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The impact and character of the use of artificial intelligence in education from the perspective of integrated teaching

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Published in:
Observatorio de la economia latinoamericana

DOI:
[10.55905/oelv22n4-130](https://doi.org/10.55905/oelv22n4-130)

Publication date:
2024

Document Version
Publisher's PDF, also known as Version of record

[Link to publication](#)

Citation for pulished version (HARVARD):
Targino Ponciano Filho, I, Nóbrega Lima, Â, Carvalho, G & Júlio Baganha, R 2024, 'The impact and character of the use of artificial intelligence in education from the perspective of integrated teaching: elements for the debate', *Observatorio de la economia latinoamericana*, vol. 22, no. 4, pp. 1. <https://doi.org/10.55905/oelv22n4-130>

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The impact and character of the use of artificial intelligence in education from the perspective of integrated teaching: elements for the debate

O impacto e o caráter do uso da inteligência artificial na educação sob perspectiva do ensino integrado: elementos para o debate

El impacto y carácter del uso de la inteligencia artificial en educación desde la perspectiva de la enseñanza integrada: elementos para el debate

DOI: 10.55905/oelv22n4-130

Originals received: 03/15/2024

Acceptance for publication: 04/01/2024

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ABSTRACT

In the context of the rapid development of tools derived from Generative Artificial Intelligence (AI) and their gradual incorporation into education, various discussions and

dilemmas arise regarding the use of these technologies in educational practices. The objective of this work, which presents a qualitative and exploratory approach, developed from a bibliographic research, is to identify and list some of the main concepts, categories, positive aspects, limits, and risks related to the use and implementation of AI in education, specifically in the teaching-learning process within formal educational environments, raising some perspectives and issues accumulated in this research field, which, from our point of view, is in a stage of construction. In this work, we adopt the ethical-political-pedagogical perspective of the constitution of so-called integrated teaching as the realization of an omnilateral and non-fragmented education project. For this purpose, we propose the following issue for discussion: does the gradual popularization of various AI tools in the teaching-learning process represent a positive trend or risks from the perspective of building an integrated education?

Keywords: Education, Artificial Intelligence, Integrated Teaching.

RESUMO

No marco do acelerado desenvolvimento das ferramentas oriundas das Inteligências Artificiais generativas (IA) e sua gradativa incorporação à educação, surgem diversas discussões e dilemas relacionadas à utilização destas tecnologias nas práticas educativas. O objetivo deste trabalho, que apresenta uma abordagem qualitativa e exploratória, desenvolvido a partir de uma pesquisa bibliográfica, é identificar e elencar alguns dos principais conceitos, categorias, aspectos positivos, limites e riscos relacionados ao uso e implementação da IA na educação, especificamente no processo de ensino-aprendizagem dentro dos ambientes formais de ensino, levantando algumas perspectivas e problemáticas até então acumuladas neste campo de pesquisa, que sob nosso ponto de vista encontra-se em etapa de construção. Neste trabalho, adotamos como perspectiva ético-política-pedagógica a constituição do chamado ensino integrado como concretização de um projeto de educação omnilateral e não fragmentada. Para isso, lançamos a seguinte problemática para a discussão: a gradativa popularização das diversas ferramentas de IA no processo de ensino-aprendizagem representa um processo de signo positivo ou riscos sob a perspectiva de construção de um ensino integral?

Palavras-chave: Educação, Inteligência Artificial, Ensino Integrado.

RESUMEN

En el marco del acelerado desarrollo de herramientas derivadas de la Inteligencia Artificial (IA) y su paulatina incorporación a la educación, surgen varias discusiones y disyuntivas relacionadas con el uso de estas tecnologías en las prácticas educativas. El objetivo de este trabajo, que presenta un enfoque cualitativo y exploratorio, desarrollado a partir de una investigación bibliográfica, es identificar y enumerar algunos de los principales conceptos, categorías, aspectos positivos, límites y riesgos relacionados con el uso e implementación de la IA en la educación, específicamente en el proceso de enseñanza-aprendizaje dentro de los ambientes de educación formal, planteando algunas perspectivas y problemáticas acumulados en esta área de investigación, que a nuestro juicio se encuentra en fase de construcción. En este trabajo, adoptamos como perspectiva



ético-política-pedagógica la constitución del sistema educativo integrado como implementación de un proyecto de educación omnilateral y no fragmentada. Por lo tanto, presentamos la siguiente problemática para la discusión: ¿La gradual popularización de las diversas herramientas de la IA en el proceso de enseñanza-aprendizaje representa un proceso de señales positivos o de riesgos frente la perspectiva de construcción de una educación integral?

Palabras clave: Educación, Inteligencia Artificial, Enseñanza Integral.

1 INTRODUCTION

Human development arises from the amalgamation of social interactions and productivity. In the present era, characterized by the advancement of productive forces rooted in science and technology, within the framework of the capitalist system, educational institutions like schools emerge as crucial hubs for fostering human sociability. They mirror and perpetuate the complexities, hurdles, and dilemmas of their contemporary historical context (Moura, Lima Filho, Silva, 2015).

Contemporary society and educational institutions find themselves immersed in a whirlwind of rapid and profound changes, spurred by the gradual proliferation of Generative Artificial Intelligences (AI) and their associated tools, which are becoming increasingly integrated into our daily lives and routines. This discussion is not merely speculative about the future; rather, it confronts the present's myriad dilemmas and contradictions.

In 2022, the introduction of generative models featuring natural language interfaces (such as DALL-E, Midjourney, and ChatGPT) to the public marked a significant milestone in the AI landscape, solidifying its permanent presence in our society. Consequently, it becomes imperative, particularly within educational settings and formal teaching environments, to cultivate and reinforce new proficiencies and competencies that align with the current trajectory of societal and technological evolution (Vicari et al., 2023). At the forefront of these competencies lies the cultivation of critical thinking among all stakeholders involved in the educational process, fostering an informed discourse on the potentials and limitations of generative AIs in education.



In addition to AI, which represents a significant computing discipline, various areas of computing have found applications in educational processes, including Virtual Reality (VR), Augmented Reality (AR), facial recognition, and data science. Within the expansive realm of data science, two technologies, Big Data and Learning Analytics, serve as tools already utilized for analyzing teachers' recorded videos. These tools enable professionals to identify aspects of the class that require further elaboration or even predict students' behaviors based on their past histories (Vicari et al., 2023; Vicari, 2021). It's worth noting that VR and AR, while distinct areas within computing, also leverage AI in a broader sense.

This ongoing revolution presents a myriad of alternative scenarios and innovative educational experiences previously unexplored. However, the application of AI in the teaching-learning process also brings significant risks that necessitate careful consideration and mitigation (Oliveira, Santos, Martins, and Oliveira, 2023).

Specifically concerning the utilization of generative AI tools—those capable of creating original elements from existing data and programming—a dichotomy emerges from current data. On one hand, some advocate for the inhibition of their use by educational institutions, while others advocate for their use and enhancement for critical purposes, viewing them through the lens of augmented intelligence (Rodrigues and Rodrigues, 2023). Augmented intelligence refers to the utilization of artificial intelligence to expand human cognitive faculties, thereby enhancing analysis, planning, and decision-making processes.

Considering this scenario, we pose the following question for debate: Does the gradual proliferation of various AI tools in the teaching-learning process signify a positive advancement or pose risks from the perspective of constructing a comprehensive and emancipatory education?

The aim of this study, employing a qualitative and exploratory approach derived from bibliographic research, is to critically examine various concepts, categories, positive attributes, limitations, and risks associated with the utilization and integration of AI tools in education, particularly within formal teaching environments. Through this exploration, we seek to elucidate perspectives and challenges that have accrued in this realm of



inquiry, which, in our estimation, remains in a formative stage. Drawing upon the insights of scholars in the field such as Linares, Fuentes, and Galdames (2023), Vicari et al. (2021, 2023), Rodrigues and Rodrigues (2023), among others, we have synthesized a comprehensive understanding of the subject. These references were compiled based on a bibliographic survey conducted on the Scielo platform during the period of February and March 2024.

In this study, we embrace an ethical-political-pedagogical standpoint centered on the realization of integrated education as the embodiment of a holistic and unified educational endeavor. In pursuit of this objective, we draw upon the insights of Marxist-oriented scholars such as Araújo and Frigotto (2015), Moura, Lima Filho, and Silva (2015), Pistrak (2009), and Saviani (2007, 1994).

2 ARTIFICIAL INTELLIGENCE IN EDUCATION: UNDERSTANDING THE PRESENT, PREPARING FOR THE FUTURE

The term Artificial Intelligence was first used in 1956 by John McCarthy, from Stanford University, at a conference at Dartmouth College, in New Hampshire, in the United States (Vicari *et al*, 2023; Oliveira, Santos, Martins and Oliveira, 2023; Teles and Nagumo, 2023).

Even with a consolidated history of research and application, AI has multiple definitions. One of the most didactic is presented by Rich and Knight (1994) who treats AI as the study of how to make computers perform tasks and activities, which today, humans do better.

In a recent work, Vicari (2021) presents a view on the transformations that have occurred in recent years around Artificial Intelligence (AI) and especially regarding its application in educational systems, while allowing to point out paradigm shifts and envision future applications. According to the author, the multidisciplinary that marked the beginnings of AI has been surpassed by interdisciplinarity, in which there is a collective gain in the accumulation and production of knowledge between the different areas that relate to AI.



There are countless AI tools with potential and applicability in the teaching-learning process, although their insertion has been occurring in a dispersed way. What has been found is that these tools have achieved good impacts and results when the focus and use occurs in an individualized way, as occurs in intelligent tutor systems (ITS), but they still do not present significant results in the field of so-called collaborative teaching (Vicari, 2021).

In their work, Oliveira, Santos, Martins, and Oliveira (2023) present a summary table of the four main categories of educational systems that benefit from AI, incorporating it in different ways into the educational process at the present time.

Table 1 - Main Categories of Educational Systems

Intelligent and Affective Tutoring Systems (ITS)	They offer a personalized and adaptive learning environment, through instructions taken from the student's performance, monitoring, including subjective aspects of the subject (emotions and motivations) making adjustments in approach and content to optimize the learning experience.
Learning Management Systems (LMS's)	They administer and manage courses, content and interactions in online teaching environments, mapping and analyzing student progress, providing personalized feedback indicating relevant resources, making the management of the process more effective.
Intelligent Educational Robotics	There is the insertion of educational robots that interact with students, in order to support problem solving, facilitating learning through physical interaction, encouraging students' creativity in a more engaging and interactive educational process .
Massive Open Online Courses (MOOC's) com Learning Analytics	They are massive teaching platforms or large-scale open courses in which, through Learning Analytics, large amounts of student data are analyzed in order to identify trends, learning behaviors, and areas for improvement.

Source: Adapted from Oliveira, Santos, Martins and Oliveira (2023).

This current picture is a snapshot of the moment, and it is necessary to assess the dynamic context that the continuous development and incorporation of AI together with other technologies in education imposes. In this perspective, there is an urgent effort to identify trends, possibilities and perspectives for the next generations of educational systems.

Through research in patent databases (even with the difficulties inherent to this methodology) and literature review, Vicari (2021) builds a map of the evolution of AI research, which allows pointing out trends in the changes and evolution of archetypes and use of AI and other communication and information technologies in education and in



future educational systems. "Projections point to educational ecosystems that will include AI, computing, communication and robotics technologies, resulting in systems with interoperability (..)" (Vicari et al, 2023, p. 41).

The roadmap, which is divided into four thematic lines ("AI for AI", "links between AI and engineering", aspects of ethics and governance of new research and products, "new trends") brings with it possibilities and in-depth discussions on safety and other different aspects regarding the use of AI in general, and in education in particular.

3 IDENTIFYING THE POTENTIALITIES AND POSSIBILITIES OF AI IN EDUCATION

The current context of accelerated incorporation of AI tools into our way of life leads to heated and deep debates in various spheres of society about the nature of this impact and its consequences. Topics such as the future of jobs in certain branches of the labour market, or the skills needed so that individuals do not remain on the sidelines of jobs in the face of such transformations, or even the ethical and safety limits of the use of AI technologies are quite common in the current situation. In the field of education, there are also countless and pertinent discussions of this nature.

As AI technologies analyze large amounts of data, allowing individual progress to be monitored, personalized and dynamic didactic and methodological interventions can be built, reducing disparities in the teaching-learning process between students with diverse backgrounds and learning abilities. This potential represents to date one of the most significant advantages of integrating AI into education (Linares, Fuentes, and Galdames, 2023; Chaudhry and Kazim, 2022).

"Virtual reality simulations and AI-powered personalized learning platforms facilitate interactive and immersive learning environments. These experiences effectively engage students at a profound level, fostering critical thinking, problem-solving, and creativity. Through the utilization of AI, educators can craft dynamic and flexible learning environments tailored to meet the diverse needs of their students" (Linares, Fuentes, and Galdames, 2023, p. 2).



Moreover, the automation of administrative and routine tasks inherent to teachers' practices through AI tools can liberate significant amounts of time, enabling educators to concentrate their efforts on activities requiring interpersonal skills and expertise. "This transition empowers teachers to forge deeper connections with their students and offer essential guidance and mentorship for holistic development" (Linares, Fuentes, and Galdames, 2023, p. 2).

Within the realm of AI tools in education, there is notable prominence in discussions surrounding generative tools capable of creating original content, such as ChatGPT from OpenAI or Bard from Google, for text production, as well as the Language Model for Dialogue Applications (LaMDA) from Google, designed for conversational dialogue, and DALL-E and Midjourney from OpenAI, for interpreting texts and generating images (Rodrigues and Rodrigues, 2023).

"ChatGPT-3 is a powerful language model developed by OpenAI that holds the potential to revolutionize human-technology interactions" (Aljanabi et al., 2023, p. 62). According to the authors, the remarkable potential of this conversational tool lies in its enhanced natural language processing (NLP) and natural language understanding (NLU). As human interaction with technology progresses, particularly through voice and text interfaces, systems like ChatGPT-3 become increasingly significant (Aljanabi et al., 2023).

ChatGPT's capabilities encompass support for academic writing and functioning as a search engine. The features provided by ChatGPT-3 allow for generating summaries, providing citations, highlighting central ideas in various texts, generating essays, dissertations, theses, and even offering assessments of grammar, style, and coherence (Aljanabi et al., 2023). Among its myriad functions, one that stands out is its potential to serve as a didactic-methodological support in problem-solving interventions within the teaching-learning process of various fields of knowledge.

In direct collaboration with other domains of computing, AI currently offers tools with significant educational potential. This collaboration is particularly evident through Virtual Reality (VR) and Augmented Reality (AR), which enhance our brain's visual



capabilities (Vicari, 2023). These technologies are accessible through devices such as glasses, tablets, computers, and smartphones.

Moreover, a new frontier is emerging in the realm of brain-computer interfaces, reminiscent of dystopian narratives but already technically feasible, albeit ethically questionable. These mechanisms, powered by AI, have the ability to directly read and stimulate the human brain. Interaction can occur through less invasive methods such as headbands, VR goggles, and other devices, or through more invasive means involving the implantation of electrodes within the human brain (Vicari et al., 2023).

The interface between AI and the human brain operates in two directions: providing information to the brain and being controlled by it. Brain stimulation-based interfaces have already found their way into educational applications through devices capable of receiving signals from the brain to gauge students' attention levels during their studies. For instance, in 2019, the company BrainCo tested a headband worn by students in a school setting during classes to measure their attention to the content being taught. Equipped with sensors that monitor brain activity associated with attention, the headband generates a profile of the students' attention, thereby informing the teacher when the students are focused in class and when they may be distracted (Vicari et al., 2023, p. 30).

4 LIMITS, RISKS, AND THE CONTRADICTIONS PERTINENT TO AI IN EDUCATION

In the midst of so many potentialities inherent to AI and its tools applicable to education, and even with its constant evolution, it is also necessary to recognize, understand and measure the limitations presented today by this field of computing.

AI is currently insufficient in typically human aspects of interaction, such as understanding aspects of human communication, lack of common sense (common sense), creativity, criticality, leadership, originality and emotions (fragility in models), among others. All the limitations identified are directly related to the current limits of computing itself, from logical-mathematical models to the physical limits of the machines (hardware) we have, a scenario that may change considerably with the development of the so-called quantum computing (Vicari et al, 2023).



In addition to all the questions raised by the authors, regarding the use of generative AIs as didactic resources in the teaching-learning process and from the point of view of conceptualization, it seems to us that the main problem is the possibility of the existence of "alternative conceptions" the same ones that can be perceived in humans, about the various fields of science. In this way, generative human-AI interaction can reinforce certain forms of reasoning and, in some ways, hinder learning.

As part of and derivation of these limits, several authors point out significant risks around the application of AI tools in education.

Linares, Fuentes, and Galdames (2023) highlight concern about the possibility that AI tools may replicate prejudices and discrimination within the educational environment as their algorithms are programmed based on a large amount of data, which, if biased, the AI system will replicate and reinforce. As an effort to mitigate this risk, the authors point out two important measures, one of a technical nature linked to the development of algorithms, and another measure of an ethical-political-pedagogical nature.

The first involves the critical evaluation of the data used in programming, ensuring its diversity and representativeness, as well as the practice of responsible audits in the implementation of algorithms that allow the identification and correction of discriminatory arguments reproduced by the system. Along with this measure, the involvement of educators, students, and other stakeholders in the design and applications of AI can prevent the reproduction and reinforcement of possible biases (Linares, Fuentes, and Galdames, 2023).

Linares, Fuentes, and Galdames (2023) also locate another concern that takes over contemporary society as a whole: the decrease in jobs, in this specific case, for teachers in the face of possible competition and the role played by AI tools in education and in the teaching-learning process. According to the authors, with the possibility of AI tools proving to be increasingly able to perform activities hitherto restricted to educators, there is a risk of reducing jobs in the sector.

Facing this risk consists, according to them, of the collaborative approach between teachers and AI tools, so that their integration into the educational environment fosters



and promotes the role of the educator and does not replace it, of the various didactic-methodological possibilities already identified (Linares, Fuentes and Galdames, 2023).

Ponciano Filho and Baganha (2023) raise a pertinent concern regarding generative and conversational AI tools, like ChatGPT, highlighting the risk that, within the absence of proper guidance and didactic-pedagogical supervision from educators, these tools may inadvertently propagate alternative conceptions in individualized study, particularly within specific fields of knowledge such as the natural sciences. In such instances, the tool ceases to serve as a supportive learning aid and instead reinforces understandings that diverge from established scientific knowledge.

As Rodrigues and Rodrigues (2023) emphasize:

"Artificial intelligence does not inherently ensure objectivity and neutrality solely by virtue of being processed by machines and purportedly shielded against human errors. This reality is evident in the utilization of tools like ChatGPT, where searches and contributions are not exempt from errors. Thus, it necessitates a reflective, conscientious, and critical approach, taking into account the context and social practices" (Rodrigues and Rodrigues, 2023, p. 10).

In the field of education and beyond, there is a growing and predominant concern around the possibility of endowing autonomy by AI systems, a concern shared by researchers, academics, philosophers, politicians, and different institutions (Oliveira, Santos, Martins, and Oliveira, 2023).

A theme that is sometimes portrayed in cinematography, the dangers of AI autonomy can be solved and mitigated, from the beginning, right from the programming project of the same, since the algorithm has the ability to "learn" new data from those who have access to it for analysis and use in solving problems to which they are requested (Machine Learning, or machine learning). This is not guaranteed, AI systems pose a threat. This is also why the debate around ethical principles in the development of AI is so relevant (Teles and Nagumo, 2023).



On this question, and especially on the idea of developing sentient machines, most scientists point out that we are far from this possibility. This discussion is born with the hypothesis of the development of artificial systems capable of feeling and having subjective experiences, just like humans, this being an interface theme between philosophy and artificial intelligence. However, even with significant advances in AI, science still does not fully understand how the consciousness and ability to feel of living beings works (Vicari et al, 2023).

As can be seen when we debate the limits, risks and contradictions surrounding AI and its incorporation into education in its different dimensions, countless discussions and incongruities inevitably arise related to themes that transcend computing and that have a strong impact, especially in the field of ethics and the future of the current form of educational (and social!) organization established.

5 WHICH EDUCATION ARE WE REFERRING TO: THE PERSPECTIVE OF INTEGRATED TEACHING

In view of the above picture, which reflects some of the main debates and elements that are currently pointed out when dealing with the use of AI in education, the great provocation that remains is, after all, what is the sign of the impact of these technologies on education and on the teaching-learning process, or in other words, should the use of AI be stimulated or barred, in the face of its contradictions identified so far?

Any immediate response may be determined by biases, limits and prejudices if the debate around which conception of education we are referring to is not first made. Here we claim the so-called integrated teaching as a conception of education and propose to interpret this essentially human activity in its ontological sense, in the light of the so-called Pedagogy of Work.

We start from the agreement and understanding that work is the founding category of the human being. This is what distinguishes us from any other animal species on the face of the earth. "Work is the creative activity through which man, that is, society, acts on nature, modifying man himself and society" (Peña, 2015, p.18).



Or as Saviani (2007) better explains, human existence is not an innate gift bestowed by nature; rather, it must be actively produced by individuals themselves through labor. Thus, humanity is not a given at birth; rather, it is attained through a continuous process of self-production. In essence, individuals are not born as fully-formed humans; they become humans through learning and self-formation. Consequently, the process of becoming human is synonymous with the process of education. This perspective suggests that the origins of education coincide with the origins of humanity itself.

Work and education are inherently human activities, intricately linked both historically and ontologically. Any shifts in the methods of production and transformation of nature inevitably result in corresponding changes in the realms of education and human development, whether within formal institutional settings like schools and curricula, or within broader societal contexts.

The rapid advancements in science and technology witnessed in recent decades have brought about profound transformations in our social fabric. Concurrently, these changes have necessitated the development of cognitive skills among individuals to meet the demands of an increasingly globalized world (Silva and Schirlo, 2014). As articulated by Moura, Lima Filho, and Silva (2015):

Education is the product of social and production relations, and the school, an institutionalized space where part of it also exists, is the result of such relations. [...] In the current phase of development of the productive forces, anchored in science, technique and technology, under the domination of the capital system, the school has become "essential" to human sociability (Moura, Lima Filho, Silva, 2015, p. 1059).

With this understanding, it becomes imperative to critically analyze the current stage of societal development in order to effectively address collective issues across various social domains. This principle holds true when discussing education, teaching, and human development.

As large-scale industry emerged, science ceased to be solely a spiritual potential and instead became a material force, fundamentally transforming the dynamics of



production—the relationship between humanity and nature (Saviani, 1994). In alignment with this perspective, Moura, Lima Filho, and Silva (2015) emphasize:

As a result, the social and technical division of labor constitutes a fundamental strategy of the capitalist mode of production, making its metabolism require a class-based educational system that thus separates intellectual labor and manual labor, simple labor and complex labor, general culture and technical culture, that is, a school that forms one-sided, mutilated human beings. both of the ruling and subaltern classes (Moura; Lima Filho; Silva, 2015, p. 1059).

On this topic, Peña (2015) goes further:

The division of labor, productive labor, and the production of new needs develop throughout history. And with them grow the objects produced by man, but which man does not dominate; Institutions created by man but which man does not master are growing. **Man alienates himself from his works**, that is, they appear to him as alien objects governed by their own laws that are imposed even against their will. And, finally, when society is divided into classes, **man alienates himself from himself and alienation between man and man is produced** (Peña, 2015, p.24, emphasis added).

Even though we understand that the complete overcoming of social relations based on alienation will only be possible with the overcoming of the society divided into social classes, today materialized in the capitalist mode of production, we consider that the school, the curriculum and the teaching practice are fields of dispute around this strategy. This reality imposes on school education the task of opposing the ongoing socio-political logic, striving for the reproduction of ethical values inherent and necessary for the construction of an egalitarian society, with the school being an environment where the humanistic and integral formation of individuals should be encouraged (Carvalho Jr, 2011).

To this end, we claim, like Araújo and Frigotto (2015), integrated education as an alternative at the service of this horizon, understanding it as

[...] a project that brings an engaged political-pedagogical content, committed to the development of integrative formative actions (as opposed to fragmented practices of knowledge), capable of promoting autonomy and broadening the horizons (freedom) of the subjects of pedagogical practices, teachers and students, mainly (Araújo and Frigotto, 2015, p. 63).



It should be noted, in time, that this understanding of integrated teaching should not be restricted to the field of professional education, as it does not materialize in a mechanical and immediate way through the concomitance of technical disciplines with the "general" or propaedeutic content, legally established. Just as its implementation is not reduced to the sole will of teachers and educational managers,

we understand that this also depends on the concrete conditions of its realization, arguing that the promotion of integrative pedagogical practices requires the constitution of a material environment that favors it and the search for the integrating element, considering the specific realities, the social totality and the subjects involved (Araújo and Frigotto, 2015, p. 65).

From this conceptual panorama accumulated by the sociology of education and the understanding that here we claim integrated teaching as a horizon for overcoming a fragmented, exclusionary education that reproduces social relations based on alienation, we can return to the question-problem of this article: What is the character of the influence and inclusion of AI tools in formal education and especially in the teaching-learning process?

6 AI AND THE CONCEPTIONS OF EDUCATION IN DISPUTE: ELEMENTS FOR THE DEBATE

The impact of AI on education is intricately linked to the overarching goals of education and the societal framework in which its integration occurs. It's impossible to categorize the influence of AI in formal teaching-learning environments as purely positive or negative without first delineating the ethical, political, and pedagogical perspective guiding our analysis. To illustrate the potential contradictions that may arise in educational practice, consider the following scenarios:

On one hand, AI-driven automation of administrative tasks can afford educators more time and resources to dedicate to planning and implementing pedagogically sound strategies, fostering holistic student development. However, it can also lead to workforce reductions, undermining the quality of education by overburdening remaining staff.



Similarly, while AI enables personalized monitoring of individual student progress, it may simultaneously erode collective learning experiences and student self-organization, which are integral to fostering solidarity, critical thinking, and autonomy. This contradicts the aim of cultivating well-rounded, autonomous learners within a comprehensive educational framework.

Thus, efforts to identify the positive aspects of AI adoption in education must be viewed within the broader context of societal transformation away from exploitative structures. Embracing integrative educational approaches that prioritize autonomy and holistic development is essential to realizing the full potential of AI tools in education (Araújo and Frigotto, 2015).

When formulating, integrating, and executing pedagogical strategies aligned with the principles of integrated teaching, Pistrak (2009) emphasizes the importance of perceiving reality as a guiding force for curriculum organization and teaching methodologies. He argues that only through active engagement with reality can children develop the skills to participate consciously and effectively in society (Pistrak, 2009, p. 131).

Araújo and Frigotto (2015) draw upon the work of Pistrak to underscore the significance of autonomy and self-organization in students across three key domains: collaborative work, organized task completion, and creative capacity development. They assert that these objectives are central to pedagogical approaches aligned with integrated teaching, distinguishing them from other methodologies prevalent in contemporary didactics.

"But, then, what distinguishes the idea of activity for liberal pedagogies, such as the Pedagogy of Competences, from socially-based pedagogies, such as EMI? Obviously, it is the commitment to social transformation, as expressed above, so that this activity has the function of developing in students their ability to act critically and consciously and to adapt reality to their needs and not the opposite, to develop their ability to adapt to the different situations posed by everyday life." (Araújo and Frigotto, 2015, p. 73)



We believe that, under the sociability of capital, the predominant tendency is the deepening of a fragmented education model and an exclusionary school, at least in two relevant aspects.

In the first place, schools in peripheral countries and aimed at social classes that do not own the means of production, and therefore do not appropriate the wealth produced socially, must remain on the margins of access to the most advanced and best quality tools in terms of this appropriation of AI technologies by formal education spaces.

In addition, the inclusion of these tools in a diffuse, disorderly way, as part of an apparent contemporary pedagogical fad and without being anchored in scientific research and in the accumulation of conclusions in the field of didactics, sociology and educational psychology can promote and ratify the current model of school and education, class-oriented, segregating and reproducing the dominant logic and ideologies.

In short, the development and relative popularization and insertion of AI tools in the school universe, in this sociability and under these conditions, tend to deepen the educational abysses existing between nations and within the same nation between school models aimed at the different established social classes.

This tendency, which we have identified here, cannot be understood as a given, inevitable and irreversible fact. The incorporation of AI and its tools can also become important allies of educators in the reproduction of pedagogical practices that are distinct and antagonistic to the dominant logic. In other words, it is necessary to make an effort to conduct research that points out how AI can be used as support tools for activities whose horizon is an omnilateral formation.

There are multiple possibilities for the use, from this perspective, of AIs in view of all their didactic potential. The good use of tools such as Chatgpt, planned and supervised by the educator, as an auxiliary resource in individual study can expand and optimize school time, as well as instigate an always questioning and critical posture on the part of students, leading them to reflect on their responses in the interaction with AI.

Something that would even allow for the re-signification of extracurricular activities, sometimes considered monotonous and unproductive by students. And this is



only feasible when this adoption does not occur, sidelining the role of the teacher as a fundamental element in educational practice.

The use of these tools needs to be encouraged in the sense of stimulating and placing the subject as a central and active part in the process of constructing concepts and not merely aiming to speed up time and activities already carried out with other resources in the classroom.

7 FINAL CONSIDERATIONS

In this work, we seek to contextualize, in the light of accumulated contributions and research, the most important aspects related to the development of AI resources and tools and their gradual incorporation into education, especially the school and formal teaching environments, and especially in the field of didactics and new methodologies, seeking to identify limits, possibilities, potentialities and risks inherent to this incorporation in this complex and challenging universe of education.

From there, trying to answer the problem-question suggested in this work, we previously raised the debate around which conception of education we refer to, claiming the perspective of integral education, an ethical-political-pedagogical proposal of a Marxist nature that takes as its horizon the realization of a full and non-fragmented human formation, as it is established in contemporary capitalist society.

Through the conceptual accumulation and the reference categories that we have adopted, we take the position that there is no *a priori* determined sign, positive or negative, to AI and its incorporation of tools derived from it in education, since it is necessary to determine which education we are referring to.

That said, we are of the opinion that, within the framework of the sociability of capital, whose education and formal teaching institutions purposely promote, reflecting class interests, a segregating, fragmented and alienating education, the tendency that predominates in this social phenomenon and in the framework of the historical conjuncture in which we live is the deepening of educational (and social) inequalities in the face of the generalization of these technologies in the teaching-learning process. We

emphasize, however, that it is possible to appropriate these resources and use them, enhancing their benefits and eliminating or mitigating their risks and negative aspects, as long as the goal is to constitute another conception of education now materialized in the proposal of integrated education.

For this, it is necessary and indispensable, according to the conclusions accumulated so far by the authors of this article, the development of research in the field of the interface between AI and education, and the use of these as theoretical-methodological ballast so that the materialization of an effectively integrative teaching can occur in denial of the diffuse and disordered way that has been verified so far with regard to the use of AI in teaching-learning.

The main purpose of the elements raised here is to foster and contribute to the strengthening of the numerous debates that arise related to the theme and to this field of research under construction.

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