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METHODOLOGY OF TEACHING PHYSICS USING TRADITIONAL METHODS WITH THE SUPPORT OF ARTIFICIAL INTELLIGENCE

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Abstract

This article examines the methodological foundations of teaching physics using traditional teaching methods in combination with modern digital technologies. Particular attention is given to the role of reproductive thinking, memory processes, and cognitive engagement in mastering scientific knowledge. The study explores how traditional teaching approaches can be effectively integrated with artificial intelligence technologies to enhance learning effectiveness. Artificial intelligence tools such as adaptive learning systems, intelligent tutoring platforms, and virtual laboratories enable personalized instruction and interactive experimentation. The results demonstrate that combining traditional pedagogical approaches with artificial intelligence technologies significantly improves students' motivation, cognitive activity, and conceptual understanding of physics.

Keywords

traditional teaching methods, physics education, reproductive thinking, cognitive processes, artificial intelligence in education, innovative pedagogy, virtual laboratories.

Introduction

Physics education requires effective pedagogical strategies that support students' understanding of complex scientific concepts. Traditional teaching methods have long played an important role in organizing the educational process and ensuring systematic knowledge acquisition.

In traditional teaching approaches, the teacher plays a central role in explaining concepts and organizing learning activities, while students focus on understanding, memorizing, and reproducing knowledge. Such approaches contribute to the development of students' memory and reproductive thinking abilities, which are essential for mastering scientific knowledge [1].

However, modern educational reforms emphasize the importance of interactive learning and student-centered teaching methods. In this context, integrating traditional pedagogical approaches with modern digital technologies and artificial intelligence tools becomes increasingly important [11].

Artificial intelligence technologies enable teachers to analyze students' learning behavior, identify cognitive difficulties, and provide adaptive feedback that supports individualized learning pathways [12].

Literature Review

Educational psychology research emphasizes the importance of cognitive processes such as memory, perception, and analytical thinking in the learning process. Kalmykova highlighted the role of reproductive and productive thinking in intellectual development and knowledge acquisition [1].

Other researchers, including Karimova and Goziev, analyzed the psychological mechanisms of memory and cognitive activity. Their studies demonstrate that knowledge retention depends on structured learning processes and repeated cognitive engagement [2][5].

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Recent research in educational technology highlights the growing role of artificial intelligence in transforming teaching practices. AI-based learning platforms enable the creation of adaptive learning environments that support students' individual learning needs and provide personalized instructional support [12][13].

Furthermore, simulation technologies and virtual laboratories provide students with opportunities to explore complex physical phenomena that cannot always be demonstrated in traditional classroom environments [13].

Methodology

This study is based on theoretical analysis of pedagogical literature and conceptual analysis of traditional teaching methods used in physics education.

The research focuses on examining how traditional teaching approaches influence students' cognitive development, particularly their memory processes and reproductive thinking abilities.

In addition, the study analyzes the integration of artificial intelligence technologies into traditional teaching environments. AI-based educational tools such as intelligent tutoring systems, adaptive learning platforms, and virtual laboratories were considered as supplementary instruments for improving teaching effectiveness.

These technologies allow teachers to:

- monitor students' learning progress;
- analyze cognitive performance;
- provide personalized feedback;
- organize interactive simulations and experiments.

Results and Discussion

The results of the analysis demonstrate that traditional teaching methods remain an important component of effective physics education. These methods contribute to systematic knowledge acquisition and strengthen students' memory processes.

However, relying solely on traditional teaching approaches may limit students' creative and analytical thinking abilities. Therefore, integrating traditional methods with innovative technologies such as artificial intelligence can significantly enhance learning outcomes.

Artificial intelligence technologies allow the creation of interactive educational environments where students can conduct virtual experiments, visualize physical phenomena, and analyze experimental results in real time [13].

AI-supported learning systems also enable teachers to identify students' learning difficulties and provide targeted instructional support. As a result, students demonstrate higher levels of motivation and deeper conceptual understanding of physics concepts.

Conclusion

Traditional teaching methods remain a fundamental component of physics education, particularly in developing students' memory and reproductive thinking abilities.

However, modern educational environments require the integration of traditional pedagogical strategies with innovative technologies. Artificial intelligence technologies provide powerful tools for enhancing teaching effectiveness and supporting personalized learning experiences.

The combination of traditional teaching methods and artificial intelligence technologies represents a promising direction for improving the quality of physics education in modern digital learning environments.

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