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Artificial Intelligence in Education: the urgency of critical formation

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Abstract

This article presents reflections derived from research on artificial intelligence in educational contexts. Its objective is to analyze the perceptions of education graduate students and faculty members regarding the integration of artificial intelligence into the educational process, considering discussions on digital culture and digital inclusion. Grounded in a state-of-the-knowledge approach, the study begins with a literature review addressing the research theme. Methodologically, it adopts a qualitative approach, using focus groups as the strategy for data generation and collection. Data are analyzed through discursive textual analysis. The results highlight not only the potential of generative artificial intelligence, particularly in terms of personalized learning and the development of critical thinking, but also raise concerns about ethical awareness, intellectual property, and equity regarding the use of and access to this technology.

Keywords: Artificial intelligence. Education. Critical training. State of the knowledge.

Inteligência Artificial na Educação: a urgência da formação crítica

Resumo

Este artigo apresenta reflexões oriundas de pesquisa relacionada à inteligência artificial em contextos educativos. Seu objetivo é analisar a percepção de docentes e estudantes de pós-graduação em educação acerca da inserção da inteligência artificial no processo educativo, considerando, para tanto, a

discussão sobre cultura e inclusão digital. Ancorado no estado do conhecimento, este estudo apresenta, inicialmente, a revisão da literatura que abarca a temática da pesquisa. Metodologicamente, faz-se uso da abordagem qualitativa, tendo como estratégia para geração e coleta de dados a realização de grupos focais. Os dados são analisados por meio da análise textual discursiva. Os resultados apontam não só para o potencial do uso da inteligência artificial generativa, principalmente na personalização da aprendizagem e no desenvolvimento da criticidade, mas também refletem preocupações quanto a conscientização ética, propriedade intelectual e equidade no tocante ao uso e ao acesso a essa tecnologia.

Palavras-chave: Inteligência artificial. Educação. Formação crítica. Estado do conhecimento.

Inteligencia Artificial en la Educación: la urgencia de una formación crítica

Resumen

Este artículo presenta reflexiones derivadas de una investigación sobre la inteligencia artificial en contextos educativos. Su objetivo es analizar la percepción de docentes y estudiantes de posgrado en educación sobre la incorporación de la inteligencia artificial en el proceso educativo, considerando para ello la discusión sobre cultura digital e inclusión digital. Basado en la metodología del estado del conocimiento, el estudio inicia con una revisión de la literatura que aborda la temática investigada. Metodológicamente, se adopta un enfoque cualitativo, utilizando grupos focales como estrategia para la generación y recolección de datos. Los datos se analizan mediante el análisis textual discursivo. Los resultados señalan no solo el potencial del uso de la inteligencia artificial generativa, especialmente en la personalización del aprendizaje y en el desarrollo del pensamiento crítico, sino que también reflejan preocupaciones relacionadas con la conciencia ética, la propiedad intelectual y la equidad en cuanto al uso y acceso a esta tecnología.

Palabras clave: Inteligencia artificial. Educación. Formación crítica. Estado del conocimiento.

Introduction

Communication and the various forms of expression precede the use of technology, which is, therefore, the basis for the adoption of digital technologies in educational contexts.

Thus, it is essential to understand that it is not the number of technological resources available that will guarantee improvements in education, but the quality of its use, combined with the ability to promote real innovation, and not just the reproduction of traditional and Cartesian models of information transmission. As Palfrey and Gasser point out,

> […] we do not need a general reshaping of education to teach children who were born digital. […] The use of technology does not make sense if it is just because we think it is 'cool.' […] We need to determine our goals, […] and then find out how technology can help us (Palfrey; Gasser, 2011, p. 276).

Given this scenario, it is evident the importance, increasingly urgent, that teachers listen to their students and seek to model their pedagogical practices according to the needs and potential evidenced in the classroom. Therefore, we believe in the potential of inter-generational integration between teachers and students, recognizing that the accumulated experience of one can be complemented by the communication dynamics of the other. That is, through a dialogue based on significant exchanges, it is possible, on the one hand, to critically organize the vastness of available information and, on the other, to transform it into knowledge and learning with meaning for life.

By the way, a study carried out by the Universidad Carlos III of Madrid (UC3M) shows that high school students, although accustomed to browsing the internet and the constant use of social networks, have a deficit in basic media literacy skills – from the distinction between journalistic genres (information versus opinion) to the difficulty in identifying fake news (Herrero-Curiel; La-Rosa, 2022). Therefore, the development of critical thinking is essential, especially with regard to reflection on the use of artificial intelligence (AI) in educational contexts.

Teacher formation should, therefore, include, in addition to developing skills for the responsible use of AI, the ability to evaluate and adapt

educational resources based on these technologies, thus aiming at promoting criticality and expanding the active participation of individuals in the teaching and learning processes.

In this regard, in a previous study, reflection was made on the integration of digital technologies and artificial intelligence in schools and universities, highlighting not only the challenges involved but also the transformative potential of these technologies to "[...] promote ethics, social transformation, and the development of critical thinking in individuals, whether they are students, teachers, or educators as a whole" (Giraffa; Kohls-Santos, 2023, p. 131).

In short, considering the relevance of the present study, a bibliographic review was carried out, based on the state of knowledge methodology, in order to present a current overview of research on the use of AI in education.

State of knowledge

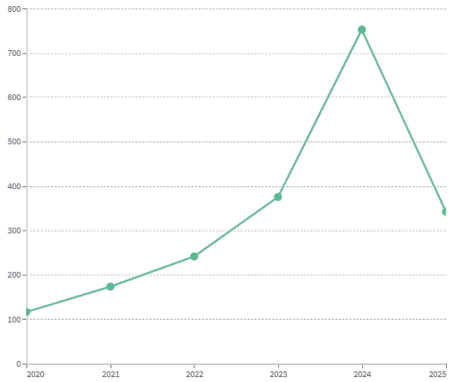
The state of knowledge comprises the search for academic and scientific studies in order to investigate current works related to the theme of this article. This action, pointed out by Morosini, Kohls-Santos and Bittencourt (2021) as identification, registration, categorization, leads to reflection and synthesis on the scientific production of a specific area in a given period. In this sense, this state of knowledge aims to investigate, in scientific articles, the use of artificial intelligence (AI) in teaching practices aimed at the customization of learning, since this is one of the possibilities of AI with regard to teaching and learning processes.

Thus, a search was carried out in the Lens database, seeking to know the current state of knowledge about artificial intelligence in educational contexts. The search took place on May 27, 2025, and the following expressions were used for this purpose: "*Artificial Intelligence*" *or* "*machine learning*" *and* "*teaching*" *or* "*learning*" *and* "*personalization*". In addition, the time frame of the last five years – 2020 to 2025 - was established. Therefore, the research returned 1,999 scientific articles published in academic journals in the established period.

Thus, according to chronological order, in 2020, 116 articles were published. In 2021, 173 published productions were identified. In 2022, 241

publications were made. In 2023, the number rose to 375 articles and, in 2024, this number doubled, accounting for 752 publications. Along the same lines, in the first five months of 2025, there are already 342 articles published, which demonstrates both the significant increase in the number of researches related to AI in educational contexts and the growing use of this resource in the processes of teaching and learning.

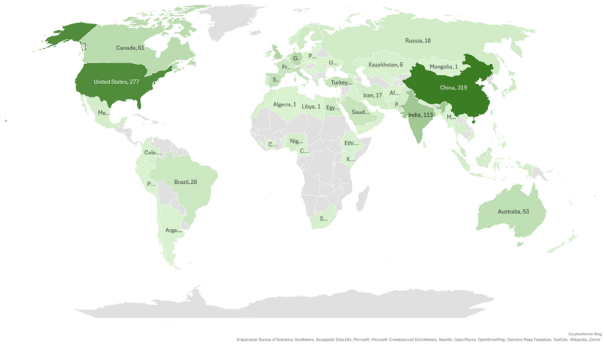
Figure 1– Distribution of articles by year



Source: prepared by the authors – research data.

Another relevant data, especially for the Brazilian educational context, is the country of origin of the aforementioned publications. In this regard, figure 2 shows the graph of the articles (organized by country of origin), presenting the 15 countries with the highest number of publications. Brazil appears in 15th position, with 28 articles.

Figure 2 – Distribution of articles by country



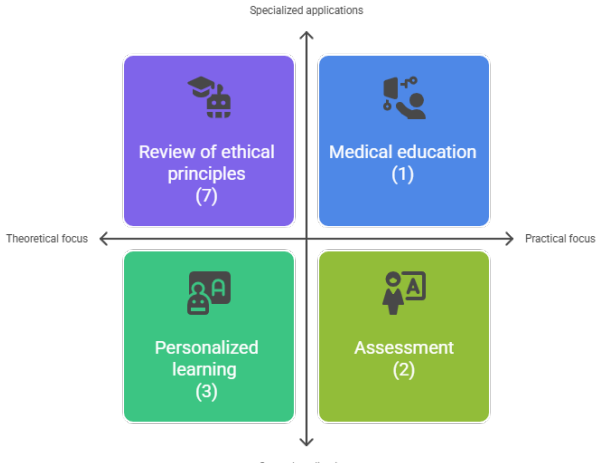
Source: prepared by the authors – research data.

Based on the above, for the analysis presented in this study, we considered the ten most relevant researches and the ten most recent on the subject. Thus, the aim was to analyze what the most recent and most cited research has brought as potentialities arising from artificial intelligence for the customization of learning in educational contexts.

In this regard, the exclusion criteria covered the unavailability of complete access to the publication, as well as studies that did not address AI and education simultaneously.

Thus, the state of knowledge methodology considered the 20 publications to compose the annotated bibliography. After observing and applying the inclusion and exclusion criteria, the corpus of analysis consisted of 13 scientific articles, organized into the thematic categories shown in figure 3. In this case, we highlight the use of ChatGPT 4.0 as a support for the analysis and organization of the research, as proposed by Kohls-Santos and Morosini (2024), with the steps of validation of artificial intelligence and human validation.

Figure 3 – State of knowledge analysis categories



Source: prepared by the authors – research data.

Thus, the seven publications related to review studies and ethical principles on the use of AI take into account aspects ranging from the educational opportunities of generative AI to concerns about the misuse of information, without adequate human validation through theory.

In this context, the authors Lan and Zhou (2025) emphasize positive and negative aspects regarding AI tools for carrying out a literature review activity by higher education students. Positively, AI tools are shown to enhance students' prediction, goal-setting, and planning capabilities through customizable trajectories and predictive analytics. In the performance phase, AI applications often lead to greater engagement and use of strategies, providing timely and personalized feedback. Regarding the negative aspects, the authors emphasize the excessive dependence on AI – which can lead to reduced student autonomy – the potential for feedback overload or dependence on AI for guidance, thus impairing self-efficacy. In addition, the importance of balancing technology with student autonomy and engagement at all stages of the activity is highlighted (Lan; Zhou, 2025).

The review studies, carried out by Bhardwaj and Kumar (2025), Hu and Wu (2025) and Akgun and Greenhow (2022), present generative AI alternatives for educational processes in the areas of robotics, automation, and oncology; the latter applied to the teaching of virtual surgical simulation

to help students become familiar with surgical procedures and operative skills. The investigation points to the need for teacher formation in relation to the use of this technology, in addition to the difficulty with implementation costs and concerns with data security. In addition, Akgun and Greenhow (2022) defend the need for ethical formation for the conscious use of AI in educational environments, extrapolating the technical-operational dimension of the technology.

For Feuerriegel, Hartmann, Janiesch and Zschech (2024), generative AI has the potential to transform domains and industries that depend on creativity, innovation, and knowledge processing. In particular, it is noteworthy that AI enables applications that were previously impossible or impractical to automate, such as realistic virtual assistants, education, and personalized services, as well as the creation of digital art.

Addressing the concern with ethics in the use of AI, Crompton and Burke (2023) analyze how AI is accessed to manage student learning to provide information, organization, and data analysis. Although it is a useful application for monitoring students, the authors emphasize the need for empirical studies that analyze the ethics in the use of data from student works. Finally, Nguyen, Nguyen, Ngo, Hong, Dang and Nguyen (2023) reflect on the discussions about the benefits of artificial intelligence in education and, at the same time, raise concerns about the adverse impacts on fundamental issues related to human rights. They alert to the fact that the complexity of AI requires a holistic and applicable set of ethical principles in the educational context, proposing a set of guidelines as a starting point to engage and stimulate new debates for the use of artificial intelligence in the educational context.

Regarding the customization of learning, two studies present customization models in specific areas: one to recommend areas of study, another to improve performance in studies. This is the third study dedicated to analyzing students' perception of the use of generative AI in learning processes.

From this perspective, the research by Duan, Gu, Wang, and Zhou (2025) proposed a model based on the fusion of data and knowledge to accurately predict the difficulty of mathematical exercises. Thus, a pre-trained model was designed, on a large scale, in order to extract semantic characteristics for each exercise. The results showed that the proposed model achieves an improvement of 22.5% in the Algebra data set, 25.5% in the Geometry

data set and 38.8% in the Calculus data set, which has great potential for qualifying the learning process of the studies.

Similarly, Xia, Li and Li (2025) implemented an AI-powered online music learning platform that aims to provide students with a personalized learning experience, especially in the selection and recommendation of music courses. The results indicate that, when capturing the long-term interest of a Mathematics student, for example, and considering their learning progress, the model effectively recommends courses that correspond to that student's interests. However, the model does not always provide optimal recommendations. In this sense, the authors emphasize that, for students with diverse interests and dispersed learning trajectories, the recommendations of the model may not meet expectations, requiring further studies and adjustments to the model for greater accuracy.

Chan and Hu's (2023) article, on the other hand, aimed to analyze students' perception of the use of generative AI (GenAI) in academic activities. The results suggest that students have a positive attitude towards GenAI technologies, when expressing that they would like to integrate technologies, such as ChatGPT, into their learning practices, as well as in their future careers. Despite the positive perspective, the study also reveals challenges related to GenAI technologies, with students expressing reservations about excessive dependence on technology, its potential impact on the value of university education and issues related to accuracy, transparency, privacy, and ethics, in addition to the concern related to the damage to critical thinking and creativity when using AI, which could also have an impact on job prospects and human values.

In the Evaluation category, research related to teacher evaluation and educational processes with artificial intelligence are presented. In this logic, Zhang's (2025) study proposed an AI-based approach to teaching English in the classroom, in order to provide students with personalized learning experiences, using the Australian Public Affairs (APAFT) question bank to evaluate the effectiveness of the proposal. In addition, neural networks were used to assess the quality of the English teacher's instruction. The research presented a new model to evaluate the performance of this teacher, identifying and considering the requirements of teacher evaluation. When evaluating teaching

performance, the author emphasizes that "the results of the simulation showed that the use of the proposed model provides better learning and teaching of English" (Zhang, 2025, p. 16).

In order to analyze the interaction and communication between students during the scientific investigation process in high school science classes, Jeon, Shin, and Ryu (2025) used machine learning and natural language processing to follow these students, which allowed the identification of specific types of interaction, including question-centered discourse, conceptual discussions, and procedural confirmations. The authors point out that, based on the discourse patterns discovered, educators are able to personalize teaching, provide focused feedback and develop targeted interventions that promote greater student engagement and improve scientific reasoning, also enabling the development of more effective teaching strategies and learning environments.

In short, the analysis of these studies points out not only the need to deepen research related to the customization of AI learning, but also a critical formation for students and teachers in order to present future discussions with a scientific basis, going beyond the simple discussion about AI being only good or bad in educational contexts.

Methodological procedures

This qualitative study is part of research approved on July 30, 2024, by the Research Ethics Committee, under CAAE (Certificate of Presentation for Ethical Review) No.: 79240924.0.0000.0029. The qualitative approach was adopted because it enables the in-depth understanding of the participants' perceptions and experiences regarding the theme studied.

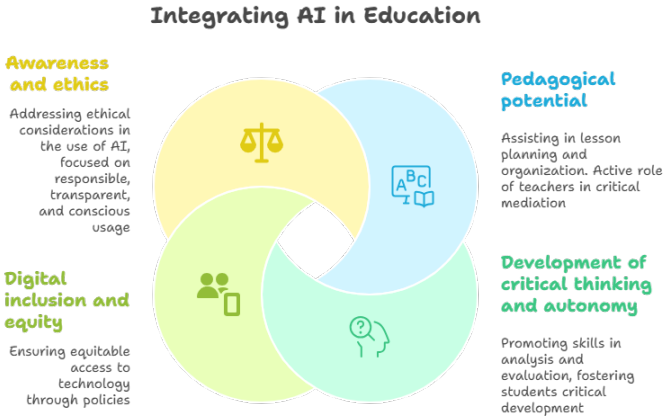
Participants were selected for convenience, considering their performance in basic, undergraduate, and graduate education, as well as their availability to participate in focus groups. Twenty professors, graduate students, participated. Among them, some are teachers of basic and undergraduate education. Regarding the declared gender, 14 are women and 6 are men. Ages range from 25 to 58 years old.

Data collection and generation were carried out through two focus

groups, composed of 9 and 11 participants, respectively. Each group participated in two sessions, organized based on the theme World Coffee Shop – Digital Inclusion and Artificial Intelligence. The sessions were recorded with the proper authorization of the participants and, later, fully transcribed. It should also be noted that all stages followed the ethical precepts provided for in Resolution No. 510/2016, ensuring the confidentiality and anonymity of the participants.

For data analysis, Discursive Textual Analysis was used, as proposed by Moraes and Galiazzi (2007). From this process, the participants' inferences were organized into four thematic categories: Pedagogical Potential, Development of Critical Thinking and Autonomy, Digital Inclusion and Equity and Awareness and Ethics, presented in figure 4.

Figure 4 – Focus group analysis categories



Source: prepared by the authors – research data.

Discussion and analysis of data

Artificial intelligence as an area of knowledge is not new. According to Vicari (2018), the first initiatives date back to the 1950s. In the field of education, actions have been known since 1970, with the development of Intelligent

Tutor Systems. However, even though they have been developed for more than 50 years, AI became popular from 2020, driven mainly by OpenAI's ChatGPT.

With this popularization of access to AI resources, the field of education was immersed in a discussion about its validity, feasibility, and negative aspects of its presence in the educational context, mainly due to the easy access by students. In other words, with technology in hand, there is a concern focused not only on prohibition, but also on the critical and reflective use of AI in the classroom. In this sense, according to Kelly (2019, p. 296), "[...] the novelty now and in the coming decades is in the high speed of connectivity of this territory and in its immensely vast scale (the entire planet)". In this study, artificial intelligence in education is seen as an opportunity for the development of criticality, cutting-edge research, and the customization of learning.

In this regard, the analysis of the participants' speeches allowed the identification of multiple and sometimes tense understandings about the place of AI in education. Their voices reveal not only instrumental perceptions of technology, but also ethical, pedagogical, and political positions in the face of the promises and risks associated with the adoption of artificial intelligence as an educational practice.

That said, the four categories emerging from the analysis are presented below: Potential for Pedagogical Support, Development of Critical Thinking and Autonomy, Digital Inclusion and Equity, Awareness and Ethics. The respective categories are discussed based on the representative excerpts of the focus groups and interpreted in the light of the theoretical framework and the objectives of this study.

Pedagogical potential

The first category that emerged from the research data concerns the recognition of artificial intelligence as an instrument to support pedagogical practice. The professors highlight that generative artificial intelligence can be an ally in pedagogical planning, in supporting textual production and in the organization of content. They recognize its value as a complementary tool to enrich teaching and learning processes, allowing them to act in a more strategic and less mechanical way. Teachers also emphasize the active role of the

teacher in critical mediation, taking advantage of AI resources to personalize learning and facilitate access to support materials.

This perspective is evidenced in the participant's speech, when stating that "[...] AI should be understood as a tool that helps in the organization of classes, research and in the construction of ideas." (Teacher 2, 2025). In the same direction, it highlights the teacher's centrality in the pedagogical use of AI when saying that "[...] *AI is a valuable tool*, but it is the teacher who uses it effectively for each student and class" (Teacher 2, 2025).

It is important to highlight, in these statements, the appreciation of AI as a power for mediating cognitive and reflective processes, contributing to the planning of activities, the systematization of information and the stimulation of creativity, especially when used intentionally and critically, since is the teacher who gives the pedagogical meaning to the use of technology. In this regard, according to Spires, Paul and Kerkhoff (2019), it is important to allow students to create and consume digital content in the classroom, since this can increase their engagement and, at the same time, foster the development of skills necessary for acting in a technological society.

In this sequence, regarding the educational process, in the words of Teacher 3, "[...] we are all in the process of learning, and the way I see it is that of a place not of teaching-learning, but of a continuous construction in the interaction, in the exchange, in the relationships permeated by the possibility of learning" (Teacher 3, 2025). This perception is undoubtedly in line with the publication made by Kohls-Santos (2021). For the author, in digital culture, the teacher, as a mediator, plans educational activities with space for interaction and exchanges, which promotes autonomy and provides the collaborative construction of knowledge and the perception of the applicability of learned knowledge.

Furthermore, the discourses present in this category express a propositional look at the potential of AI in and for pedagogical processes. Technology is perceived as a catalyst for more open, interactive learning experiences, centered on collaboration and closer to the reality and interests of the individuals. From this perspective, Grassini (2023) examines the impacts of ChatGPT and artificial intelligence (AI) on teaching, highlighting the potential of these tools to support teachers in activities such as: automated correction, content translation,

and personalized teaching. According to the author, artificial intelligence can free up teachers' time for creative planning and individualized guidance, in addition to promoting interactive learning environments that stimulate skills such as critical thinking and problem solving. On the other hand, she points out ethical and pedagogical risks such as the stimulation of disinformation, technological dependence, and plagiarism. According to Grassini's study (2023), the irresponsible use of AI can compromise student autonomy and academic integrity. In addition, for the author, it is important to ensure diversity in training data, transparency in algorithms and educational policies, in order to ensure equity in the access and ethical use of technology; which leads us to reflect on autonomy and critical thinking, so necessary for the conscious use of generative AI.

Development of critical thinking and autonomy

This second category concerns the potential of artificial intelligence for the development of students' autonomy and critical thinking. In view of this, the participants demonstrate concern with the way AI is used in educational contexts, highlighting that, more than offering ready-made answers, it must be integrated into the formative process in order to foster reflection, intellectual property and conscious decision-making based on prior and scientific knowledge.

According to the participants, it is necessary to promote the critical formation of students so that they know how to evaluate, interpret and consciously use the contents generated by artificial intelligence. They also consider it essential for students to develop cognitive skills, such as analysis, reflection, and discernment, without becoming dependent on technology. As indicated, "[...] if we want an AI at the service of education, we need to leave the ready-made, standardized models and qualify the questions" (Teacher 2, 2025). Another participant adds that "[...] the teacher plays an important role as a critical mediator, promoting reflective thinking and encouraging students' creativity" (Teacher 3, 2025).

In this regard, participants emphasize the teacher's role in building students' autonomy in the face of the use of digital artifacts. However, this

autonomy must be based on criticality and theoretical knowledge to deepen reflections aimed at the critical reading of digital reality.

In this regard, according to Sánchez Torrejón (2025), teacher formation needs to go beyond technical knowledge, so that this professional can help their students to develop knowledge that is relevant to their daily lives. According to the testimonial of Teacher 8,

> […] we must teach our students to be aware, to know how to interpret and understand how the digital medium can bring benefits to them. It is important to show students the importance of being critical and knowing how to preserve their integrity and not believe everything they see (Teacher 8, 2025).

Effectively, it is the teacher's critical look that provides the opportunity for the significant use of technologies.

Regarding the construction of knowledge with the support of AI, one of the participants reflects on its use in the university context. For him, "*AI makes it possible, in this university context, to transform our ability to discover new things, to develop ideas and help do high-level science*" (Teacher 19, 2025). He states, however, that it is necessary "[…] to be critical in relation to the content generated from an interaction with AI and the property in relation to knowledge to compare the information on a scientific basis; it is also necessary to pay attention to the intellectual property of this material" (Teacher 19, 2025).

Finally, the reports show that the promotion and development of critical thinking and autonomy depend on the articulation between pedagogical intentionality, teacher mediation, and ethical formation. In this sense, AI can be a valuable resource, if used in a responsible, critical, and reflective way, being part of the educational and formative processes of students and teachers.

As important as criticality, issues related to digital inclusion and equity of access and opportunities need to be on the agenda of discussions related to the presence of AI in educational contexts. Thus, such points are discussed in the next section, when presenting the digital inclusion and equity category.

Digital inclusion and equity

Regarding digital inclusion and equity, participants agree on the potential of artificial intelligence to qualify processes and accelerate the accomplishment of tasks. However, in line with the United Nations Educational, Scientific and Cultural Organization (UNESCO), teachers express concern about the possible increase in inequality in their access and use, both in educational contexts and in the daily lives of the population.

> Throughout the life cycle of AI systems, respect, protection and promotion of diversity and inclusion must be guaranteed. [...] This can be done by promoting the active participation of all individuals or groups (Unesco, 2021, p. 19).

In other words, artificial intelligence can benefit students with learning disabilities, but this requires everyone to have equitable access to digital resources. Therefore, it highlights the need for public policies and institutional strategies to ensure adequate infrastructure and formation, promoting digital inclusion.

In this sequence, AI "[...] can point out paths, for example, when organizing data, presenting options and resources for teaching customization, qualifying processes, breaking language barriers, etc." (Teacher 8). This perception reinforces the idea that AI, when thought and used with pedagogical intentionality, can meet the needs of different student profiles, contributing to the overcoming of obstacles, such as standardization and linguistic limitations, and the process can be closer and personalized by respecting the singularities of people.

It is still necessary to be aware of the risks associated with digital exclusion, which can be amplified in this context of AI use, since such resources may not be accessible to the entire population. In this logic, Teacher 5 states that "[...] digital exclusions can result in disparities in access to educational opportunities, exacerbating existing inequalities" (Teacher 5, 2025).

This perspective alerts to the fact that unequal access to technologies – added to the lack of formation for their critical use – can accentuate the gaps between students, especially those in vulnerable situations. In this way,

> […] it is essential to incorporate digital technologies in the curriculum, promote critical thinking and problem solving, but also have access policies and technological infrastructure. […] It is crucial to cultivate continuous learning, preparing students for a constantly evolving world (Teacher 16, 2025).

Thus, the perspective to digital equity not only involves the creation of conditions so that all students can develop skills to deal with emerging technologies, but also requires critical action in the face of the structures that limit access to these resources. Therefore, effective public policies are necessary, both for access to technology and for the formation of students and teachers. In addition, its use requires to be considered the criticality (both in the classroom and outside it), reflections on the ethical issues involved in the generation of content and information, as well as their distribution and sharing.

Awareness and ethics

When discussing ethics and raising awareness about the responsible use of artificial intelligence, especially generative AI, it is essential understand the accountability involved in their use, in addition to considering the space that these digital technologies occupy in daily life.

The functioning of generative AI depends on algorithms developed by human teams that make technical and conceptual choices when defining how systems will learn, process data, and generate responses. These algorithms are powered by large volumes of data and operate based on statistical standards, which means that there is no conscious understanding on the part of AI, only probability-based simulations.

Thus, the responsibility for the use of the information generated by these systems is distributed between the developers – who design the algorithms, define their limits, and directly influence their behavior – and the users – who need to critically interpret the results, as well as decide how they will use or share them. Ultimately, it is the human being who is responsible for the consequences of this use. This is evidenced in the warnings present in the artificial intelligence platforms, which warn of possible failures and reinforce the need to verify relevant information from other reliable sources.

In this regard, UNESCO, in 2021, launched the publication "Recommendation on the Ethics of Artificial Intelligence", in which it presents important aspects on the ethical responsibility of the use of AI and on the need for human supervision. The document presents that

> […] it is possible that, at times, people decide to trust AI systems for reasons of effectiveness, but the decision to cede control in limited contexts remains with human beings, as they can use those systems to make decisions and act, but an AI system can never replace responsibility and human final accountability (Unesco, 2021, p. 22).

Ethics in the use of artificial intelligence is a cross-cutting concern. In this regard, the analysis highlights the participants' concern with the ethical aspects that involve the use of AI in education, especially in the context of academic production and professional formation. The speeches reveal the perception that technological development needs to be accompanied by formative processes that promote critical awareness, commitment to intellectual integrity and individual and collective responsibility before knowledge. Thus, Teacher 3 highlights the need to intentionally work on raising awareness about the use of generative AI. And he states that "[…] first we have to work on raising awareness of the use of generative AI in the context of academic production […] learning/teaching to develop a prompt that has a research characteristic" (Teacher 3, 2025).

Technology, in this sense, is not neutral; it requires ethical and epistemological guidance to be responsibly integrated into the educational process. Here enters again the essential role of the teacher in the formative processes. One of the participants reflects that "[…] the teacher maintains its central importance. It guides students in the responsible and ethical use of AI, fosters critical thinking and emotional skills, integrates technology into the curriculum, and brings an irreplaceable human element. " (Teacher 5, 2025)

Extrapolating the role of the teacher in this process, another participant exposes the role of the student himself as the protagonist of his formative process.

> This ethical use also involves understanding that it is I, the student, who am at the university, who have the responsibility not only for the delivery of a work, but for the construction of knowledge and

> the formative process. [...] This issue of ethics goes through there too, the issue of knowledge, when we talk about AI, especially in generative artificial intelligence (Teacher 19, 2025).

This excerpt brings to light the notion of co-responsibility of the student, both in relation to the educational process and to his formative process. The ethical use of AI is closely linked to authorship, intellectual honesty, and clarity about the type of professional and citizen you want to form. Ethics, therefore, is a constitutive part of the university experience and is projected in social insertion and in the exercise of the profession. Thus, to form for ethics is to form for autonomy, for criticality and for commitment to the construction of knowledge in a world increasingly mediated by technologies.

Ethics in the use of AI in education, therefore, requires a commitment to the formation of students for the responsible and critical use of these technologies, promoting digital citizenship and the development of reflective thinking in the face of the responses generated by these systems. Human supervision is indispensable in this process, since decisions supported by algorithms must be analyzed by educators capable of guaranteeing the quality, reliability, and contextual interpretation of the information. It is also essential to respect principles such as data privacy, diversity, sustainability, and intellectual property, according to the guidelines of the United Nations Educational, Scientific and Cultural Organization (UNESCO) on teaching skills in AI. One should also avoid uncritical amazement at these tools, remembering that they have no consciousness or feelings, often based on superficial information or common sense. According to UNESCO (2024) and the Organization for Economic Cooperation and Development (OECD) (2025), teaching in this scenario must involve constant supervision, ensuring that the results generated by artificial intelligence are evaluated based on human judgment. Thus, understanding the functioning of algorithms becomes essential for teachers to apply fair evaluation criteria and foster ethical discussions with students, ensuring a critical, transparent, and formative application of AI in the educational context.

To elucidate the debate and provoke a critical reflection on the role of artificial intelligence in education, figure 5 presents the main favorable points and the perceived limitations in the use of these technologies, based on the participants' speeches. The systematization of "pros and cons" aims to foster a

critical reflection on the conscious and ethical use of AI in educational contexts, considering both its pedagogical possibilities and the challenges they impose on teaching practice and student formation.

Figure 5 – Artificial intelligence in education

Source: prepared by the authors – research data.

The research data indicate that the participating teachers signal the risks of dependence, plagiarism, misinformation, and uncritical use. They defend the urgency of preparing not only teachers, but also students, to deal with the ethical dilemmas of AI, understanding its limits, possible biases and social consequences. From this perspective, they suggest educational actions aimed at the responsible, transparent, and conscious use of technology, incorporating this dimension into teacher formation.

Some reflections

The analyzes developed throughout this study allowed us to understand how teachers of basic, undergraduate, and graduate education have interpreted and re-signified the use of artificial intelligence in educational contexts. From the contributions shared in the focus groups, it was possible to identify not only instrumental perceptions about AI, but also ethical, pedagogical, and political reflections that cross its integration into school and university daily life.

Teacher formation should remain in a humanistic perspective, with a strong emphasis on the ethical use of artificial intelligence, and should occur progressively, as proposed by UNESCO. At the first level, teachers need to understand the ethical principles of AI, such as privacy, diversity, and sustainability, and start using basic tools in pedagogical contexts. At the second level, teachers are expected to critically apply these technologies, integrating them into student-centered strategies and debating human responsibility in the face of automated decisions. At the third level, teachers become innovative leaders, and agents of co-creation solutions together with AI, customizing models and producing reflective content about their impacts on education and society. In addition to these levels, it is recommended that teachers develop a critical-reflective view, since the use of AI should serve as a starting point for ethical discussions and for the strengthening of fair and transparent evaluation practices.

Finally, the demand for teacher formation and the creation of spaces for discussion that compose a formation beyond instrumentalization is opened, seeking the construction of concepts that support an emancipatory pedagogical practice, both for teachers and students. Thus, a window of opportunity arises to combat not only amazement, but also the fear associated with generative models that imitate human behaviors, which, it should be remembered, have no consciousness or feelings; therefore, "they do not know what they are doing". It is essential to reaffirm the value of affection and interaction between people, because it is through these experiences that everyone constitutes himself as a sensitive and active citizen in a society that increasingly lacks empathy, care for the planet and constructive relationships. Unlike the intentionality that guides human actions, artificial intelligence only executes commands, without making a value judgment or evaluating whether a certain instruction is correct or adequate. Undoubtedly, artificial intelligence presents itself as a powerful resource, but its constructive use depends on human action and reflection.

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