EDUCAÇÃO 5.0 E NEUROCIENCIA NA ERA DA INTELIGENCIA ARTIFICIAL

EDUCATION 5.0 AND NEUROSCIENCE IN THE AGE OF ARTIFICIAL INTELLIGENCE

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Werlen dos Santos Alves[1]

RESUMO

O presente artigo investiga de forma detalhada a convergência entre a neurociência, a educação 5.0 e a inteligência artificial, explorando como estes elementos podem transformar o processo educativo. A percepção dos mecanismos cerebrais pode ser articulada com ferramentas tecnológicas inovadoras, alterando as percepções e atitudes dos alunos em relação a uma variedade de questões educacionais e sociais contemporâneas. Por meio da metodologia de pesquisa bibliográfica, que envolve a análise cuidada de artigos relevantes e significativos, procuramos alcançar uma compreensão crítica das interações sociais mediadas por estas influentes tecnologias. O objetivo principal é compreender de que forma as práticas pedagógicas podem ser efetivamente adaptadas às descobertas mais recentes da neurociência, de modo a integrar a inteligência artificial e proporcionar experiências de aprendizagem adaptativas, promovendo um ensino eficaz que esteja perfeitamente alinhado com as crescentes exigências e desafios da Educação 5.0. Conclui-se que as evidências apresentadas ressaltam a relevância de um modelo de ensino que não se limita à adoção de inovações tecnológicas, mas que também integre essas tecnologias com a neurociência, de modo a potencializar a experiência educativa, promover a autonomia dos alunos e atender às suas necessidades individuais, preparando os estudantes para os desafios do mundo contemporâneo.

Palavras-chave: Educação 5.0. Neurociência. Inteligência Artificial.

ABSTRACT

This article investigates in detail the convergence between neuroscience, education 5.0 and artificial intelligence, exploring how these elements can transform the educational process. The perception of brain mechanisms can be articulated with innovative technological tools, altering students' perceptions and attitudes towards a variety of contemporary educational and social issues. Through the methodology of bibliographical research, which involves the careful analysis of relevant and significant articles, we seek to achieve a critical understanding of the social interactions mediated by these influential technologies. The main objective is to understand how pedagogical practices can be effectively adapted to the latest discoveries in neuroscience in order to integrate artificial intelligence and provide adaptive learning experiences, promoting effective teaching that is perfectly aligned with the growing demands and challenges of Education 5.0. In conclusion, the evidence presented highlights the relevance of a teaching model that is not limited to the adoption of technological innovations, but which also integrates these technologies with neuroscience

[1] Specialization. Master's student in Emerging Technologies in Education at Must University.
Email: werlendossantosalves@gmail.com

in order to enhance the educational experience, promote student autonomy and meet their individual needs, preparing students for the challenges of the contemporary world.

Keywords: Education 5.0. Neuroscience. Artificial Intelligence.

RESUMEN

Este artículo investiga en detalle la convergencia entre neurociencia, educación 5.0 e inteligencia artificial, explorando cómo estos elementos pueden transformar el proceso educativo. La percepción de los mecanismos cerebrales puede articularse con herramientas tecnológicas innovadoras, alterando las percepciones y actitudes de los estudiantes hacia una variedad de cuestiones educativas y sociales contemporáneas. A través de la metodología de investigación bibliográfica, que implica el análisis cuidadoso de artículos relevantes y significativos, buscamos alcanzar una comprensión crítica de las interacciones sociales mediadas por estas influyentes tecnologías. El objetivo principal es comprender cómo las prácticas pedagógicas pueden adaptarse eficazmente a los últimos descubrimientos de la neurociencia para integrar la inteligencia artificial y proporcionar experiencias de aprendizaje adaptativas, promoviendo una enseñanza eficaz que esté perfectamente alineada con las crecientes demandas y desafíos de la Educación 5.0. En conclusión, las evidencias presentadas resaltan la relevancia de un modelo de enseñanza que no se limite a la adopción de innovaciones tecnológicas, sino que también integre estas tecnologías con la neurociencia para mejorar la experiencia educativa, promover la autonomía de los estudiantes y satisfacer sus necesidades individuales, preparando a los estudiantes para los desafíos del mundo contemporáneo.

Palabras clave: Educación 5.0. Neurociencia. Inteligencia Artificial.

INTRODUCTION

The relevance of the theme lies in the convergence between contemporary pedagogies and technological innovations, central to the training of educators. It is essential to adopt a holistic view that values reflective practice and adaptation to the diverse needs of students. The development of socio-emotional skills, combined with the mastery of technical skills, becomes a priority. Curricula that encourage collaboration and critical analysis prepare students for the challenges of the twenty-first century, promoting solidarity and respect for diversity.

The school environment must be conducive to creativity and curiosity, which are fundamental for meaningful learning. Adoption of active methodologies that prioritize the student's voice contributes to a more motivating education. Digital technologies emerge as allies, facilitating interactive learning experiences. However, educators must be critical about the use of these tools, ensuring their ethical application. Education should be seen as a continuous and collaborative process, where students, teachers and managers share responsibility for a fairer and more inclusive future. The commitment goes beyond the transmission of knowledge; It is about the integral formation of the human being, capable of navigating ethically in a world in constant evolution.

The methodology adopted in this article is based on a thorough bibliographic research, with the clear objective of gathering, analyzing and synthesizing the existing literature on contemporary pedagogical practices, as well as their interconnections with technological innovations that have transformed the educational scenario. This method, when applied, allows a deep and comprehensive understanding of the main concepts and currents of thought that permeate this very relevant theme, in addition to enabling the detailed identification of controversies, tensions and challenges inherent to the debate on current education. This analysis not only enriches knowledge about pedagogical practices, but also highlights the importance of adapting to the new technological context.

The article is organized as follows: after this introduction, a bibliographic research will be presented that substantiates the theoretical bases of the study; then, we will discuss active methodologies and their practical implications in the educational environment; Subsequently, socio-emotional skills in the context of the training of educators will be addressed; Finally, we will present the conclusions and reflections on the paths for future education, highlighting the importance of a critical and ethical look at digital technologies.

EDUCATION 5.0

Education 5.0 responds in an extremely effective and adaptable way to the growing demands of a society that is not only dynamic but also deeply interconnected, being

increasingly influenced and shaped by advances in digital technology and artificial intelligence. This new and innovative educational model, which can be considered a significant evolution of Education 4.0, goes much further by focusing on inclusion, interdisciplinarity, and the development of socio-emotional skills, all of which are fundamental for the integral and comprehensive education of students (Abrahão, Souza & Costa, 2024). It represents an important and significant transition from traditional teaching, which was predominantly centered on mere memorization and the simple transmission of knowledge, to modern pedagogical approaches that emphasize meaningful, long-lasting, and practical learning. In this new and challenging context, the role of the educator becomes even more crucial and relevant, as it must foster creativity, innovation, and critical thinking among students, preparing them adequately to face the challenges and demands of contemporary daily life. (Ribeiro, Lima & Marques, 2023).

In this context, the generation of screenagers, which represents today's teenagers, is made up of young people who grew up immersed in a digital and highly connected environment, facing challenges and opportunities generated by the rapid evolution of technology. These digital natives interact with electronic devices from an early age, shaping their ways of learning, socializing, and communicating with the world. (Pereira et al.2024) In this dynamic scenario, education must evolve to meet the demands of this generation, integrating technologies such as artificial intelligence and augmented reality. This makes digital tools allies in the educational process, allowing students to maximize available resources and prepare for the challenges of the future. In addition to technical skills, this approach seeks to cultivate values such as empathy, resilience, and intercultural skills, which are fundamental for the formation of conscious citizens who can adapt to the constant transformations of society. In this way, with Education 5.0, students not only acquire technical knowledge, but also become more apt to face a constantly changing world. (Barroso et al.2025)

The impact of technology on education is a complex and multifaceted phenomenon. While it significantly expands access to knowledge and improves teaching methods in innovative ways, it also raises numerous concerns about the equity and quality of learning among students. The adoption of technologies in Education 5.0 must be carefully accompanied by critical and in-depth reflection to ensure that there are fair and equal opportunities for all learners, regardless of their social or economic background, or the circumstances they face. It is critical that decisions regarding the implementation of technology consider the diversity of students and their different educational needs. (Possato et al.2024)

Within this perspective, Education 5.0 proposes an innovative and student-centered approach. This approach integrates several active and personalized methodologies, which seek to promote truly meaningful and collaborative learning among all participants in the educational process. By valuing the individuality of each student, this approach not only encourages active participation but also emphasizes the importance of collective knowledge construction. In this way, students become protagonists of their own education, stimulating an environment where everyone can contribute and learn from each other, facilitating the development of essential skills and competencies for the twenty-first century, as well as fostering a culture of respect and diversity in classrooms. (Chen, Chen, & Lin, 2020).

NEUROSCIENCE IN THE AGE OF ARTIFICIAL INTELLIGENCE

Neuroscience, which is the science dedicated to the study of the nervous system and its multiple functions, plays a fundamental and crucial role in understanding the complex process of human learning, especially when we consider the recent and significant technological advances that are being made in the area of Artificial Intelligence (AI). The human brain, which consists of an extraordinarily complex structure, is responsible for a multitude of cognitive processes that form the basis of our natural and innate ability to learn and assimilate new information. These processes encompass various functions such as perception, memory, attention, and reasoning, which are all intricately interconnected and are constantly influenced by a vast network of interconnected synapses (Oliveira, 2023).

Cognitive functions, which are essential for learning, are affected by both innate genetic factors and each individual's unique environmental experiences, which underscores the need for a multifaceted and in-depth understanding to not only address, but also improve, the way we learn. Ongoing research in neuroscience reveals that learning should not be seen as a linear and simple process, but rather as a dynamic and adaptable phenomenon that changes according to the context and individual characteristics of each learner (Ramos and da2024).

Artificial Intelligence in education is revolutionizing teaching in a significant way, establishing a direct and productive connection with the latest advances in neuroscience. In-depth knowledge about how the human brain works, its intricate connections, and processes, can be applied very effectively in diverse and innovative AI tools, which results in much more personalized, engaging, and efficient learning experiences for students (Souza et al.2023).

AI is capable of simulating, in a sophisticated and advanced way, human cognitive processes, allowing this technology to adapt in the best possible way to each student's unique learning style. Innovative applications, such as smart tutors that personalize content and learning management systems that monitor progress, are specifically designed to offer instantaneous and targeted feedback, something that is absolutely necessary to strengthen memory and ensure more meaningful and lasting learning. This use of AI in the educational context promises to transform the way educators approach teaching and how students interact with knowledge (Souza et al.2023).

In addition, *e-learning platforms* and *chatbots* have become common in the educational environment, while recommendation systems are implemented to suggest content that is in tune with each student's behavior and preferences. The introduction of gamification, coupled with AI, creates much more engaging learning environments that stimulate not only interest but also the development of critical skills. This approach activates neural networks in the brain that are intrinsically linked to motivation, which translates into more effective performance.

Finally, AI also plays a vital role in democratizing access to knowledge. It makes learning more accessible, thus benefiting a larger number of students while respecting the fundamental principles that govern the functioning of the human brain (Almeida et al., 2024).

Neuroscience is undoubtedly essential in offering extremely valuable insights into the way students process information and learn in varied and unique ways. This detailed understanding allows artificial intelligence (AI) technologies to be carefully tailored to meet the individual needs of each student. With this, a personalization of teaching is promoted that not only maximizes the learning potential of each one, but also considers the different ways of learning that each student can have (Almeida et al., 2024).

This innovative approach, which is grounded in scientific findings, helps educators identify and employ effective strategies more accurately. This results in the development of methods and practices that really make a big difference in the educational process and promote the integral development of all students, contributing to a more effective and enriching learning environment.

THE CONVERGENCE BETWEEN EDUCATION 5.0 AND NEUROSCIENCE

The confluence between Education 5.0 and Neuroscience represents a substantial advance in our understanding of the human learning process, emphasizing the relevance of Artificial Intelligence technology. Education 5.0, which is characterized by the personalization of the educational experience, peer collaboration, and the adoption of

technological innovations, requires an in-depth analysis of neuroscience findings, which investigates the mechanisms underlying learning and memory. Knowing cognitive processes, such as neural plasticity and the impact of emotions on the ability to learn, is essential for the development of effective pedagogical strategies adapted to the needs of students in the current reality (Almeida et al., 2024).

Evidence-based teaching strategies can be enhanced with neuroscientific knowledge about the assimilation and retention of information by students. Methods such as deliberate practice, continuous feedback, and gamification, illuminated by neuroscientific discoveries on motivation, improve academic performance and develop critical competencies such as critical thinking and creativity in the Digital Age. In addition, the personalization of learning benefits from the analysis of neuroeducational data, allowing curricula adjusted to learning styles and individual cognitive peculiarities (Valle Silva Lopes & da Silva Duque-Pereira, 2024).

Adaptive learning environments emerge as a response to the diverse needs of students, using cutting-edge technology. Artificial intelligence allows students to monitor progress and adjust content according to their performance, promoting continuous and self-regulated learning. Platforms with simulations or augmented reality stimulate areas of the brain linked to spatial reasoning and problem-solving, making learning more engaging. The union between Education 5.0 and Neuroscience redefines the educator as a facilitator, creating an ecosystem that values individuality and cooperation, preparing students for future technological challenges. (Júnior et al.2023)

The convergence between Education 5.0 and neuroscience offers a vast and rich range of creative opportunities to personalize learning in ways that are effective and unique to each individual. This powerful interaction turns into an extremely promising field for educational approaches that meet the varied and specific needs of each student in an increasingly diverse context. In addition, by integrating neuroscience with the innovative and up-to-date pedagogical practices of Education 5.0, we have been able to establish a much stronger link between educational theory and practice, resulting in learning that is much more meaningful, deep, and lasting for all students involved in this enriching process (Valle Silva Lopes & da Silva Duque-Pereira, 2024).

FINAL CONSIDERATIONS

The article highlights the relevance of Education 5.0 and Neuroscience within the context of Artificial Intelligence, emphasizing the need to integrate new technologies into the educational process. It investigates the convergence of these areas, underscoring how

collaboration between them can create a more adaptive, student-centered learning environment that values the individuality of each student. The main conclusions highlight the importance of teaching that not only incorporates technological innovations, but also meets contemporary educational demands, promoting more effective and personalized learning.

Therefore, the study also highlights the need for teacher training that is aligned with the competencies required by Education 5.0. This implies the continuous training of educators, who must be able to integrate neuroscience into their pedagogical practices, using artificial intelligence as an ally in the personalization of learning.

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