Training teachers to use technology: Artificial Intelligence (AI) and the new challenges facing education

https://doi.org/10.56238/sevened2024.003-019

Rita de Cássia Soares Duque[1] , Rhadson Rezende Monteiro[2], Valéria Jane Siqueira Loureiro[3], Isidro José Bezerra Maciel Fortaleza do Nascimento[4], Reginaldo Leandro Placido[5], Cícero José da Silva[6] and Maria do Socorro Gomes Saraiva[7]

ABSTRACT

The study of teacher training and capacity building for the effective use of technology, including artificial intelligence, is imperative today, as it not only redefines pedagogical practices but also shapes the future of education, empowering educators to deftly navigate an ever-evolving educational landscape. In this scenario, this article critically examines the training of teachers for the effective use of digital technologies, focusing on the growing relevance of artificial intelligence in contemporary education. Through an innovative approach, the text explores training strategies that go beyond mere technical proficiency, highlighting the importance of digital and data literacy, as well as the harmonious collaboration between educators and artificial intelligence. Ethical challenges, humanistic considerations, and strategies for evaluating the effectiveness of technology training are discussed. By addressing barriers and proposing strategies to overcome them, the article concludes the discussion with reflections on future perspectives, outlining an educational horizon where technology and pedagogy converge to promote more efficient and innovative learning.

Keywords: Teacher Education, Educational Technology, Artificial Intelligence, Digital Literacy.

[1] Master of Science in Education
Department of Education (SEDUC)
Rondonópolis – MT, Brazil
E-mail: cassiaduque@hotmail.com
[2] Gilding in Law
Federal University of Santa Catarina (UFSC)
Santa Catarina – Brazil
E-mail: advrmonteiro@gmail.com
[3] Doctor in Education
Federal University of Sergipe – (UFS)
Aracaju, Brasil
E-mail: vjsloureiro.profe.ufs@gmail.com
[4] Doctor of Education
University of São Paulo (USP)
Teresina, Brazil
E-mail: isidrofortaleza@hotmail.com
[5] Doctor of Education,
Instituto Federal Catarinense – (IFC)
Santa Catarina, Brazil
E-mail: profereginaldo@gmail.com
[6] Doctorate student in Linguistics
Federal University of Paraíba – (UFPB)
Pernambuco, Brazil
E-mail: ciceroprofessorbrasil@gmail.com
[7] Federal University of Piauí (UFPI)
Master's student in Education
Piauí, Brazil
E-mail: saraivag@hotmail.com

INTRODUCTION

In recent years, the rapid rise of technology has significantly transformed the educational landscape, instigating the urgent need for a critical analysis of how educators can be effectively prepared to explore and integrate these innovations into their pedagogical practices (GOMES and SOARES, 2011). At the epicenter of this transformation is the intricate relationship between teacher education and the emergence of digital technologies. This article aims to shed light on the contemporary challenge of training educators to master the use of technologies, going beyond conventional boundaries and into the fascinating realm of artificial intelligence (AI).

The educational landscape of the 21st century requires a metamorphosis in teaching methods, and the integration of digital tools and artificial intelligence emerges as a catalyst for this transformation. Faced with this scenario, teacher training emerges as a critical point, a portal through which educators can enter the universe woven by the synergy between the human and the digital. Understanding how educators can not only adapt but thrive in this digital environment is a crucial issue for the effectiveness of the education system as a whole.

When exploring the nuances of teacher training for the use of technology, it is vital to highlight not only technical capacity but also deep understanding of how these tools can be leveraged to promote meaningful learning (ALVES, 2014). This innovation does not only refer to the adoption of new technologies, but to a fundamental transformation in the pedagogical approach, where technology and artificial intelligence are not mere accessories, but intrinsic partners in the educational process.

In this context, it is important to explore the realm of artificial intelligence, an ever-evolving sphere that offers unique opportunities and challenges for educators. Artificial intelligence is not just a tool, but a co-creator in the teaching-learning process. Therefore, it is necessary to question whether it is possible to prepare teachers not only to use, but to collaborate with AI entities in their classrooms. This is a question that leads to deep reflections on the role of the educator in the context of a digital age permeated by algorithms and machine learning.

In this context, innovation in teacher education is not only limited to what is taught, but also to how it is taught (FAVA, 2018). Learning becomes a holistic experience, where technology and artificial intelligence are not mere enablers, but dynamic agents in the development of essential skills for the 21st century. Through this exploration, the present study seeks not only to analyze but also to catalyze an innovative vision for teacher education, where the integration of technology and artificial intelligence is not an option, but an imperative necessity for educational excellence.

DEVELOPMENT

INNOVATIVE TRAINING STRATEGIES

The digital revolution drives an urgent evolution in the way educators are trained, requiring innovative strategies that transcend traditional training practices. According to Silva (2019), teacher training can no longer be conceived only as a transfer of technical skills; It should embrace a more holistic vision, incorporating contemporary pedagogical principles and the development of digital skills.

In this scenario, the use of approaches such as project-based learning, online collaborative learning and virtual simulations emerge as catalysts for more immersive and contextualized training. By integrating practice directly into the learning process, educators can not only acquire technological skills but also understand how these skills fit organically into their pedagogical practices.

The transformation of teacher education is also manifested in the adoption of more flexible and personalized models. Strategies such as mobile learning, which allows educators to access resources and training at any time and place, dismantle temporal and geographical barriers, promoting continuous and adaptive learning (LIMA-LOPES *et al*. 2021).

Similarly, gamification in teacher education offers a playful environment that not only captivates but also encourages the exploration of technologies in an engaging way. Not only do these strategies empower educators technically, but they also nurture a mindset of constant learning, which is critical in an educational environment driven by technological innovation.

Innovative teacher education should also address the integration of emerging tools such as virtual reality (VR) and augmented reality (AR). By simulating classroom environments and complex pedagogical scenarios, these technologies provide educators with hands-on opportunities for experimentation and improvement of their skills (AFONSO *et al*. 2020).

Training, therefore, is no longer a passive experience, but an interactive journey, where educators can face virtual challenges before applying innovative strategies in their real classrooms. Thus, by adopting training strategies that go beyond the conventional, educators become not only users of technology, but true catalysts for digital transformation in their educational contexts.

THE IMPORTANCE OF DIGITAL AND DATA LITERACY

Digital literacy is the foundation on which successful teacher education is built in the age of technology. It is not only about mastering digital tools, but also about the deep understanding of the digital ecosystem that permeates pedagogical practices (GRANDEZ and CORREA, 2022).

The ability to discern information online, critically evaluate digital resources, and understand the ethical implications of using technology are essential skills that intertwine with digital literacy.

Teachers must be endowed not only with technical skills but also with a keen discernment to guide their students in an ever-evolving digital world.

At the same time, data literacy plays a crucial role, especially in a scenario where artificial intelligence and algorithms shape learning. Teachers should be trained to interpret and use data ethically and effectively. This not only includes the ability to analyze data to inform pedagogical practice, but also an understanding of the ethical nuances involved in the collection and use of educational data (DEITOS and ARAGÓN, 2021). Data literacy isn't just about numbers and statistics; It's about empowering educators to make informed and ethical decisions in an increasingly data-driven environment.

In a broader context, digital and data literacy transcends the mere use of devices and software. It involves fostering a critical mindset towards digital information, empowering educators to continuously question, discern, and adapt to rapid technological change. According to Silva and Silva (2020), by prioritizing digital and data literacy in teacher education, more resilient professionals are trained, who thrive in an increasingly dynamic educational universe, guiding their students through the turbulent waters of the digital age.

COLLABORATION BETWEEN EDUCATORS AND ARTIFICIAL INTELLIGENCE

As artificial intelligence (AI) becomes an increasingly prominent presence in the education landscape, effective collaboration between educators and AI systems emerges as a key pillar for truly innovative education (CRUZ *et al*. 2023).

The relationship between humans and algorithms transcends mere technical implementation; It's an intellectual symbiosis where both entities contribute in unique ways. Educators, endowed with human intuition, expertise, and empathy, can harness the potential of AI to personalize learning by offering an adaptive approach that meets individual student needs.

According to Duque *et al.* (2023, p. 6.868) "(...) educators need to be able to adapt to change and develop the skills needed to take advantage of the opportunities offered by AI in the educational context."

This collaboration is not a substitution of the role of the educator, but an expansion of their capacities. In this sense, AI can take over routine and analytical tasks, freeing up time for teachers to focus on more complex and meaningful aspects of education, such as developing social-emotional skills and stimulating creativity. According to the study by Duque *et al.* (2023) Human-AI collaboration isn't just efficient; it creates a powerful synergy that powers the educational process, transforming it into a dynamic and personalized experience.

However, this collaboration is not without its challenges. Ethical issues, such as transparency in algorithms and the privacy of student data, emerge as crucial considerations. Educators play a

crucial role in mediating these concerns, ensuring that the implementation of AI is not only effective but also ethical. In addition, the continuous training of educators becomes essential so that they can effectively understand and manage the ever-evolving AI tools.

When exploring collaboration between educators and AI, it is imperative to consider concrete use cases. Studies of successful implementations, where AI complements and enriches pedagogical practices, provide valuable insights. By highlighting real-world examples of how AI can be an effective ally for educators, one can inspire a change in mindset, transforming the initial fear into an enthusiastic opening for the promising collaboration between the human and the algorithm in the educational field (AFONSO *et al.* 2020).

ETHICAL CHALLENGES AND HUMANISTIC CONSIDERATIONS

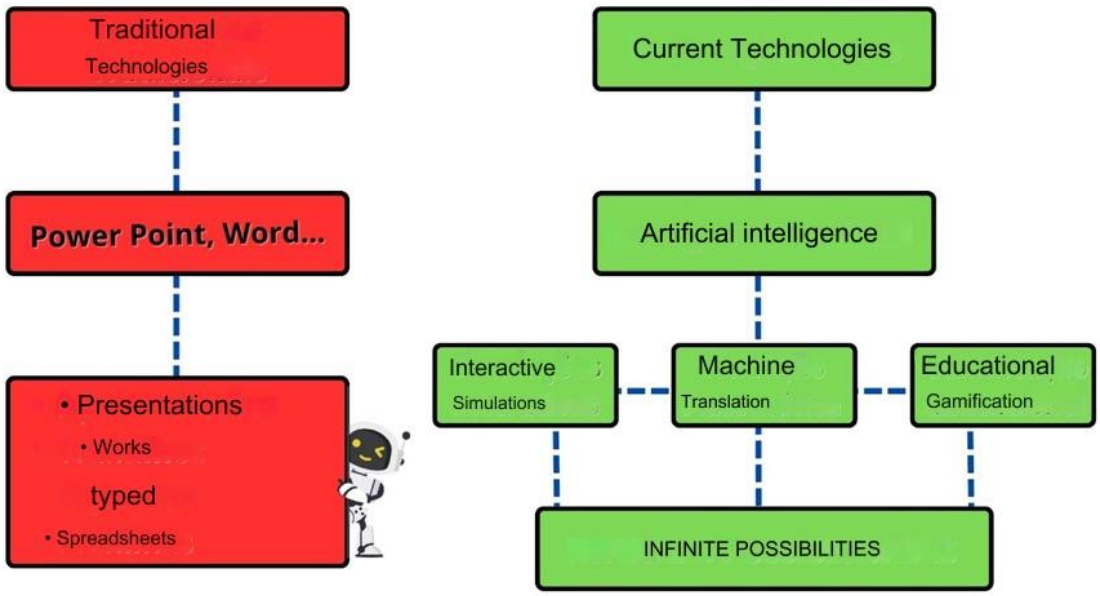
The integration of advanced technologies, such as artificial intelligence, into education brings with it a number of ethical challenges that require deep reflection and careful approaches. One of the pressing challenges is transparency in algorithms. Educators must understand how AI systems make decisions to ensure there is no bias or discrimination. Algorithmic opacity can compromise fundamental ethical principles, raising questions about equity in access to digitized education (BOULAY, 2023).

The issue of data privacy is also at the epicenter of these ethical considerations. As students interact with digital platforms, the collection and use of educational data becomes inevitable. However, balancing the need for data for educational personalization with ensuring student privacy is an ethical tightrope. Educators are responsible not only for academic development, but also for protecting the privacy and emotional well-being of their students in a digital environment.

Another ethical challenge is the issue of human displacement. As AI takes over tasks traditionally performed by educators, concern arises about the potential replacement of education professionals. Keeping humanity at the heart of education is essential; Technology should be an enhancer tool, not a substitute for the unique human connection that educators provide. Ethical reflection is, therefore, an essential compass to navigate these unknown waters of educational automation (SILVA, 2023).

Humanistic considerations are crucial in shaping technological development in education. It is essential that technology is implemented with empathy and cultural sensitivity (LIMA-LOPES *et al.* 2021). Understanding different perspectives and contexts is crucial to avoid imposing cultural standards, ensuring that technology serves as an inclusive and respectful tool for diversity. In this sense, the ethical training of educators becomes a crucial anchor to guide navigation through ethical challenges and sustain a humanistic approach amid the increasing digitalization of education.

Figure 1. Schematic representation of a comparison of the benefits of Artificial Intelligence in education.



Source: Authors.

EVALUATION OF THE EFFECTIVENESS OF TECHNOLOGY TRAINING

Evaluating the effectiveness of teacher training in technology is an imperative to ensure that the efforts invested result in tangible improvements in pedagogical practices. Assessment should not be limited to technical proficiency alone, but extend to the practical application of these skills in the context of teaching and learning. According to Cruzeiro et al (2019), a key indicator is classroom observation, where the educator can demonstrate how the training positively impacted the dynamics of the classroom, promoting the active participation of students and effectively incorporating digital tools.

Quantitative metrics also play a vital role in assessing the effectiveness of training. This can include technology utilization rates, student academic performance, retention rates, and other measurable indicators. In addition, collecting feedback from students on the integration of technology into their learning experiences provides a valuable perspective on the perceived effectiveness of the training by key stakeholders, the students themselves.

A holistic assessment approach should consider not only the immediate results but also the ongoing development of the educator over time. These include adaptability to technological changes, the ability to innovate in pedagogical practices, and the long-term impact on preparing students for a digital world (ESPÍNDOLA *et al.* 2020). Continuous evaluation, through regular feedback and periodic analysis, creates a cycle of constant improvement that is essential in a technologically dynamic environment.

Additionally, it is critical to consider the specific needs of different educational contexts when evaluating the effectiveness of technology training. Urban, rural, public, and private schools may

have distinct requirements, and success metrics should be tailored to reflect these nuances. A tailored approach to assessment takes into account the diversity of educational contexts, ensuring that training is truly effective in different settings.

The evaluation of the effectiveness of technology training is not an end in itself, but rather a means to continuously improve the professional development strategies of educators (CRUZ *et al.* 2023). By taking a comprehensive and adaptive approach to measuring the impact of training, one can build a solid path towards a sustainable and meaningful educational transformation.

BARRIERS AND OVERCOMING STRATEGIES

The integration of technologies in education, while full of promise, faces a number of barriers that require robust strategies to overcome. A common barrier is resistance to change on the part of educators. Familiarity with traditional teaching methods often results in hesitancy to adopt new technologies (SILVA, 2023). Overcoming this barrier requires not only technical training, but also the creation of an organizational culture that fosters an open-mindedness to innovation, recognizing that technology is an ally, not a threat.

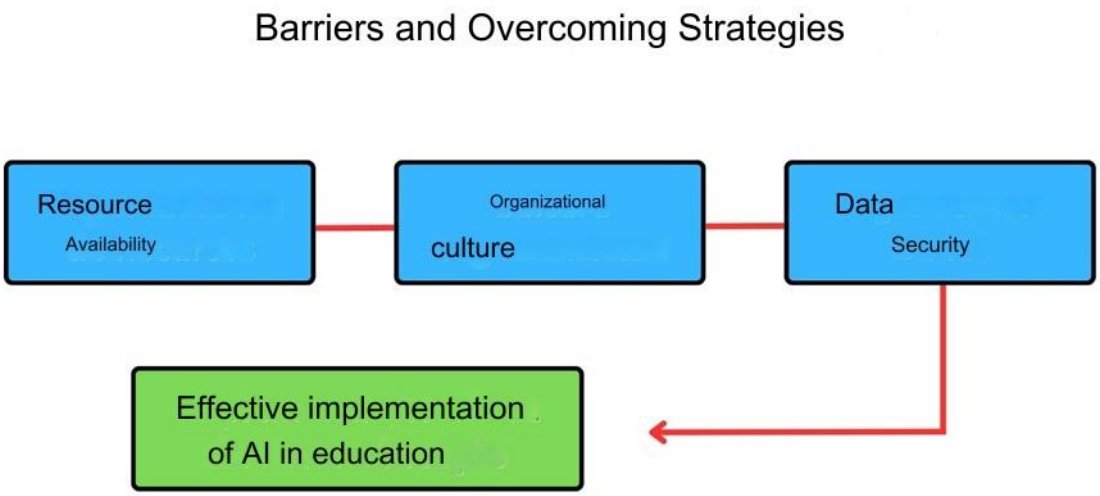
Lack of adequate resources is another significant barrier. Many schools, especially those in disadvantaged areas, may not have access to modern hardware, reliable internet connectivity, or advanced educational software. Strategies to overcome this barrier may include partnering with organizations, seeking external funding, and utilizing more affordable technologies, such as mobile devices, which can circumvent some infrastructure limitations.

Data privacy and security concerns pose a substantial ethical challenge. In this regard, Júnior et al (2023) state that educators and educational institutions must ensure that student information is protected from unauthorized access and misuse. Strategies to overcome these concerns include implementing stringent data security policies, seeking technology solutions with high encryption standards, and continuously educating educators on data protection best practices.

Lack of proper training is a barrier that can compromise the effectiveness of technology integration. Coping strategies include continuing professional development programs that not only offer technical training but also highlight the pedagogical benefits of technology. Mentorships between experienced and novice educators can also play a crucial role in facilitating the transfer of practical knowledge.

Another notable barrier is the lack of alignment between technologies and educational goals. Coping strategies involve a careful selection of tools and platforms that are aligned with learning objectives, avoiding the adoption of technologies just for the sake of their novelty. A strategic approach to technology integration, with a clear focus on educational goals, is key to overcoming this barrier and ensuring that technology is an effective enabler of learning (ALVES, 2014).

Figure 2. Flowchart with the steps to overcome for an effective and adequate implementation of Artificial Intelligence in the educational field.



Source: Authors.

FINAL THOUGHTS AND FUTURE PERSPECTIVES

At the end of this discussion on the training of teachers for the use of technology, it is evident that society is facing an exciting and challenging crossroads in education. The digital revolution is shaping the contours of teaching and learning in unimaginable ways, and teacher education emerges as the compass that guides educators through these turbulent waters. However, for this journey to be truly transformative, it is imperative not only to overcome existing barriers, but also to anticipate and adapt to future technological changes.

The future of teacher training for technology demands a proactive and innovative approach. The rapid evolution of artificial intelligence, virtual reality, data analytics, and other emerging technologies will open up new pedagogical possibilities. Therefore, training strategies need to be dynamic and flexible, preparing educators to constantly embrace and integrate new tools that enrich the educational experience.

Moreover, ethical considerations must remain at the heart of these developments. As we explore the frontiers of artificial intelligence in education, it is crucial to establish robust ethical guidelines to ensure that the transformative power of technology is used in a fair, inclusive, and respectful manner. Ongoing dialogue between educators, researchers, policymakers, and technology developers is essential to creating an ethical and sustainable education ecosystem.

Finally, it is clear that training teachers for technology is not a final destination, but an ongoing journey. By engaging with this innovation, one can promote ethics and adaptation to change, shaping not only the future of educators but, more importantly, the future of learning for generations to come.

REFERENCES

1. Afonso, G. B., Martins, C. C., Katerberg, L. P., Becker, T. M., Santos, V. C., & Afonso, Y. B. (2020). Potencialidades e fragilidades da realidade virtual imersiva na educação. *Revista Intersaberes, 15*(34).

2. Alves, S. R. (2014). *Tecnologia Educacional* (1ª ed.). Editoração Eletrônica: Sérgio Alves.

3. Boulay, B. du. (2023). Inteligência artificial na educação e ética. *Revista de Educação a Distância e eLearning, 6*(1).

4. Cruz, K. R., Toledo, R. da S., Oliveira, A. S., Almeida, J. K. da S. T., Moreira, A. M., & Gandin, L. R. A. (2023). IA na sala de aula: como a Inteligência Artificial está redefinindo os métodos de ensino. *Rebena - Revista Brasileira De Ensino E Aprendizagem, 7*, 19–25.

5. Cruzeiro, M., Andrade, A., & Machado, J. (2019). Formação de professores e utilização das tecnologias digitais na escola. *Revista Portuguesa de Investigação Educacional, (19)*, 281-307.

6. Deitos, F. N., & Aragón, R. (2021). O processo de alfabetização com o uso das tecnologias digitais: uma revisão sistemática. In *27º Workshop de Informática na Escola (WIE)* (pp. 275-286). Porto Alegre: Sociedade Brasileira de Computação.

7. Espíndola, M. B., Cerny, R. Z., & Xavier, R. S. (2020). As perspectivas de tecnologia dos educadores em formação: valores em disputa. *Revista Eletrônica de Educação, 14*, 1-17.

8. Fava, R. (2018). *Trabalho, Educação e Inteligência Artificial: a era do indivíduo versátil* (1ª ed.). Editora: Penso.

9. Grandez, G. del P. Q., & Correa, R. G. V. (2022). Alfabetização Digital: conhecimento essencial para ensinar durante a pandemia. *Horizontes Revista de Investigación en Ciencias de la Educación, 6*(25), 1606-1614.

10. Duque, R. de C. S., et al. (2023). IA na formação docente: era digital SIM. (1ª ed.). Editora: Amplamente Cursos e Formação Continuada.

11. Duque, R. de C. S., Turra, M., dos Santos, A. A., et al. (2023). Formação de professores e a Inteligência Artificial: desafios e perspectivas. *Contribuciones a las Ciencias Sociales, 16*(7), 6864–6878.

12. Lima-Lopes, R. E., Câmara, M. T., & Oliveira, M. L. T. (2021). Reflexões sobre formação de professores, linguagem e tecnologias. *Comunicação & Educação, 26*(1), 179-191.

13. Silva, A. e S., & Silva, K. C. (2020). Alfabetização e letramento tecnológicos do professor: potencialidades e desafios. *Revista Atos de Pesquisa em Educação, 15*(1), 226-253.

14. Silva, C. B. (2019). Tecnologias educacionais: inovação e formação de docentes. *Temas em Educação e Saúde, 15*(1), 169–174.

15. Silva, V. L. (2023). Ética e responsabilidade na era da inteligência artificial: aprendizagem digital no chat GPT. *Trabalho de Conclusão de Curso (Especialista em Mídia e Educação)*, Universidade Federal do Pampa.

16. Zuin, V. G., & Zuin, A. Á. S. (2011). Professores, tecnologias digitais e a distração concentrada. *Educar em Revista, (42)*, 213-228.