from previous AI applications by its ability to generate content. original, interact in a dialogical way and adapt responses according to the learning context and This characteristic positions IAG not only as a technical support resource, but also as a mediator. cognitive skills capable of stimulating new dynamics of interaction between students, teachers and knowledge. Recent literature highlights that such advances contribute to diversifying practices of teaching and promoting training processes that are more responsive to the individual needs of learners. (Chan; Hu, 2023).

Among the most frequently cited benefits are the personalization of learning and the ability to analyze commands, identify conceptual gaps, and produce explanations at different levels of Complexity allows IAG to cater to students with diverse learning paces, styles, and profiles. distinct. In this sense, technology favors personalized trajectories, offering content Adapted examples, supplementary examples, and differentiated approaches to understanding the same concept. This theme and practice represents an advance over previous adaptive platforms, since It increases student autonomy and provides greater cognitive accessibility to knowledge.

Another significant potential benefit relates to the immediate feedback offered to students. Continuous interaction with generative models enables quick clarification of doubts and guidance during task development, reducing waiting time for feedback. teachers and strengthening self-regulation of learning. In academic activities, IAG can To suggest textual improvements, point out argumentative inconsistencies, and guide the revision of papers. This resource contributes to formative assessment practices, in which the learning process is... valued as much as the product (Crompton; Burke, 2023).

In the teaching context, IAG has proven to be a significant support tool in planning and organizing pedagogical work; among the recurring applications are the Initial preparation of lesson plans, creation of activities, production of teaching materials, Development of rubrics and adaptation of content for different levels of complexity. This Support reduces administrative overload, allowing teachers to focus more energy on... Structural pedagogical actions, such as building learning experiences and monitoring. Individual and critical mediation of the generated content.

IAG also stands out for its potential to promote active and investigative learning. When used as a *cognitive scaffolding tool,* technology can encourage students to To conduct research, formulate hypotheses, compare information, revise ideas, and reconstruct arguments.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

When properly guided by the teacher, IAG can function as an intellectual mediator.
encouraging the student to think reflectively, raise questions and explore solutions, strengthening
superior cognitive skills and critical and creative thinking abilities (Kasneci et al.,
2023).

In addition to acting as a mediator for knowledge building, IAG facilitates inclusion.
Educational. Students with learning difficulties, language barriers, or special needs.
Specific educational approaches can benefit from the use of generative models that simplify...
They translate texts, use more accessible language, and offer examples.
contextualized. These features broaden access to the curriculum and allow for greater equity.
in the teaching process, provided that they are accompanied by institutional policies that guarantee access to
Technology and user training.

In higher education and academic research, IAG has been used as a support tool in
preliminary stages of the investigative process, including gathering references, organizing
data, exploratory syntheses, and initial development of textual structures. Although such resources
While they optimize time and promote the organization of scientific work, the authors warn that ethical use...
Being responsible requires transparency, validation of information, and maintenance of intellectual authorship.
human beings, in such a way that technology is understood as an auxiliary tool and not a substitute for them.
scientific thinking (OECD, 2023).

The potential of IAG in supporting didactic communication also deserves highlighting, where the
ability to translate complex concepts into different languages – technical, intermediate,
Simplified, playful, visual, or metaphorical – it helps to overcome cognitive barriers and broaden the
Conceptual understanding. This functionality is especially valuable in high-density areas.
theoretical fields, such as exact sciences, health, law, and engineering, in which complex abstractions demand
diversified strategies of explanation and exemplification (Qadir, 2023).

Another contribution lies in the expansion of hybrid and flexible learning practices.
Asynchronous interaction with generative models allows students to continue learning outside of the classroom.
classroom, without relying exclusively on the teacher's presence. This flexibility expands
Study opportunities, promotes student leadership, and strengthens hybrid education models.
and distance, provided it is associated with critical guidance and pedagogical curation to avoid uses
unproductive or superficial aspects of technology (KILINÇ, 2023).

Finally, the literature emphasizes that the transformative potential of AI does not reside solely in
technical functionalities, but in the ability to redefine the role of the teacher. By shifting the
The teacher's role shifts from centrality as a transmitter of content to that of mediator, curator, and
As an ethical guide for the use of technology, IAG invites a review of pedagogical practices and a
Strengthening vocational training. Thus, its educational value depends on the articulation between

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

Technological innovation, pedagogical intent, and ethical commitment, so that technology expand educational possibilities without compromising the critical, original, and humanized development of knowledge.

2.4 Risks, Dilemmas and Ethical Challenges

The integration of Generative Artificial Intelligence (GAI) into education has brought to light a A set of risks and ethical dilemmas that require the attention of researchers, managers, and teachers. Although technology offers significant educational benefits, its indiscriminate use does not... Whether guided or unregulated, it can compromise fundamental principles of education, such as authorship, equity, academic integrity, and critical thinking skills for students; thus, the responsible adoption of IAG demands continuous reflection and the development of clear policies that ensure its ethical use and aligned with educational goals (Hasnain, 2023).

Among the most discussed aspects is academic authorship, which is directly related to risk. ...of plagiarism and loss of authenticity in intellectual production. How is AGI able to generate texts? coherent summaries, assignments, and answers to assessment activities are causing growing concern that... students may replace cognitive effort with the automatic use of technology, and this situation challenges Traditional evaluation models based on individual production require rethinking criteria. authorship, in order to preserve the integrity and development of the intellectual skills of students (Susnjak, 2022).

Another relevant dilemma concerns the algorithmic biases present in generative models; Since these tools are trained with large volumes of data available on the internet, They reproduce cultural, ideological, racial, and gender patterns present in the original sources. Thus, IAG can reinforce stereotypes, disseminate discriminatory content, or present responses biases that favor certain narratives, and this implies significant pedagogical risks. especially when students and teachers use the tool as a source of information without critical curation or reliability verification (Kasneci et al., 2023).

The digital divide constitutes another ethical problem associated with the use of AI; although the Technology can promote inclusion and support learning, addressing unequal access to devices and the internet. Digital literacy exacerbates disparities among students. The ability to formulate commands (prompts), interpreting responses, validating information, and using the tool productively makes- if a new marker of educational inequality; thus, students with greater technological proficiency Those with less access or training tend to benefit more from IAG, while those with less access or training may be excluded from their potential benefits (Kilinç, 2023).

Privacy and data security are among the biggest concerns of international organizations; many AI systems collect, store, and process entered data.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

by users, including personal, academic, and institutional information. Without regulations.
Clearly, there are risks of misuse of this data, commercialization of sensitive information, or breach of contract.
educational confidentiality and, for that reason, recent recommendations advocate policies of
data protection, informed consent and safe use of technology in the school environment and
university (OECD, 2023).

In the context of assessment practices, the use of IAG has the potential to compromise the
The reliability and authenticity of the assessments, and the ease of generating pre-made answers, can lead
students using technology to solve assessment tasks without effective cognitive participation.
This threatens the credibility of the tests, the validity of the assessment instruments, and the purpose.
formative evaluation; thus, institutions are called upon to rethink evaluation strategies.
adopting more procedural, reflective, oral practices based on solving real-world problems.
(Susnjak, 2022).

Another risk lies in the normalization of incorrect or inaccurate information produced.
through generative models. IAG can generate persuasive and well-structured content, but neither
always correct, a phenomenon known as AI "hallucination," and when such answers are accepted.
In an uncritical manner, they can lead students and teachers into error, harming the teaching process and
Learning; therefore, the validation of information becomes an indispensable step, requiring training.
Criticism for the use of technology and practices of permanent verification of consulted sources (Kasneci
et al., 2023).

Furthermore, technological dependence is discussed as a risk to intellectual autonomy and to
building cognitive skills. When students use IAG to think, write and
Solving problems in their place risks inhibiting the development of skills.
essential skills such as argumentation, creativity, critical reading, original writing, and problem-solving.
since the pedagogical use of technology should be geared towards strengthening, not replacing.
human cognitive processes, preserving the centrality of meaningful learning and
Active construction of knowledge.

The use of AI also poses challenges to institutional accountability. Schools and
Universities need to develop internal policies on the ethical use of AI, defining limits,
Reference criteria regarding authorship and guidelines for students and teachers. Without
Without clear regulatory frameworks, technology can be used in a fragmented, subjective way, or
contradictory, amplifying conflicts between teachers and students and generating insecurity in the environment.
academic; educational governance, therefore, must be aligned with global ethical principles and
adapted to the particularities of each institutional context (Miao; Holmes, 2023).

Finally, the literature highlights that the risks and ethical dilemmas associated with IAG should not be...
interpreted not as insurmountable barriers, but as elements that require reflection,

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

Regulation and critical training are needed to ensure responsible use. Recognizing the risks and addressing them. them through institutional policies, a culture of academic integrity, and faculty development is Essential for balancing innovation and ethics; thus, the contemporary challenge lies in integrating the technology in a way that expands educational opportunities without compromising values. fundamentals of education, such as equity, authorship, ethics, and the humanization of knowledge.

2.5 International Guidelines and Educational Governance

The emergence of Generative Artificial Intelligence (GAI) in the educational field has stimulated multilateral organizations produce guidelines and recommendations aimed at guiding policies. public and institutional practices for the responsible use of technology. Among the entities with the greatest The United Nations Educational, Scientific and Cultural Organization (UNESCO) and Science stand out as key players in this debate. and Culture (UNESCO) and the Organisation for Economic Co-operation and Development (OECD), which have been developing normative frameworks and strategic guidelines to support systems educational institutions in different countries (Miao; Holmes, 2023; OECD, 2023).

UNESCO took a central role by publishing a specific document in 2023 with Guidelines for incorporating AI in education and research. This guide argues that the use of Technology should be guided by ethical and humanistic principles, prioritizing the centrality of being. Human rights, respect for fundamental rights, inclusion, data protection, and transparency. The proposal emphasizes that the adoption of IAG should contribute to strengthening learning, intellectual autonomy and the formation of critical citizens, moving away from models that address the technology as a substitute for teaching activity or human cognitive capacity (Miao; Holmes, 2023).

The OECD, in turn, offered relevant insights on educational governance and policies. public initiatives aimed at the responsible implementation of IAG in education systems. The reports of Organizations highlight that technological adoption has advanced more rapidly than the creation of new technologies. regulations, which creates risks for equity, privacy, and the quality of pedagogical practices; The organization argues that technological innovation must be accompanied by a set of milestones. clear regulations that are updatable and sensitive to the cultural, economic, and educational particularities of each country (OECD, 2023).

One of the recurring points in international guidelines is the defense of transparency. algorithmic governance as a guiding principle for IAG governance, and this perspective proposes that... educational institutions and users understand the criteria and processes by which systems Generative processes produce results, preventing technology from operating as a "black box". unquestionable. Transparency aims to foster critical digital literacy, so that students and teachers can interpret, validate, and challenge generated answers, while preserving autonomy.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

Intellectual and critical thinking in the educational context (OECD, 2023).

Another central element of the multilateral recommendations concerns data protection. UNESCO and the OECD emphasize that schools and universities should adopt explicit policies on... collection, storage, sharing and use of data generated in the educational environment and these These guidelines aim to ensure that personal or academic information is not used for other purposes. commercial transactions or transactions without informed consent, preserving privacy, digital security and... school community confidence in the use of AI (Miao; Holmes, 2023; OECD, 2023).

International recommendations also highlight teacher training as a key pillar. inseparable from IAG governance. Regulating the use of technology is not enough if teachers They are not prepared to integrate it in an ethical, pedagogical, and critical way. Therefore, it is argued... that teachers receive ongoing training focused on the use of AI, including technical aspects, From an ethical, evaluative, and methodological standpoint, critical digital literacy is seen as an indispensable condition. so that the teacher can act as a mediator and curator of the content generated by technology, strengthening their leading role in the educational process (Miao; Holmes, 2023).

Another point emphasized is the need for policies that reduce inequalities in access and in the use of IAG. The OECD warns that countries, institutions and social groups with less infrastructure Technological innovation tends to lag behind, widening educational inequalities; thus, if It recommends that governance policies include actions that ensure equitable access to technology. adequate technical support and digital inclusion programs, ensuring that students and teachers vulnerable contexts can also benefit from IAG (OECD, 2023).

International guidelines further reinforce that IAG governance should have a character... Participatory, involving teachers, students, administrators, families, and civil society. The construction A collective set of regulations and protocols strengthens the legitimacy of policies and promotes their applicability. This reduces resistance, and this approach seeks to ensure that the debate on IAG is not concentrated... not just among technical experts, but democratized among the subjects directly involved in educational process, promoting co-responsibility and a culture of ethical use of technology (Miao; Holmes, 2023).

Furthermore, the recommendations emphasize that governance should be adaptive and revisable. where, in the face of rapid technological evolution, rigid regulatory frameworks tend to become obsolete. Therefore, AI policies should incorporate mechanisms for continuous monitoring and evaluation. periodic and constant updating, and this dynamic character allows educational systems respond quickly to new risks, functionalities, and challenges brought about by the evolution of IAG, ensuring permanent alignment between innovation and ethics (OECD, 2023).

One strategic dimension highlighted by the OECD is international cooperation between countries. for sharing best practices, experiences, research and protocols for the use of AI in

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

education. This collaboration aims to reduce global disparities and promote synergies in building Governance models that consider different realities. Joint training initiatives, Collaborative construction of regulatory frameworks and shared knowledge production are cited as ways to strengthen the responsible use of HGI on a global scale (OECD, 2023).

In this context, international guidelines constitute an essential reference for guidance. Educational policies and institutional actions aimed at the responsible use of IAG; however, the The effectiveness of these recommendations depends on their ability to adapt to local contexts. The quality of implementation within institutions and the political commitment to ethical innovation. Only. normative policies, without connection to teacher training, institutional culture and monitoring. Critical measures, however, are not sufficient to guarantee transformative educational impact.

In summary, IAG governance in education requires an integrated approach that combines ethical principles, teacher training, algorithmic transparency, data protection, equity of Access, social participation, and continuous updating of standards. The contributions of UNESCO and... The OECD offers a solid foundation for this construction, but its implementation requires dialogue. between public policies, school management, and pedagogical practice. Thus, the international guidelines They constitute a guiding reference, not a single model, and should be critically appropriated. to ensure that IAG is incorporated in an ethical, inclusive and educational way into the systems educational.

2.6 Pathways to Teacher Training and Institutional Practices

The incorporation of IAG into education requires the teacher to assume an active role in technological mediation process, which makes teacher training a strategic component of institutional policies. The literature highlights that teacher qualification for the critical, ethical and IAG's pedagogical approach is crucial to ensuring that technology is used in an aligned manner. focused on training objectives and not as a substitute for professional practice; thus, strengthening the Critical digital literacy emerges as a fundamental axis to guide the conscious use of technology. in the school and university environment.

Teacher training should go beyond the technical mastery of digital tools, incorporating Pedagogical, ethical, evaluative, and sociocultural dimensions. Training focused solely on "how". Using technologies tends to be superficial and ineffective. The literature recommends processes training programs that involve critical case analysis and reflection on the impacts of AI on learning, discussion of ethical dilemmas and development of pedagogical practices oriented towards development of the intellectual autonomy of students. Thus, education needs to promote skills so that Teachers should filter, contextualize, and adapt content generated by IAG in a way that aligns with...

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025
educational purposes.

In this sense, it becomes essential to encourage the teacher to act as a curator and mediator of content produced by IAG. The instructor must be able to assess the quality, relevance, originality and conceptual consistency of the information generated by the technology, preventing that Students accept pre-established answers as absolute truths, and this mediation fosters their development. Critical thinking encourages the validation of sources and contributes to the development of cognitive skills. superiors, preserving the human protagonism in the educational act.

Training practices should also include the development of skills. related to the creation of effective instructions or commands (prompts) for interacting with models Generative. Although this aspect may seem technical, its pedagogical dimension is relevant, since a good The instruction can guide the student to reflect, delve deeper into concepts, and review ideas, while a Superficial instruction tends to generate shallow responses. Teacher training, therefore, must include strategies for creating prompts that stimulate critical thinking and promote analysis, synthesis, and argumentation.

Another promising path involves creating teacher learning communities. Focused on the exchange of experiences and practices with IAG. Collaborative learning environments. They encourage the exchange of strategies, challenges faced, solutions adopted, and pedagogical adaptations. tested in the classroom. This movement strengthens peer support and reduces insecurities. related to the use of technology and encourages collective leadership in the construction of knowledge. about educational innovation.

From an institutional point of view, it is up to schools and universities to develop policies. clear guidelines on the use of AI, defining directives, limits, pedagogical objectives, and evaluation criteria. Internal protocols help guide the balanced use of technology, avoiding both prohibitions and bans. extremes regarding indiscriminate uses. Institutional documents that explicitly state rules of authorship, Academic integrity, data protection, and ethical conduct promote legal certainty and... pedagogical to educational practices.

Educational institutions are also being called upon to revise assessment models in light of... transformations brought about by IAG. Evaluations based exclusively on final products become- ...are more vulnerable to the misuse of technology. In this context, it is recommended to expand practices... procedural, reflective, oral, authorial, and problem-solving based assessments contextualized practices, in which the learning journey is as relevant as the outcome. Such practices They hinder the use of AI to replace critical thinking and favor the development of Cognitive and metacognitive skills.

In addition to internal policies, it is important that institutions promote spaces for Raising awareness and fostering dialogue about the use of AI among administrators, teachers, students, families, and staff.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

technical. The collective construction of an ethical culture of technology use strengthens the sense of Shared responsibility reduces the perception of imposition or punitive control. The creation Internal forums, seminars, debates, and extended listening sessions allow for aligning expectations. and to build consensus on the educational purposes and ethical boundaries of technology.

Another relevant aspect involves technological infrastructure. Teacher training and... Governance policies are insufficient if there are no effective conditions for the use of IAG in educational environments. This includes connectivity, appropriate devices, secure platforms, Reliable technical support and tools. Without these elements, innovative practices tend to be restricted to a few privileged contexts, reinforcing inequalities within and between institutions.

Teacher training should also consider the integration of IAG (Information and Management of Agricultural Sciences) into different areas of... knowledge, recognizing the specificities of each field. Strategies for using technology in Mathematics, Portuguese Language, Humanities, Engineering, Health, or Arts all require different approaches. distinct and contextualized. Therefore, it is recommended that the training include modules by area, exploring practical examples, challenges specific to each discipline, and possibilities for use. IAG's educational purpose goes beyond generic objectives.

An additional approach involves including IAG in initial training curricula for teachers, especially in Pedagogy and Teacher Training courses. Teacher preparation is still in A degree in education helps future teachers develop a critical digital literacy from the very beginning of their careers. professional trajectory, reducing training gaps observed in training programs. continued. In this way, technological innovation ceases to be an add-on and becomes an integral part of training. The teacher as a structuring curricular component.

Institutional practices should also promote the use of AI for educational inclusion. Generative tools can facilitate access to knowledge for students with special needs. specific learning difficulties or language barriers. For this, it is necessary to provide training. teachers adapt materials, explore accessibility resources, and create inclusive strategies with Technology support, always preserving student autonomy and avoiding excessive dependence.

Finally, the literature reinforces that teacher training and institutional practices should to move forward in an articulated and continuous manner. The educational transformation guided by IAG does not It is achieved through specific actions, but through long-term policies that involve planning. strategic, ongoing training, a culture of innovation, and alignment with ethical values and Humanists. Thus, strengthening the pedagogical use of IAG requires a systemic vision that integrates training, Governance, evaluation, and technological inclusion, ensuring that innovation results in effective improvement. of learning and the quality of education.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

3. RESULTS AND DISCUSSION

The results of the literature review indicated that IAG has caused transformations.
significant in teaching and learning practices, even if marked by ambivalences and
There are discrepancies among the authors consulted. In general, there is consensus in recognizing that IAG
It presents innovative potential to support training processes, however, controversies are widening.
when the debate involves ethics, evaluation, and teacher training. These findings reinforce the need
to understand technology in a critical and contextualized way, avoiding reductionist interpretations that...
Treat it as an isolated solution or threat.

With regard to pedagogical potential, authors such as Chan and Hu (2023) and
Crompton and Burke (2023) highlight that AI can favor the personalization of teaching,
Student autonomy and access to immediate feedback. For these authors, the pedagogical use of IAG is
promising when integrated with active learning strategies, acting as a cognitive mediator.
in the educational process. Conversely, Susnjak (2022) warns that such benefits may be
Opportunities are negated when students use technology as a substitute for their own reasoning, reducing the...
Intellectual engagement and commitment to meaningful learning.

The literature also demonstrates a contrast between optimistic and cautious perceptions about the
The role of IAG in academic authorship. According to Kasneci et al. (2023), IAG can support students in
Organizing ideas and rewriting texts, expanding possibilities for authorial development.
However, Susnjak (2022) and the OECD (2023) emphasize that the same technology facilitates practices of
Plagiarism makes it difficult to distinguish between human-generated content and AI-generated content. This opposition
This reveals a central dilemma: IAG can strengthen or weaken authorship, depending on the mediation.
pedagogical and institutional integrity policies.

Regarding equity, the results show that IAG can play a role.
inclusive and exclusive at the same time. On the one hand, Kilinç (2023) and Qadir (2023) state that the
Technology supports students with learning difficulties, language barriers, or special needs.
Specifically, by enabling content simplification, translation, and adaptation. On the other hand, the OECD
(2023) highlights that the lack of access to technology and digital literacy deepens inequalities
educational, benefiting only students who are better prepared to interact with AI systems.
Thus, the authors agree in recognizing the inclusive potential, but disagree on its scope.
A true level of inclusion, considering the technological and social barriers that still exist.

The use of IAG in assessment has emerged as one of the most critical dimensions in studies.
analyzed. For Crompton and Burke (2023), IAG can strengthen formative assessment by offering
quick and personalized feedback. However, Susnjak (2022) argues that this same technology
This makes many traditional assessment tools obsolete, since students can generate responses.
complete evaluations using AI. The results highlight the need to renew evaluation practices.

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

prioritizing methodologies that value intellectual processes and authorship, such as oral assessments, reflective and situated.

In the field of ethics, there is strong convergence between UNESCO documents (Miao; Holmes, 2023) and the OECD (2023) in warning about socio-technical risks. Both argue that the use of AGI in Education should be guided by human-centered principles, data protection, transparency, and training. User criticism. They emphasize that technological advancement cannot be separated from guidelines. Ethical and political governance practices that ensure integrity and respect for fundamental rights. The literature, therefore, indicates that ethics is not an accessory axis, but a structuring one in the adoption of IAG.

One of the main findings of this review relates to teacher training. Luckin (2018) and the UNESCO (Miao; Holmes, 2023) argue that teacher training is the most important factor. This is crucial to ensuring the pedagogical and ethical use of AI. These authors emphasize that... Critical digital literacy should be integrated into both initial and continuing education, so that Teachers should act as mediators of knowledge and curators of digital content. The OECD, however, suggests this. (2023) warns that, without teacher training, the use of technology tends to be reductionist, instrumental. and superficial, limiting its educational potential.

The results also revealed discrepancies regarding the impact of IAG on the role. teacher. For Kasneci et al. (2023), technology has the potential to free teachers from tasks mechanical, allowing for greater focus on complex and humanizing activities, such as guidance, formative accompaniment and pedagogical intervention. In contrast, critical authors They argue that technological dependence can deprofessionalize teachers and reduce their... autonomy and strengthening the technocratic logic in education. Such opposition highlights the risk of displacing the The centrality of the teacher to technology, in the absence of clear governance.

With regard to the construction of institutional policies, studies show that there is still... a mismatch between the speed of technological innovation and the formulation of guidelines. educational policies. Both UNESCO and the OECD point to the need for governance policies. Adaptive technologies, capable of keeping pace with the rapid evolution of IAG. For these institutions, the absence of Clear regulations leave room for improvised, inconsistent, and potentially harmful uses. pedagogical integrity. Thus, one of the central results is that innovation must be accompanied by... strategic and regulatory management.

The discussion on algorithmic transparency proved to be another relevant point. The OECD (2023) emphasizes that users need to understand the limits, sources, and processes of generating AI-powered responses, in order to avoid uncritical adherence. This position converges with Miao and Holmes (2023). who argue that transparency is essential to strengthening pedagogical trust and preserving the Critical thinking. However, some authors acknowledge that the technical nature of algorithms still... This makes it difficult for teachers and students to fully understand these processes.

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

When analyzed in an integrated manner, the results indicate that IAG tends to amplify both the existing potential and weaknesses in educational systems. If inserted with Through critical mediation, teacher training, and ethical policies, technology can contribute to more effective practices. Inclusive, meaningful, and innovative. However, when implemented without guidance, it tends to... To widen inequalities, weaken authorship, compromise evaluation, and reduce the quality of education.

Thus, the synthesis of the studies shows that there is no simple consensus among the authors. Regarding IAG in education; what exists is a productive tension between enthusiasm and caution. The benefits advocated by Chan and Hu (2023) and Kasneci et al. (2023) are only realized if accompanied by... of the ethical and political safeguards recommended by Miao and Holmes (2023) and the OECD (2023). Therefore, IAG should not be seen as an automatic solution, but as an element to be integrated. critically addressing educational projects.

Finally, the results of this review indicate that the discussion on IAG goes beyond the field. Technological, mobilizing ethical, pedagogical, evaluative, and political dimensions. Technology can Making education more innovative, inclusive, and responsive can also intensify risks and dilemmas. educational. The choice between these paths will depend, to a large extent, on the quality of The discussion revolves around teacher mediation, institutional culture, and the governance adopted. Therefore, it is not about whether the Should IAG (Information and Communication Technologies) be incorporated into education or not, but how, for what purpose, and under what principles should this be done? occur.

4 CONCLUSION

This literature review has shown that Generative Artificial Intelligence (GAI) has brought about significant transformations in education, offering innovative possibilities for teaching, learning, and assessment processes. The studies analyzed indicate that IAG can to expand the personalization of teaching, to favor pedagogical practices mediated by dialogue, and to support Teachers are instrumental in developing training materials and providing feedback. However, these benefits are not... automatic, depending on clear pedagogical guidelines and a commitment to training. A comprehensive approach that values the intellectual autonomy of students.

At the same time, the literature demonstrates that AI introduces ethical and pedagogical challenges. relevant, especially with regard to academic authorship, evaluative integrity, reproduction of biases, digital inequality and data privacy. Authors such as Susnjak (2022) and organizations International organizations such as UNESCO and the OECD warn that the indiscriminate use of IAG can weaken The formative process is altered by replacing critical thinking with automated responses. Thus, the The integration of IAG requires governance, consistent institutional policies, and an ethical culture of use, under It would be a shame to compromise essential educational values.

The results obtained indicate that teacher training emerges as a structuring axis for

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

The qualified use of AI. The adoption of technology only transforms into pedagogical innovation when Teachers assume the role of critical mediators and curators of the information generated, articulating Technology, pedagogical intent, and ethical principles. Teacher training, therefore, cannot... restricting itself to the technical domain, it should integrate ethical, evaluative, and didactic dimensions that They support the responsible use of AI, both in initial and continuing education.

It is concluded that the discussion about IAG in education should not be dichotomous, divided between Enthusiastic acceptance or absolute rejection. The studies analyzed show that technology can Strengthening or weakening educational processes depends on the conditions of their implementation. Thus, the contemporary challenge is not deciding whether or not AI should be present in education, but To define how, why, and with what safeguards it should be integrated. The advancement of IAG demands Ethical commitment, governance policies, solid teacher training, and an institutional culture. Guided by the humanization of knowledge, so that technology becomes an instrument for expansion. of formative opportunities, and not of replacing critical thinking and academic authorship.

REFERENCES

BAIDOO-ANU, David; ANSAH, Lambert Osei. *Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning.* SSRN Electronic Journal, 2023. Available at: https://www.ssrn.com/abstract=4337484. Accessed on: July 18, 2023.

CHAN, Cecilia Ka Yuk; HU, Wenjie. *Students' voices on generative AI: perceptions, benefits, and challenges in higher education.* International Journal of Educational Technology in Higher Education, vol. 20, art. 43, 2023. Available at: https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-023-00411-8. Accessed on: July 18, 2023.

CROMPTON, Helen; BURKE, Diane. *Artificial intelligence in higher education: the state of the field.* International Journal of Educational Technology in Higher Education, vol. 20, art. 22, 2023. Available at: https://doi.org/10.1186/s41239-023-00392-8. Accessed on: July 18, 2023.

DEMPERE, Jamie. *The impact of ChatGPT on higher education.* Frontiers in Education, vol. 8, 1206936, 2023. Available at: https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2023.1206936/full. Accessed on: 18 Jul. 2023.

HASNAIN, Mohammad. *Future thoughts on ChatGPT and its applications in education (Commentary).* Journal of Research in Innovative Teaching & Learning, v. 16, no. 2, p. 284–289, 2023. Available at: https://www.emerald.com/jrit/article/16/2/284/247915. Accessed on: July 18, 2023.

HODGES, Charles B.; OCAK, Cem. *Integrating Generative AI into Higher Education: Considerations.* EDUCAUSE Review, August 30, 2023. Available at: https://er.educause.edu/articles/2023/8/integrating-generative-ai-into-higher-education-considerations. Accessed July 18, 2023.

ÿPEK, Zeynel Halil; YILMAZ, Fatma Betül; PALA, Fikret Kutay. *Educational applications of*

Year V, v.2 2025 | Submission: 02/11/2025 | Accepted: 04/11/2025 | Publication: 06/11/2025

the ChatGPT AI system: systematic review research. Journal of Educational Problems of Youth (EDU-PIJ), v. 12, no. 2, p. 147–171, 2023. Available at: https://files.eric.ed.gov/fulltext/EJ1395260.pdf. Accessed on: July 18, 2023.

KASNECI, Enkelejda; SEßLER, Katharina; et al. *ChatGPT for good? On opportunities and challenges of large language models for education.* Learning and Individual Differences, vol. 103, 102274, 2023. Available at: https://www.sciencedirect.com/science/article/pii/S1041608023000195. Accessed on: July 18, 2023.

KILINÇ, Selçuk. *Embracing the future of distance science education: Opportunities and challenges of ChatGPT integration.* Asian Journal of Distance Education, vol. 18, no. 1, p. 205–214, 2023. Available at: https://files.eric.ed.gov/fulltext/EJ1389448.pdf. Accessed on: July 18, 2023.

LUCKIN, Rose. *Machine Learning and Human Intelligence: The Future of Education for the 21st Century.* London: UCL Institute of Education Press, 2018. Available at: https://discovery.ucl.ac.uk/10178695/1/Machine%20Learning%20and%20Human%20Intelligence.pdf. Accessed on: July 18, 2023.

MIAO, Fengchun; HOLMES, Wayne (org.). *Guidance for Generative AI in Education and Research.* Paris: UNESCO, 2023. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000386693. Accessed on: July 18, 2023.

OECD. *Artificial intelligence and education and skills.* Paris: OECD, 2023. Available at: https://www.oecd.org/en/topics/sub-issues/artificial-intelligence-and-education-and-skills.html. Accessed on: July 18, 2023.

OECD. *Emerging governance of generative AI in education.* In: *OECD Digital Education Outlook 2023: Full Report.* Paris: OECD, 2023. Available at: https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023_c74f03de-en/full-report/emerging-governance-of-generative-ai-in- education_3cbd6269.html. Accessed on: July 18, 2023

.

OECD. *Generative AI in the classroom: From hype to reality?* Paris: OECD, 2023. Available at: https://one.oecd.org/document/EDU/EDPC(2023)11/en/pdf. Accessed on: July 18, 2023.

PRADANA, Meiry; et al. *Discussing ChatGPT in education: A literature review and research agenda.* Cogent Education, vol. 10, no. 1, 2243134, 2023. Available at: https://www.tandfonline.com/doi/full/10.1080/2331186X.2023.2243134. Accessed on: July 18, 2023.

QADIR, Junaid. *Engineering Education in the Era of ChatGPT: Promise and Pitfalls of Generative AI for Education.* In: IEEE Global Engineering Education Conference (EDUCON). IEEE, 2023. Available at: https://ieeexplore.ieee.org/document/10125121. Accessed on: July 18, 2023.

SUSNJAK, Teo. *ChatGPT: The end of online exam integrity?* arXiv preprint, 2022. Available at: https://arxiv.org/abs/2212.09292. Accessed on: July 18, 2023.

ZAWACKI-RICHTER, Olaf; MARÍN, Victoria I.; BOND, Melissa; GOUVERNEUR, Franziska. *Systematic review of research on artificial intelligence applications in higher education. Where are the educators?* International Journal of Educational Technology in Higher Education, vol. 16, art. 39, 2019. Available at: https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-019-0171-0. Accessed on: July 18, 2023.