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PREPARING FUTURE PRIMARY SCHOOL TEACHERS TO USE ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN THE PROCESS OF EDUCATION DIGITALIZATION

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Abstract
The digital transformation of the education system is fundamentally changing the content and structure of pedagogical activity. In particular, the development of artificial intelligence (AI) technologies expands opportunities for personalized learning, analytical evaluation of the educational process, and automation of learning activities. This article analyzes the theoretical and methodological foundations for preparing future primary school teachers to effectively use artificial intelligence technologies in the context of education digitalization. The study presents a comparative analysis of international scientific literature and identifies the main pedagogical mechanisms for the use of artificial intelligence technologies in teacher education. In addition, a methodological approach based on the AI-TPACK model aimed at developing the digital pedagogical competencies of future teachers is proposed.

Keywords: Artificial intelligence, digital education, pedagogical competence, AI-TPACK model, education digitalization, primary education.

Introduction

In the 21st century, global technological development processes are accelerating the modernization of the education system. Digital technologies, especially artificial intelligence tools, significantly influence the organization of the educational process, the content of pedagogical activity, and the management of learning processes. Artificial intelligence technologies enable the creation of individualized learning environments, analytical analysis of the educational process, and prediction of students' learning outcomes [8].

According to reports published by UNESCO, generative artificial intelligence technologies are considered an important factor that brings innovative changes to education systems [9]. OECD experts emphasize that the development of artificial intelligence technologies requires reconsidering the professional role of teachers[10].

At the same time, the readiness of teachers to use artificial intelligence technologies within teacher education systems remains insufficiently developed. This issue is particularly relevant in the training of primary school teachers. The primary education stage plays an important role in developing students' digital literacy and forming the initial foundations of cognitive development.

Therefore, the current situation requires the development of scientific and methodological foundations for preparing future primary school teachers to effectively use artificial intelligence technologies.

The use of artificial intelligence in education has been widely studied in international scientific research in recent years. A systematic review conducted by Zawacki-Richter and colleagues shows that most studies on artificial intelligence in education focus mainly on technological aspects, while the role of teachers has not been sufficiently explored [2].

Celik developed the Intelligent-TPACK model, which identifies the system of knowledge required for teachers to effectively integrate artificial intelligence tools into education. This model is based on the integration of pedagogical knowledge, technological knowledge, and subject content knowledge [1].

Kasneci and colleagues analyzed the opportunities and challenges of generative artificial intelligence in education and emphasize that these technologies can significantly optimize the creation, analysis, and assessment of learning materials [3].

Selwyn argues that artificial intelligence technologies will not completely replace teachers but will transform their pedagogical roles and bring them to a new level [5].

Holmes and colleagues note that the integration of artificial intelligence in education expands opportunities for personalized learning and enables deeper analysis of students' learning processes [6].

Research in the field of learning analytics also indicates that artificial intelligence-based learning analytics allows more effective monitoring and analysis of students' learning activities [9; 10].

The research object of this study consisted of students studying in primary education programs at higher pedagogical education institutions.

The readiness of future teachers to use artificial intelligence technologies was evaluated based on the following competencies:

Technological competence – skills in using artificial intelligence tools;

Pedagogical competence – the ability to integrate artificial intelligence into teaching methodology;

Analytical competence – the ability to analyze the educational process;

Ethical competence – responsible and ethical use of artificial intelligence technologies.

The results of the study indicate that preparing future primary school teachers to use artificial intelligence technologies should be organized through the following stages:

Motivational stage – developing students' understanding of the importance of artificial intelligence technologies in education.

Theoretical stage – studying the pedagogical opportunities and didactic foundations of artificial intelligence technologies.

Practical stage – students develop lesson plans using artificial intelligence tools.

Reflective stage – analyzing the results of using artificial intelligence technologies in the educational process.

The results of the research correspond with international scientific findings. In particular, the Intelligent-TPACK model developed by Celik highlights the importance of integrating technological and pedagogical knowledge in teaching [1].

Similarly, the AI Competency Framework for Teachers developed by UNESCO emphasizes the importance of developing teachers' competencies in the use of artificial intelligence technologies [9].

In the context of the digital transformation of education, preparing future primary school teachers to effectively use artificial intelligence technologies becomes an important pedagogical challenge.

The research results lead to the following conclusions:

- integrating artificial intelligence technologies into teacher education contributes to the development of teachers' digital pedagogical competencies;
- the AI-TPACK model can serve as an effective methodological framework for preparing future teachers;
- the use of artificial intelligence technologies expands opportunities for individualization of the educational process.

In the future, the development of specialized educational modules on the use of artificial intelligence technologies in teacher education and the expansion of experimental research in this area will have significant scientific and practical importance.

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