https://doi.org/10.36315/2025v1end076
Education and New Developments 2025

ARTIFICIAL INTELLIGENCE IN TEACHER TRAINING: BENEFITS, CHALLENGES AND TOOLS

Bruno F. Gonçalves
CITED, Polytechnic Institute of Bragança (Portugal)

Abstract

The use of artificial intelligence has emerged as an important tool for teacher training, providing new approaches to the development of pedagogical skills, classroom management, and the personalization of teaching. This research aims to identify the most relevant AI tools for teacher training and to examine the benefits and challenges of integrating AI into teacher training, with a focus on the advantages of personalizing teaching and the difficulties associated with adopting new technologies in the educational context. The methodology used is a literature review, in which studies, scientific articles, and reports on the application of AI in teacher training are analyzed to identify the technological tools available for teaching. The results suggest that AI has enormous potential to transform teacher training, offering tools that make it possible to personalize the training process, adapting it to teachers' needs and learning styles. However, the implementation of these tools faces challenges such as the need for ongoing teacher training, resistance to adopting new technologies, and the lack of technological infrastructure in some educational institutions.

Keywords: *Artificial intelligence, digital technologies, essential tools, teachers, teaching training.*

1. Introduction

The use of AI in teacher training makes it possible not only to personalize the training process, adapting it to teachers' learning styles and rhythms, but also to offer resources that enhance the development of pedagogical skills in line with the demands of contemporary education. In addition, AI technologies can provide real-time feedback, automate administrative tasks, and promote greater interaction between teachers and students. However, the implementation of these tools faces major challenges, such as resistance to adopting new technologies, the need for ongoing teacher training, and limited technological resources in some educational institutions.

This research aims to identify the benefits and challenges of integrating AI into teacher training, focusing on the advantages of personalizing teaching and the difficulties associated with adopting new technologies in the educational context. In addition, it seeks to identify the most relevant AI tools currently available to support teacher training.

Studying these two objectives in conjunction is essential to gain a comprehensive understanding of the current and potential role of AI in the professional development of teachers. While identifying the tools allows us to map the practical resources that can enhance training processes, analyzing the associated benefits and challenges offers a critical perspective on their real impact and feasibility in diverse educational settings. This dual approach not only highlights the opportunities for innovation and improvement in teacher education but also informs decision-makers and educators about the structural, pedagogical, and ethical conditions necessary for successful AI integration.

To achieve this objective, the article is organized as follows: the first section presents the literature review on the use of AI in education and teacher training; then the methodology adopted to carry out the research is described; subsequently, the main results obtained from the analysis of the selected studies are discussed; finally, the conclusions are presented, highlighting the practical implications and suggestions for future research.

2. Literature

The research was carried out through a literature review with the aim of identifying the main benefits of integrating AI into teacher training. Amorim et al., (2023) Highlight several advantages, such

as more effective planning, implementation, and evaluation, the development of critical and ethical skills, curriculum reformulation, the adoption of transversal practices in AI governance, innovation in assessment models, and the automation of teaching management processes. These aspects reinforce the importance of seeing AI as an instrument for transforming teacher training.

The personalization of learning, the expansion of teachers' skills, and the creation of more dynamic and adapted educational experiences are also pointed out as relevant benefits. AI makes it possible to adapt teaching to students' needs, support the analysis of educational data, and collaborate in the construction of richer pedagogical experiences (Duque, Monteiro, et al., 2023).

According to Duque et al., (2023)AI, AI contributes to the development of teaching skills, the personalization of teaching, and the promotion of innovation in pedagogical practice. Similarly, Oliveira (2023) states that AI supports the personalization of teaching, the analysis of educational data, and the automation of administrative tasks, optimizing teachers' time for planning and individual support for students.

Santos (2023) adds that AI provides pedagogical and technological support, promotes innovative learning environments such as gamification and the use of videos, and contributes to a more fluid and personalized educational experience. Cardona et al. (2023) Highlight the importance of AI in creating personalized educational systems, assessing student performance, collaboration between teachers, and promoting AI literacy.

Oliveira (2023) reinforces the role of AI in data analysis, objective assessment, and support for students outside of school hours, as well as the automation of routine tasks, reducing bureaucracy and optimizing processes. Mahendran Maniam (2023) argues that AI makes it possible to personalize teacher training, simulate real-life scenarios, make data-driven decisions, and prepare for an AI-driven world.

Salas-Pilco et al., (2022) Highlight the possibility of visualizing behaviour, predicting dropouts, supporting self-study, and assessing teaching skills with intelligent systems. Tammets & Ley (2023) State that AI can help teachers better understand what is happening in the classroom, promoting real-time adjustments and evidence-based decisions.

Gunawan et al. (2021) highlight AI's contribution to lesson planning, real-time feedback, and improving teaching practices. Jamal (2023) Adds that AI facilitates access to quality resources, promotes continuous professional development, and provides personalized feedback.

Kusmawan (2023) Mentions that AI democratizes access to training, enables simulated practice with avatars, and provides real-time data to improve teaching performance. Ruizhe et al. (2023) point out that AI contributes to more effective and up-to-date teaching methods.

Al-Zyoud (2020) Adds the development of AI-based educational software, the creation of training paths, integrated educational databases, and support for career advancement. Tunjera & Chigona (2023) Reinforce that AI can improve equal access to education, personalize educational content, and promote technological skills in teachers, while also highlighting the importance of collaboration between all educational agents.

Finally, Wu et al. (2023) state that AI can improve the quality of teaching, combine technology with traditional methods, and reduce the costs associated with teacher preparation.

After presenting the benefits of AI in teacher training, it is equally essential to consider the main challenges that this integration still faces. The evidence available in recent literature points to a series of technical, pedagogical, institutional, and ethical obstacles that need to be overcome if the potential of AI in education is to be realized effectively.

One of the central challenges is teachers' resistance and lack of motivation to incorporate AI into their pedagogical practices. This reluctance is generally related to fear of professional substitution, technical insecurity in handling the tools, and a perceived increase in workload (Guimaraes et al., 2025; Júnior et al., 2025; Veras et al., 2024).

In addition, there is a general lack of technical and pedagogical training for teachers. Most teachers do not have adequate training to operate AI tools, interpret the data generated by algorithms or adapt their teaching methodologies to the use of these technologies. The rapid evolution of AI intensifies this gap, especially when educational institutions do not offer continuous and up-to-date training programs (Santos & Silva, 2024; Guimaraes et al., 2025; Júnior et al., 2025).

Another significant obstacle concerns limited infrastructure. The lack of appropriate technological resources, such as up-to-date equipment, stable connectivity, and adequate technical support, is a common obstacle, especially in less developed regions, considerably limiting the potential for applying AI in the educational context (Guimaraes et al., 2025; Júnior et al., 2025; Veras et al., 2024).

Added to these factors are ethical and social challenges, including concerns about the privacy of student data, the possible biases embedded in algorithms, and the risk of dehumanizing teaching processes. These issues require specific preparation for teachers so that they can use AI responsibly and critically (Guimaraes et al., 2025; Júnior et al., 2025; Veras et al., 2024).

The integration of AI also requires a profound pedagogical restructuring. Teachers need not only to master technological tools, but also to rethink their teaching strategies, adapting them to more dynamic and personalized models, which can lead to insecurity and professional overload (Ernandes et al., 2024)

Finally, there is a lack of robust public policies and consistent institutional support. The lack of educational guidelines that promote continuing training in AI and support the effective implementation of these technologies is an obstacle to their widespread adoption (Guimaraes et al., 2025; Grigorio, 2025).

Taken together, these challenges point to the urgent need for ongoing, contextualized, and motivating teacher training programs. These programs should cover both the technical, ethical, and pedagogical aspects of using AI, as well as being accompanied by investments in infrastructure and public policies that support the digital transformation in education.

3. Methodology

This research was conducted using a qualitative approach, focusing on a literature review, to identify and analyze the main scientific contributions related to the application of AI tools in teacher training. The choice of this methodology is justified by the need to understand, based on theoretical evidence, how AI has been used to support teacher professional development, as well as the benefits and challenges arising from its integration into educational processes.

To address the first objective — identifying the main benefits and challenges of integrating AI into teacher training — a literature search was conducted in recognized databases such as RCAP and Google Scholar. Keywords used included “artificial intelligence in teacher training”, “AI tools in education”, “educational technology”, and “teacher professional development”. Studies published between 2020 and 2025, in Portuguese or English, and directly addressing the use of AI-based technologies in the context of teacher training were selected for analysis. Papers that focused exclusively on AI use by students, lacked full-text access, were opinion-based, or did not present empirical data or a systematic review were excluded.

After the initial screening, the selected documents were subjected to a qualitative content analysis, seeking to identify not only the tools mentioned but also the application strategies described, the impacts reported on teaching practice, and the obstacles faced in adopting them in real teacher training contexts. This analysis made it possible to bring together a representative set of theoretical and practical contributions, providing a solid basis for discussing the results and for critical reflection on the role of AI in improving teacher education.

In order to achieve the second objective of the research - to identify AI tools aimed at teacher training - an exploratory web search was carried out. This stage consisted of consulting specialized websites, educational repositories, academic blogs, educational technology platforms, and institutional reports to map AI tools actually used or recommended for training contexts. The selection of tools took into account their applicability to teacher training, their functionalities (such as personalization of learning, analysis of educational data, simulation of pedagogical scenarios, and automation of tasks), and the clarity of the information provided by the developers or users themselves.

4. Results

4.1. Benefits and challenges of integrating AI into teacher training

The analysis of the literature reveals a consistent set of benefits provided by the integration of AI in teacher training. Of particular note is the possibility of improving the planning, implementation, and evaluation of teaching, as well as the personalization of learning, adapting methodologies and content to the profile and pace of students. AI supports the development of professional skills, including the analysis of educational data, the use of technological tools, and the adaptation of pedagogical practices to contemporary challenges. Other benefits include the automation of administrative tasks, the creation of innovative and immersive learning environments, such as gamification and the use of intelligent tutors, and the simulation of classroom scenarios for practical training. AI also favors equitable access to quality training, especially in remote contexts or with fewer resources, and promotes collaboration between teachers by sharing practices and resources. In addition, it contributes to efficiency and innovation in the training process, offers real-time feedback, and allows for more informed pedagogical decisions. The results point to the great potential of AI to transform teacher training, making it more personalized, effective, data-driven, and aligned with the demands of a constantly evolving education system.

Although the integration of AI into teacher training brings significant benefits, such as the modernization of pedagogical practices and the development of critical and ethical skills, it still faces a number of challenges. Among the main obstacles identified are teachers' resistance and lack of motivation, lack of technical and pedagogical training, limited technological infrastructure, ethical and social concerns, the need for pedagogical restructuring, and the absence of consistent public policies. These factors point to the urgency of continuous, contextualized training programs accompanied by investments in infrastructure and institutional support to ensure the effective and ethical adoption of AI in education.

4.2. IA tools for the teacher training

AI is transforming teacher training by offering tools that facilitate everything from lesson planning to personalizing teaching and automating administrative tasks. Below are some of the main categories and examples of tools that can be used to train teachers and improve their professional practice.

- Content planning and creation: Tools such as TeachMate AI, Eduaide.Ai, TeacherMatic, Teachy, Canva, Genially, and Adobe Express make it easier to plan lessons and create personalized, visual, and interactive materials. Platforms such as Curipod and Eureca help to create dynamic and gamified lessons, while apps such as NotebookKLM and Napkin practically organize ideas.
- Automated assessment and feedback: Solutions such as Gradescope, Quizizz, Classcraft, and Diffit.me automate corrections, transform assessments into games, and offer personalized feedback. Tools such as Cognii generate automatic questions and answers, streamlining the teacher's work and promoting fairer and more inclusive assessments.
- Personalization of teaching and monitoring: Platforms such as CENTURY Tech, Carnegie Learning, SchoolAI, and Eureca adapt content and learning paths to the pace of each student, facilitating progress monitoring and promoting more efficient pedagogical interventions. Classcraft also uses gamification to motivate and monitor student performance.
- Writing, research, and communication assistants: Tools such as ChatGPT, Gemini, Perplexity, Mettzer, and Grammarly assist in the production and revision of texts, in addition to facilitating research. Solutions such as Otter.ai, Speechify, and Dragon Speech Recognition improve accessibility through transcription and text-to-audio conversion, benefiting teachers and students with special needs.

The results show that AI is transforming teacher education by facilitating planning, personalizing teaching, and automating tasks. These tools increase efficiency and inclusion, offering a variety of resources that meet current education needs. To harness the full potential of AI, it is essential to invest in teacher training and adequate infrastructure, ensuring more innovative and effective pedagogical practices.

5. Conclusions

The integration of AI into teacher training has proven to be a revolution in the educational process, providing significant advances in planning, personalizing teaching, and automating administrative tasks. AI tools facilitate the creation of personalized teaching content, automated assessments, efficient monitoring of student progress, and support in the production and review of texts. In addition, they promote innovative learning environments, such as gamification and simulations, and expand equitable access to training, especially in remote regions or those with limited resources. These resources contribute to the modernization of pedagogical practices, making training more effective, inclusive, and aligned with contemporary educational needs.

On the other hand, the full adoption of these technologies faces significant challenges, such as teacher resistance, lack of adequate technical and pedagogical training, limitations in technological infrastructure, and ethical and social concerns related to the use of AI. To overcome these obstacles, it is essential to invest in ongoing training, robust infrastructure, and consistent public policies that support the ethical and effective implementation of these tools. This will make it possible to harness the full potential of AI to transform teacher training, promoting innovative, collaborative, and student-centered pedagogical practices, prepared for the challenges of a constantly evolving educational system.

Acknowledgments

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the Project Scope: UIDB/05777/2020 (https://doi.org/10.54499/UIDB/05777/2020).

References

Al-Zyoud, H. M. M. (2020). The role of artificial intelligence in teacher professional development. *Universal Journal of Educational Research*, *8*(11B), 6263-6272.

Amorim, A., Bandeira, J., & Florencio, P. J. (2023). *Formação docente e Inteligência Artificial*.

Cardona, M. A., Rodríguez, R. J., & Ishmael, K. (2023). *Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations*.

da Cruz Santos, M. F., & da Silva, C. C. (2024). Inteligência artificial na formação docente: uma revisão da literatura. *Revista Educação e Cultura Contemporânea*, *21*, 11364.

Duque, R. de C. S., Monteiro, R. R., de Oliveira Filho, F. L. C., Loureiro, V. J. S., Placido, R. L., da Silva, C. J., da Silva, J. M., Saraiva, M. do S. G., & de Brito Silva, A. M. (2023). Formação de professores para o uso de tecnologia: A Inteligência Artificial (IA) e os novos desafios da educação. *Caderno Pedagógico*, *20*(2), 838-852.

Duque, R. de C. S., Turra, M., dos Santos, A. A., Soares, L. G., Pascon, D. M., Dalla Bernardina, L., Peres, H. H. C., Barros, M. W. B., de Alencar Gomes, D. J. R., & Simões, G. S. (2023). Formação de professores e a Inteligência Artificial: desafios e perspectivas. *Contribuciones a las Ciencias Sociales*, *16*(7), 6864-6878.

Ernandes, I., de Lourdes Alves, D., dos Santos Vital, S. M., da Silva, J. G., da Cruz Chagas, J., Sousa, E. S., Fernandes, A. B. R., & Rodrigues, F. F. (2024). A integração da inteligência artificial na educação básica: desafios e estratégias para a formação continuada de professores. *Humanum Sciences*, *6*(1), 11-20.

Guimaraes Junior, J. C., Pinheiro, S. D., Santos , K. C. C. de L., Costa, H. C. de M., Sousa, A. R. de, Bitencourt, V. M. M., Andrade, F. D. de, & Grigorio, É. L. G. A. (2025). Desafios e oportunidades da formação docente para o uso de inteligência artificial na educação. *Contribuciones a las Ciencias Sociales*. https://doi.org/https://doi.org/10.55905/revconv.18n.1-029

Gunawan, K. D. H., Kaniawati, I., & Setiawan, W. (2021). The responses to artificial intelligence in teacher integrated science learning training program. *Journal of Physics: Conference Series*, *2098*(1), 12034.

Jamal, A. (2023). *The Role Of Artificial Intelligence (AI) In Teacher Education: Opportunities & Challenges*.

Júnior, J. F. C., da Mata Ribeiro, R., Oggione, G. B., Lins, P. P. M., de Albuquerque Machado, L. M. M., Rodrigues, M. O., do Nascimento, C. O. S., da Silva, M. M., Machado Filho, S. de J. L., & dos Santos, M. C. F. (2025). Docentes Na Era Da Inteligência Artificial: Competências E Desafios Na Educação Contemporânea. *Aracê*, *7*(2), 8815-8832.

Kusmawan, U. (2023). Redefining Teacher Training: The Promise of AI-Supported Teaching Practices. *Journal of Advances in Education and Philosophy*, *7*(9), 332-335.

Mahendran Maniam, D. K. (2023). A study on the need for ai integration in teacher education. *Journal of Research Administration*, *5*(2), 10332-10342.

Oliveira, E. A. dos S. (2023). Conhecimento Poderoso e Inteligência Artificial (IA): Aliando Didaticamente Tecnologias para Educabilidades. *Sisyphus: Journal of Education*, *11*(3), 31-45.

Rasul, T., Nair, S., Kalendra, D., Robin, M., Santini, F. O., Ladeira, W. J., Sun, M., Day, I., Rather, R. A., & Heathcote, L. (2023). The role of {ChatGPT} in higher education: {Benefits}, challenges, and future research directions. *Journal of Applied Learning and Teaching*, *6*(1), 41-56. https://doi.org/10.37074/jalt.2023.6.1.29

Ruizhe, W., Chen Jie, J., & Ahmad, A. (2023). The Opportunities and Challenges of Artificial Intelligence (AI) Application in Education: Literature Review. *International Journal of Multidisciplinary Research and Publications, 6(1), 1-5.*

Salas-Pilco, S. Z., Xiao, K., & Hu, X. (2022). Artificial intelligence and learning analytics in teacher education: A systematic review. *Education Sciences*, *12*(8), 569.

Santos, A. (2023). Desafios e Oportunidades da Inteligência Artificial na Educação e na Formação. *RE@ D-Revista de Educação a Distância e Elearning*, *6*(2), e202311-e202311.

Tammets, K., & Ley, T. (2023). Integrating AI tools in teacher professional learning: a conceptual model and illustrative case. *Frontiers in Artificial Intelligence*, *6*.

Tunjera, N., & Chigona, A. (2023). Investigating Effective Ways to Use Artificial Intelligence in Teacher Education. *European Conference on E-Learning*, *22*(1), 331-340.

Veras, W. A., Melo, L. C., da Silva, D. S., Sousa, S. D. A., Simão, M. V. O., & Serra, A. R. C. (2024). Conectando Saberes: Desafios e Oportunidades da Inteligência Artificial na Educação do Século XXI. *Revista JRG de Estudos Acadêmicos*, *7*(17), e171430-e171430.

Wu, W., Burdina, G., & Gura, A. (2023). Use of Artificial Intelligence in Teacher Training. *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT)*, *18*(1), 1-15.