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STUDENTS' CREATIVE LEARNING IN TEACHING PHYSICS USING THE PRODUCTIVE METHOD WITH THE SUPPORT OF ARTIFICIAL INTELLIGENCE

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ABSTRACT

This study examines the didactic foundations of students' creative learning in physics education through the application of the productive teaching method supported by artificial intelligence technologies. The research analyzes how innovative pedagogical approaches contribute to the development of students' independent thinking, problem-solving abilities, and cognitive engagement. Particular attention is given to the role of motivation in stimulating students' learning activity and academic achievement. Artificial intelligence tools such as adaptive learning platforms, intelligent tutoring systems, and virtual laboratories provide opportunities for personalized learning and interactive experimentation. The findings indicate that the integration of productive teaching methods with artificial intelligence technologies significantly enhances students' creative thinking, learning motivation, and conceptual understanding of physics.

Keywords

productive method, physics education, creative learning, artificial intelligence in education, learning motivation, innovative pedagogy, digital learning environments.

Introduction

Modern educational systems aim to develop students' creative thinking, analytical reasoning, and independent learning abilities. Traditional teaching approaches that emphasize memorization and passive knowledge acquisition are gradually being replaced by more student-centered and inquiry-based learning models.

One of the most effective pedagogical strategies for developing creative thinking is the productive teaching method. This approach encourages students to actively participate in the learning process by analyzing problems, proposing solutions, and applying theoretical knowledge to practical situations [7].

Physics education requires teaching strategies that promote conceptual understanding, analytical reasoning, and experimental thinking. The productive teaching method allows students to move beyond passive learning and engage in active exploration of scientific phenomena.

The rapid development of digital technologies and artificial intelligence has also created new opportunities for improving educational effectiveness. Artificial intelligence systems can analyze learning data, provide adaptive feedback, and support personalized learning pathways for students [9].

Literature Review

Educational psychology research highlights the importance of motivation and cognitive engagement in effective learning processes. McClelland's theory of achievement motivation

explains that individuals are driven by the desire to achieve success and avoid failure [4].

Similarly, Atkinson and Heckhausen investigated how motivational factors influence students' academic behavior and persistence in solving complex learning tasks [5][6].

Recent studies emphasize the role of artificial intelligence in education. AI-based learning environments enable educators to create adaptive instructional systems that respond to students' learning needs and support individualized learning strategies [10].

Furthermore, simulation technologies and virtual laboratories provide students with opportunities to explore complex physical processes that may be difficult to demonstrate in traditional classroom settings [11].

Methodology

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

The study examines how productive learning approaches influence students' creative learning processes, cognitive engagement, and motivation.

Artificial intelligence technologies such as intelligent tutoring systems, adaptive learning platforms, and virtual laboratories were analyzed as supportive tools for organizing modern learning environments.

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 the productive teaching method significantly enhances students' creative learning abilities in physics education.

Students become active participants in the learning process, engaging in analytical thinking, collaborative learning, and scientific inquiry activities. Motivation plays a crucial role in determining students' academic success.

Students who are motivated to achieve academic success demonstrate greater persistence, deeper cognitive engagement, and stronger interest in scientific subjects [4].

The integration of artificial intelligence technologies further enhances the effectiveness of productive teaching methods. AI-supported learning platforms enable teachers to identify students' learning difficulties and provide adaptive instructional support [10].

Virtual laboratories and simulation technologies are particularly valuable in physics education because they allow students to visualize physical phenomena and conduct experiments in safe digital environments. Through these technologies, students develop research skills and deeper conceptual understanding of scientific principles [11].

Conclusion

The productive teaching method represents an effective pedagogical approach for developing students' creative learning abilities in physics education.

The integration of artificial intelligence technologies into the educational process enhances teaching effectiveness by providing adaptive learning environments and interactive experimental opportunities.

Therefore, combining productive pedagogy with artificial intelligence technologies represents a promising direction for improving the quality of physics education in modern digital learning environments.

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