Educator Insights: A Journal of Teaching Theory and Practice
Volume 1, Issue 12, December 2025
brightmindpublishing.com
ISSN (E): 3061-6964


# ARTIFICIAL INTELLIGENCE AS A TOOL IN TEACHER TRAINING: A LITERATURE REVIEW

F. B. Khudaykulova
Teacher, Faculty of Preschool and Primary Education
Chirchik State Pedagogical University
https://orcid.org/0000-0002-0220-626X

**Abstract**
This article examines the use of artificial intelligence (AI) technologies in the process of professional teacher training. The study is presented in the form of a critical analysis of international scientific literature, based on the works of seven major researchers. It thoroughly explores the current state of AI in education, its opportunities and challenges in teacher training. The results of the study indicate that artificial intelligence can serve as an effective tool for personalizing education, implementing differentiated instruction, and enhancing professional competence. However, ethical issues, data privacy, and the need to improve digital literacy among teaching staff remain pressing challenges.

**Keywords**: Artificial intelligence, teacher training, AI in education, pedagogical competence, professional development, AI literacy.

## Introduction

In the 21st century, artificial intelligence (AI) technologies are increasingly permeating all spheres of socio-economic life. This trend is also clearly evident in the field of education, where intelligent tutoring systems, automated assessment tools, personalized learning platforms, and AI-based analytics systems are being widely implemented.

However, one of the main actors in this process-the teacher-is often not sufficiently addressed in research. The extent to which teacher education institutions and professional development programs integrate AI tools, as well as the effectiveness of this integration and the challenges encountered, remains insufficiently explored.

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The aim of this article is to conduct a systematic review of existing international scientific literature on the use of AI as a tool in teacher education, to analyze the works of leading researchers, and to identify current challenges in the field.
As a methodological approach, seven studies published between 2018 and 2025 in reputable scientific journals were systematically analyzed. The literature was retrieved from Scopus, Web of Science, and ERIC databases. Selection criteria included citation frequency, methodological rigor, and thematic relevance.

## 2. LITERATURE REVIEW

2.1. Rosemary Luckin (2018) In her work "Machine Learning and Human Intelligence: The Future of Education for the 21st Century", Rosemary Luckin provides a comprehensive theoretical analysis of the relationship between artificial and human intelligence in education.
She emphasizes the emotional, creative, and social dimensions of human intelligence and highlights that AI is superior only in narrow, data-driven tasks. She recommends integrating an "intelligence model" into teacher education systems and argues that teachers should guide learners not merely through technology, but through technology-enhanced learning.
According to Luckin, effective integration of AI in education requires a deep understanding of human intelligence. Teacher education institutions should develop not only technological skills but also critical thinking, metacognitive literacy, and "AI collaboration" competencies.
2.2. Holmes and Tuomi (2022) In their article published in the European Journal of Education, Holmes and Tuomi conduct a systematic analysis of existing AI systems in education.
They categorize AI tools into intelligent tutoring systems, adaptive learning platforms, automated assessment tools, and analytics systems. The authors emphasize that most AI educational technologies are detached from pedagogical theory and focus primarily on technical efficiency.
This poses a significant challenge for teacher education programs, as future teachers may not be able to critically evaluate AI tools due to insufficient pedagogical and technological integration. The authors also highlight ethical issues such as algorithmic bias and data privacy and stress the importance of ethical literacy in teacher training programs.

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2.3. Zawacki-Richter et al. (2019) In their systematic review of 146 studies published between 2007 and 2018, the authors found a concerning result: only 6% of the studies were conducted by researchers in teacher education institutions. The remaining studies were mainly produced by computer science specialists, with minimal consideration of pedagogical and ethical issues. This indicates that teacher education institutions are largely excluded from AI-related research and development processes.

The authors identify personalized learning, intelligent tutoring systems, and analytics tools as the main trends in AI in higher education, but emphasize the lack of pedagogical grounding in their integration into teacher training systems.

2.4. Frontiers in Education (2024) - Study 1 This systematic review identifies major challenges in training teachers to use AI tools. The most significant barrier is low motivation, as many teachers do not perceive AI as beneficial to their work. Other challenges include insufficient AI literacy, lack of institutional guidance, and the absence of culturally and contextually adapted training programs. The authors recommend training programs that integrate theory and practice in safe, experimental environments.

2.5. Frontiers in Education (2024) - Pre-service teachers

This study investigates how pre-service teachers perceive AI tools in higher education. The results show that future teachers mainly view AI as a tool for overcoming language barriers and facilitating knowledge acquisition.

However, their AI literacy-particularly critical and responsible use of AI-is underdeveloped. Based on Long and Magerko (2020), the study operationalizes the concept of AI literacy and emphasizes its inclusion as a mandatory component of teacher education programs.

2.6. . Computers and Education: Artificial Intelligence (2024)

This comprehensive systematic review analyzes the role of AI in teaching and teacher professional development.

It finds that generative AI tools such as ChatGPT can assist teachers in lesson planning and material development. However, integration into pre-service teacher training remains insufficiently explored.

While teachers can save time and focus more on student interaction, gaps remain in the depth and continuity of AI-related competencies.

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## 3. COMPARATIVE ANALYSIS AND DISCUSSION

A comparative analysis of the seven studies reveals several common trends.

First, all authors acknowledge the significant potential of AI in teacher education, although its practical implementation remains limited. Zawacki-Richter et al. (2019) highlight that only 6% of studies involve teacher education specialists, a trend confirmed by later studies.

Second, Luckin (2018) and Holmes & Tuomi (2022) emphasize that AI should not replace human intelligence but rather enhance it. Teachers remain central actors in the educational process.

Third, ethical issues are consistently emphasized, including algorithmic bias, data privacy, and the risk of over-reliance on AI systems. Ethical literacy must therefore be an integral part of teacher education programs.

Fourth, experimental training programs have proven effective but their large-scale implementation requires institutional support, funding, and qualified personnel.

## 4. CONCLUSIONS AND RECOMMENDATIONS

The literature review leads to the following conclusions:

1. Artificial intelligence is a powerful tool for teacher training and professional development, but its potential is not yet fully realized.
2. Teacher education institutions must become active participants in AI-related research.
3. AI literacy should be an essential component of teacher education programs, encompassing technical, critical, ethical, and pedagogical competencies.
4. Practice-oriented and expert-guided training programs in safe environments significantly improve teachers' AI competence.
5. For Uzbekistan, it is recommended to develop a national policy for integrating AI into teacher education programs and to introduce AI literacy modules in higher education institutions.

Future research should focus on empirical studies of AI integration in teacher education in Uzbekistan, the development of national AI literacy assessment tools, and pilot projects on AI-based personalized learning models.

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