EDUCATION 4.0: TECHNOLOGICAL REVOLUTION OR DISGUISED THREAT?

EDUCAÇÃO 4.0: REVOLUÇÃO TECNOLÓGICA OU AMEAÇA DISFARÇADA?

EDUCACIÓN 4.0: ¿REVOLUCIÓN TECNOLÓGICA O AMENAZA ENCUBIERTA?

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ABSTRACT

This article offers a critical analysis of Education 4.0, addressing its concepts, foundations, and challenges from an integrative perspective. Initially, it contextualizes Education 4.0 within the context of Industry 4.0 and digital culture, highlighting the ambivalence between pedagogical innovation and risks to the human dimension of education. The methodology adopted, an integrative literature review, ensured the necessary breadth to understand multiple facets of the phenomenon. The text details the pedagogical potential of emerging

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technologies, such as artificial intelligence and augmented reality, and the importance of active methodologies and personalized learning for the development of 21st-century skills. It also discusses the essential digital skills for students and teachers, emphasizing the importance of continuing education that articulates technical, critical, and ethical aspects. It explores inequalities in access to technological infrastructure, demonstrating that "digital inclusion" needs to go beyond the mere provision of devices to be defined as social justice. The article also addresses risks associated with technological dependence, information overload, and the commodification of education, which threaten the mental health of those involved and the autonomy of the educational project. Finally, it proposes that Education 4.0 will be a pedagogical revolution with robust public policies, an integrated curriculum, ethical data governance, and qualified teacher training, while it will become a threat when dominated by market and technical interests. The article concludes by emphasizing the need for a careful balance between innovation and humanization, and suggests future research agendas to deepen the understanding of the sociocultural impacts of this educational transformation.

Keywords: Education 4.0. Digital Technologies. Digital Skills. Digital Inclusion. Teacher Training.

RESUMO

Este artigo oferece uma análise crítica da Educação 4.0, abordando seus conceitos, fundamentos e desafios numa perspectiva integradora. Inicialmente, contextualiza a Educação 4.0 no contexto da Indústria 4.0 e da cultura digital, ressaltando a ambivalência entre inovação pedagógica e riscos à dimensão humana da educação. A metodologia adotada, uma revisão integrativa da literatura, garantiu a abrangência necessária para compreender múltiplas faces do fenômeno. O texto detalha os potenciais pedagógicos das tecnologias emergentes, como inteligência artificial e realidade aumentada, e a importância das metodologias ativas e da personalização da aprendizagem para o desenvolvimento de competências do século XXI. Discute, ainda, as competências digitais essenciais para estudantes e docentes, destacando a importância de uma formação continuada que articule aspectos técnicos, críticos e éticos. Explora as desigualdades no acesso à infraestrutura tecnológica, evidenciando que a "inclusão digital" precisa ultrapassar a mera provisão de dispositivos para se definir como justiça social. São também abordados riscos associados à dependência tecnológica, sobrecarga informacional e mercantilização da educação, que ameaçam a saúde mental dos envolvidos e a autonomia do projeto educativo. Por fim, propõe que a Educação 4.0 será uma revolução pedagógica na existência de políticas públicas robustas, currículo integrado, governança ética de dados e formação docente qualificada, enquanto se converterá em ameaça quando dominada por interesses mercadológicos e técnicos. O artigo conclui enfatizando a necessidade de um equilíbrio cuidadoso entre inovação e humanização, e sugere agendas futuras de pesquisa para aprofundar o entendimento dos impactos socioculturais dessa transformação educacional.

Palavras-chave: Educação 4.0. Tecnologias Digitais. Competências Digitais. Inclusão Digital. Formação Docente.

RESUMEN

Este artículo ofrece un análisis crítico de la Educación 4.0, abordando sus conceptos, fundamentos y desafíos desde una perspectiva integradora. Inicialmente, contextualiza la Educación 4.0 en el contexto de la Industria 4.0 y la cultura digital, destacando la ambivalencia entre la innovación pedagógica y los riesgos para la dimensión humana de la educación. La metodología adoptada, una revisión bibliográfica integradora, garantizó la amplitud necesaria para comprender las múltiples facetas del fenómeno. El texto detalla el potencial pedagógico de las tecnologías emergentes, como la inteligencia artificial y la realidad aumentada, y la importancia de las metodologías activas y el aprendizaje

personalizado para el desarrollo de las competencias del siglo XXI. También analiza las competencias digitales esenciales para estudiantes y docentes, enfatizando la importancia de una formación continua que articule aspectos técnicos, críticos y éticos. Explora las desigualdades en el acceso a la infraestructura tecnológica, demostrando que la «inclusión digital» debe ir más allá de la mera provisión de dispositivos para definirse como justicia social. El artículo también aborda los riesgos asociados a la dependencia tecnológica, la sobrecarga de información y la mercantilización de la educación, que amenazan la salud mental de los participantes y la autonomía del proyecto educativo. Finalmente, propone que la Educación 4.0 será una revolución pedagógica con políticas públicas sólidas, un currículo integrado, una gobernanza ética de datos y una formación docente cualificada, mientras que se convertirá en una amenaza cuando esté dominada por intereses comerciales y técnicos. El artículo concluye enfatizando la necesidad de un equilibrio cuidadoso entre innovación y humanización, y sugiere futuras agendas de investigación para profundizar en la comprensión de los impactos socioculturales de esta transformación educativa.

Palabras clave: Educación 4.0. Tecnologías Digitales. Competencias Digitales. Inclusión Digital. Formación Docente.

1 INTRODUCTION

Education 4.0 emerges as an educational expression of Industry 4.0, inserted in a context of intense digital transformation, process automation, data expansion on a massive scale, and integration between the physical and virtual worlds through intelligent technologies. In this scenario, schools and training institutions are pressured to update curricula, methodologies, and forms of assessment to respond to a social and productive environment marked by permanent connectivity, digital platforms, artificial intelligence, and new skills requirements. At the same time, there is a growing discourse that education should prepare "adaptable" subjects to a volatile market, driven by innovation and performance, making us reflect deeply on the new roles of formal learning.

It is in this context that the notion of Education 4.0 is consolidated as a proposal for alignment between educational processes and the so-called fourth industrial revolution, bringing pedagogical practices closer to emerging technologies, personalization of learning and digitally mediated active methodologies. The promises include more dynamic classes, immersive experiences, real-time feedback, and flexible training trajectories, articulated with skills such as creativity, collaboration, complex problem solving, and digital fluency. However, alongside this innovative potential, questions arise about the direction and meanings of this transformation: who does this modernization serve? Does it expand educational rights or does it reinforce market and control logics?

In view of this scenario, the research problem that guides the article can be formulated in terms of the ambivalence constitutive of Education 4.0: to what extent does the diffusion of advanced digital technologies in the educational field configure itself as a technological revolution capable of qualifying learning and democratizing opportunities and to what extent can it operate as a disguised threat, deepening inequalities, weakening the teaching work and negatively impacting human dimensions of the educational process? The guiding question summarizes this tension: "Does Education 4.0 effectively represent a pedagogical-technological revolution or does it constitute a disguised threat to the project of critical, inclusive and humanizing education?".

The justification for the study lies in the fact that Education 4.0 has become a hegemonic discourse in policies, institutional documents and training, often associated with the idea of technological inevitability and necessary modernization. This movement influences decisions about investments in infrastructure, teacher training programs, curriculum design, and evaluation, while coexisting with school realities marked by

precariousness, unequal access to technologies, work overload, and challenges related to the mental health of students and teachers. Critically discussing this scenario is relevant to avoid both uncritical technicality and alarmism, producing a balanced analysis of potentialities and risks.

The general objective of this article is to critically analyze Education 4.0 as an educational phenomenon situated in Industry 4.0 and digital culture, examining its foundations, promises and contradictions in the light of recent literature. As specific objectives, it intends to: explain the main concepts, discourses and assumptions associated with Education 4.0; map evidence on the impacts of emerging technologies on teaching and learning processes; problematize implications for teacher training and performance; discuss effects on inclusion, inequality and social justice; to point out risks and ambivalences that can convert the "revolution" into a threat to the humanizing character of education and to propose guiding principles for a more critical and balanced integration of technologies in the school.

In terms of organization, the text begins with this introduction, which situates the problem, presents the guiding question and explains the relevance of the study. It then describes the methodological procedures of the literature review, indicating selection criteria, time frame and analysis strategy. The second chapter discusses concepts, foundations and promises of Education 4.0, articulating them in the context of Industry 4.0 and digital culture. The third chapter addresses teacher training and digital skills required in the 4.0 era, highlighting challenges and possibilities. The fourth chapter deals with the axes of inclusion, inequalities and risks associated with the intensive use of technologies, including aspects of health, well-being and social justice. The fifth chapter deepens the discussion on risks, ambivalences and side effects, exploring tensions between innovation and commodification, between technical efficiency and integral education. The sixth chapter resumes the question "technological revolution or disguised threat?", summarizes the main findings of the review and presents paths for a more humanized, critical Education 4.0 committed to the democratization of the right to education. The article concludes in its eighth chapter, with the final considerations.

As for the methodological procedures adopted in the preparation of this review, they were defined with the aim of offering a broad, current and critical view of the phenomenon of Education 4.0, articulating theoretical and empirical productions in the area of education and technologies. A predominantly integrative literature review was chosen, a modality that allows the gathering and synthesis of studies with different methodological approaches, aiming at a

broader understanding of a theme as complex as the one addressed in this study. The bibliographic search focused on databases widely used in research in education and human sciences, such as SciELO, CAPES Journal Portal, ERIC, Scopus, Web of Science and Google Scholar, as well as journals specialized in education and educational technologies accessible through institutional repositories.

2 EDUCATION 4.0: CONCEPTS, FOUNDATIONS AND PROMISES

The discussion on Education 4.0 is part of a context of profound technological, economic and cultural transformations associated with Industry 4.0 and the expansion of digital culture on a global scale. At the same time that possibilities for innovation, personalization of learning and the development of new skills are announced, tensions around educational purposes, training for work and the subjective and social impacts of this process are also growing. Understanding the concepts, foundations and promises of Education 4.0 is, therefore, a condition for critically evaluating whether this agenda represents an effective pedagogical renewal or whether it tends to reinforce logics of control and adaptation to a highly automated market.

In this sense, it is clear that the educational scenario has been deeply affected by the many changes brought about by the digital age. Digital technologies bring the power to create new learning opportunities, but they also require students to develop certain skills and abilities. These skills go beyond conventional academic knowledge and aim to help students deal with the obstacles of the 21st century and stand out in an increasingly technological and global world. In this context, the concept of education 4.0 emerges, which is characterized by the incorporation of digital technology in all aspects of education, from classrooms to online learning platforms (Costa Júnior, 2024).

This is when the concept of Education 4.0 emerges, which has been presented as an educational offshoot of Industry 4.0, understood as the fourth industrial revolution marked by the integration of cyber-physical systems, the internet of things, advanced automation, and the intensive use of real-time data (Schwab, 2016; Silva; Olave, 2020). In this context, Education 4.0 designates teaching proposals that articulate emerging digital technologies, curricular reorganization, and the development of skills considered central to the twenty-first century, such as critical thinking, creativity, collaboration, complex problem solving, and digital literacy (Leonel *et.al.*, 2022). Such proposals dialogue with the idea that education should prepare subjects to act in a connected, globalized and highly mediated society by

data, bringing the pedagogical discourse closer to agendas formulated by international organizations and by the business field itself.

The relationship between Education 4.0 and Industry 4.0 appears explicitly in studies that analyze training for technical and engineering areas, in which the need to articulate scientific and technological knowledge with socio-emotional and innovation skills is highlighted. From this perspective, the school and the university are called upon to develop curricula that dialogue with new forms of work organization, incorporating projects, real challenges, use of data and interaction with productive environments. At the same time, critical authors warn of the risk of reducing education to an instrument of adaptation to the demands of capital, by emphasizing functionalist and adaptive skills to the detriment of an integral, historically and politically situated education (Frigotto, 2010; Penna *et al.,* 2022).

On the pedagogical level, Education 4.0 is often associated with active methodologies, such as problem-based learning, projects, flipped classrooms, gamification, and collaborative network activities, which seek to move the student from a passive position to a role of greater protagonism (Bacich; Moran, 2018; Berbel, 2011). The personalization of learning, driven by virtual environments, adaptive systems, and the use of educational data, appears as a promise to adjust teaching to the pace, interests, and needs of each student, articulating with the digital culture in which children, young people, and adults are already immersed (Coll; Monereo, 2010; Kenski, 2012). This digital culture involves daily practices of interaction in social networks, collaborative production of content, circulation of information in multiple languages and screens, which redefines the way in which one learns inside and outside school.

Among the pedagogical potentials pointed out for the technologies associated with Education 4.0, artificial intelligence (AI), augmented reality (AR), educational big data, and digital learning platforms stand out. AI systems have been explored to support the personalization of teaching, through intelligent tutors, real-time performance analysis, and recommendations for training resources adjusted to the student's profile, which can contribute to more immediate feedback and more accurate pedagogical interventions (Holmes; Bialik; Fadel, 2019; Luckin, 2018). AR and virtual reality technologies enable immersive experiences, simulations, and complex visualizations, expanding opportunities for practical and interdisciplinary exploration in areas such as science, engineering, health, and the arts.

The use of big data and analytics in education is presented as a way to identify learning patterns, predict dropout risks, monitor engagement, and support pedagogical and

management decisions, especially in online and hybrid education environments (Siemens, 2013; Gasevic; Dawson; Jovanovic, 2016). Digital platforms, in turn, create ecosystems in which students and teachers can interact synchronously and asynchronously, share resources, develop collaborative projects, and make study times and spaces more flexible, partially displacing the centrality of the physical classroom (Moran, 2012; Kenski, 2012). Together, these technologies are often presented as instruments for pedagogical innovation, expansion of learning opportunities and construction of more flexible training trajectories, although they carry ambivalences and risks that need to be problematized at other times in the article.

3 DIGITAL SKILLS AND TEACHER TRAINING IN THE 4.0 ERA

Technologies have evolved a lot in recent years, profoundly changing the ways we communicate, produce and access information, in addition to transforming society as we know it. Therefore, education will need to adapt and incorporate new tools to improve the teaching and learning process. While technology can be a valuable tool for educators, they need to have adequate technical skills to use it effectively. These technological skills encompass the mastery of computers, software and hardware, and are fundamental for teachers to use technology in the classroom (Costa Júnior *et al.*, 2023).

The era of Education 4.0 imposes significant challenges to the development of digital skills and teacher training, crucial elements to effectively articulate technology and pedagogy. The maturation of these skills, which transcend the technical use of digital tools, also involves critical and ethical dimensions that are fundamental to teaching and student protagonism in digitally mediated environments. Becoming digitally competent implies mastering technical operational, safety and problem-solving skills, but also developing critical understanding of the social impact of technologies and ethical engagement in the production and use of information.

The digital skills required of students and teachers can be organized into three complementary dimensions: basic technical skills, such as handling equipment and *software*; critical skills, which involve analyzing, evaluating, and reflecting on digital content; and ethical aspects related to responsible use, privacy, and digital citizenship. While students need to develop autonomy to seek, organize, and share knowledge digitally, teachers must integrate these practices into pedagogical work, mediating the use of technology and promoting

inclusive and collaborative environments. Digital literacy, in this sense, operates not only on the instrumental level, but also in the formation of critical and ethical subjects in digital culture.

The initial and continuing training of teachers for the pedagogical use of digital technologies is a decisive factor to overcome mere technical adaptation and promote quality educational innovations. Training models that combine theory and practice, articulate active methodologies and provide reflective development have proven to be more effective. Reference-based programs such as TPACK (Technological Pedagogical Content Knowledge) emphasize the harmonious integration between technological, pedagogical and content knowledge, highlighting the need for contextualization of technologies in the curriculum and teaching practices.

In addition, institutional and cultural conditions exert a significant influence on the success of teacher education, including adequate educational policies, technological infrastructure, technical support, and time for experimentation and peer collaboration. School culture must value the teaching professional as a protagonist agent of innovation, investing in continuous development processes that promote resilience and innovation capacity in the face of rapid technological transformations.

4 INCLUSION, INEQUALITIES AND SOCIAL JUSTICE IN NEW TIMES

The accelerated incorporation of digital technologies in the context of Education 4.0 brings to light crucial challenges related to inclusion, inequalities, and social justice. Although technologies offer the potential to expand access to knowledge and diversify forms of learning, they also show structural disparities that refer to historical and social inequalities, putting at risk the realization of the right to education for all. The discourse of digital inclusion, when disconnected from integrated public policies that are sensitive to socioeconomic, cultural, and pedagogical dimensions, can become mere "technical inclusion", which does not solve inequalities or promote social justice.

Unequal access to equipment, adequate infrastructure and quality connectivity continues to be one of the main obstacles to the full democratization of Education 4.0. Students from peripheral regions, public schools in vulnerable rural or urban areas, and families in situations of economic vulnerability face difficulties in enjoying the benefits of digital technologies, deepening a gap that already separates very different educational realities. This technological exclusion has direct impacts not only on access to digitized content and platforms, but on the possibility of active participation in collaborative learning processes,

formative assessment, and the development of critical digital skills. The mere provision of devices alone does not guarantee inclusion, and it is necessary to have an articulated set of public policies that contemplate teacher training, sustainability of networks and pedagogical mediation.

In the context of inclusive education, Education 4.0 must face the challenge of ensuring access and learning for vulnerable groups, such as students with disabilities, students in contexts of socioeconomic deprivation, black, indigenous and quilombola populations, among others. Technology can offer accessibility and personalization features that favor equity, but this depends on an educational project that considers the cultural and social specificities of these groups, adopting inclusive and sensitized pedagogical methods. In addition, the use of digital technologies in the school environment exposes students and teachers to complex power dynamics, such as digital violence, online harassment, and symbolic exclusion, which challenge the construction of a democratic and supportive culture in schools.

On the other hand, technology provides resources for individuals with communication problems, such as autistic people, facilitating interaction and expression of thoughts. In the educational context, technology stands out by enabling a more inclusive and personalized teaching methodology, providing support for different learning styles. However, obstacles such as the absence of adequate infrastructure and financial barriers still exist, preventing complete digital inclusion (Freire *et al.,* 2023).

The promotion of critical citizenship in the school digital culture has been pointed out as a central strategy to face such challenges, by enhancing the protagonism of students, developing ethical reflection skills on the use of technologies and strengthening active participation in digital spaces in a safe and responsible way. Training for digital democracy becomes as fundamental as technological access, constituting an axis for the construction of social justice within the scope of Education 4.0, which breaks with the idea of merely technical inclusion and incorporates cultural, political and pedagogical dimensions in the educational process.

5 RISKS, AMBIVALENCES AND SIDE EFFECTS

Education 4.0, despite its transformative potential, is not free from risks, ambivalences and side effects that deserve critical reflection. The intensive use of digital technologies imposes challenges to the care of the psychological, pedagogical and social dimensions of the educational process, going beyond simple instrumental adoption. The tensions emerge

from the relationship between technical efficiency, always sought by digital innovation, and the need to preserve an integral education, which considers the subject in its entirety, including its well-being and critical development.

One of the most evident risks of Education 4.0 is the growing technological dependence, which can lead to informational overload, fragmentation of attention, and cognitive and emotional exhaustion of students and teachers. Multimediality, overstimuli, and pressure for quick responses can negatively affect concentration and the ability to deeply reflect, which are essential for meaningful learning. In addition, there are direct impacts on mental health, with an increase in anxiety, stress, and digital fatigue, factors that compromise the pedagogical relationship and the quality of teaching. These aspects point to a necessary renegotiation of the pace and modalities of use of technology in education, which preserves spaces for unplugging and reflection.

Another field of concern refers to the commodification of education in the context of Education 4.0, marked by the massive capture of educational data and the logic of competencies focused primarily on the labor market. There is a tendency for educational spaces, instruments and pedagogical processes to be subjected to neoliberal rationalities, guided by efficiency, productivity and employability, to the detriment of critical, citizen and emancipatory education. The collection and monetization of student data raises ethical and privacy issues that still lack adequate regulation, configuring potential colonization of educational spaces by commercial interests.

This subordination of educational work to the demands of the market redefines the relationship between knowledge, power and autonomy, emphasizing the formation of human capital adaptable to volatile and competitive economic contexts, which can generate precariousness of teaching work and devaluation of the socio-emotional dimensions of the educational process.

Selwyn (2017, p. 87-88) also evaluates that:

> Unfortunately, much of the recent discussion around Education and Technology has been woefully fragile. Academic research in the area is frustratingly poor, and much of the evidence for the benefits and risks of using the technology lacks generalizability and rigor. Discussions among both laypeople and experts still tend to be desperately optimistic or dystopian. Objective discussions are often weakened by an understandable desire of educators to improve education using any means possible. The imperative to reform education for an era of technological and demographic change (INSTITUTE OF DIRECTORS, 2016) is repeated ad infinitum by policymakers and entrepreneurs [...].

Thus, a critical analysis is needed that is not limited to celebrating Education 4.0 as a technological innovation, but that incorporates the vigilance of the risks and tensions that cross it, proposing educational practices that balance technology, ethics and humanization.

6 BETWEEN REVOLUTION AND THREAT

Education 4.0 represents a field of tensions between revolutionary potentialities and concrete threats to the humanizing educational project. The pedagogical revolution is present to the extent that digital technologies, such as artificial intelligence, *big data*, augmented reality, and digital platforms, enable personalization of learning, flexibility of times and spaces, active methodologies, and student protagonism. These conditions favor curricular innovation, the development of complex skills and collaborative learning, expanding the reach and diversity of training experiences. On the other hand, Education 4.0 can become a threat whenever its implementation is limited to a merely technical, market, or control logic, without dialogue with the democratic, inclusive, and ethical project of education. This occurs when social inequalities are deepened, teacher training is neglected, the mental health of those involved is despised, and the critical dimension of the curriculum is eclipsed.

The balance between these poles depends on concrete conditions that involve effective public policies, coherent curriculum design, ethical data governance, and continuous and qualified teacher training. Public policies must ensure adequate infrastructure, universal and sustained connectivity, as well as robust programs for training and valuing teachers, recognizing their protagonism and autonomy. Curriculum design needs to integrate technologies critically, articulating digital skills with socio-emotional skills and humanistic knowledge, ensuring that pedagogical innovation does not replace or weaken the reflective and relational work of the school. The governance of educational data must respect privacy, security, and the principle of digital sovereignty, preventing commercial capture and misuse of personal information. Teacher training needs to be continuous, contextualized, centered on the development of technical, pedagogical and ethical skills, enabling the teacher to mediate and problematize the use of technologies in the educational process.

From this perspective, a critical and pragmatic agenda for a humanized Education 4.0 that incorporates principles of equity, participation, and social and environmental sustainability in educational policies and practices is recommended; flexible, interdisciplinary and inclusive curriculum design, which articulates digital technologies with methodologies that promote autonomy and critical thinking; democratic and transparent governance of

educational data, with regulation that protects rights and avoids excessive commodification; investments in initial and continuing education, valuing the role of the teacher as a critical mediator and agent of social innovation; and encouragement of interdisciplinary and field research that deepens the impacts of technologies on learning, mental health and educational inequalities, guided by ethical and democratic values.

These paths can contribute to the consolidation of Education 4.0 as an authentic and responsible pedagogical revolution, mitigating risks and expanding opportunities for quality, critical and humane education, in dialogue with the challenges of the 21st century.

7 FINAL CONSIDERATIONS

Here the main points addressed in each chapter are summarized, reflecting on the challenges and opportunities of Education 4.0, in order to support a critical and pragmatic view of its role in the contemporary educational scenario.

Initially, the contextualization of Education 4.0 in the panorama of Industry 4.0 and digital culture was presented, highlighting the tension between the promises of technological innovation and the risks of losing the human dimension in education. Next, it sought to elucidate the concepts, foundations and promises of Education 4.0, emphasizing the role of emerging digital technologies, 21st century skills, active methodologies and the personalization of learning.

In the following chapter, the importance of digital skills and continuous and qualified teacher training was discussed, highlighting the complexity of the technical, critical and ethical skills that students and teachers need to develop. The fourth chapter addressed the dimension of inclusion, inequalities and social justice, showing that access to technology without integrated and diversity-sensitive policies can aggravate exclusions and demand a digitally critical and citizen education. The fifth chapter focused on the risks and ambivalences of Education 4.0, such as technological dependence, the impacts on mental health and the commodification of education, emphasizing the need for an ethical and humanizing reflection. The seventh chapter promoted a critical synthesis, pointing out that Education 4.0 can represent a pedagogical revolution when mediated by efficient public policies, integrated curriculum, ethical data governance and robust teacher training, but that it becomes a threat when limited to the market and technicist logic. As a conclusion, the final considerations are presented.

The final reflection of the article emphasizes that the incorporation of technologies in education must be guided by a delicate balance between innovation and care, between technical efficiency and integral training, between digital inclusion and social justice. To this end, it is essential that educators, managers, and policymakers adopt a critical and contextualized perspective, promoting pedagogical practices that are inclusive, ethical, and committed to the full development of the subjects. The future of Education 4.0 depends, therefore, on the collective ability to build and sustain educational spaces that integrate technology, humanization, and democracy, contributing to the formation of critical, creative, and supportive citizens in the digital age.

Finally, the article suggests deepening research on the effects of Education 4.0 in diverse contexts, especially focusing on the impacts on mental health, tackling digital inequalities, and the broader consequences of educational data governance, thus guiding the construction of fairer and more effective policies and practices for the twenty-first century.

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