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ISSUES OF DEVELOPMENT AND MANAGEMENT OF METHODOLOGY OF
TEACHING PHYSICS IN GENERAL SCHOOLS BASED ON ARTIFICIAL
INTELLIGENCE

Allaniyazova Bibigul Sarsenbay qizi

allaniyazovabibigul@gmail.com

Independent researcher of Karakalpak State University

Annotation: This article examines the issues of effective management of the use of artificial intelligence technologies in the process of developing the methodology of teaching physics in general schools. The main goal of the study is to improve the methodological and management mechanisms for integrating educational tools based on artificial intelligence into the process of teaching physics. The study used literature analysis, pedagogical observation, comparison and empirical analysis methods. The results showed that the systematic and controlled use of artificial intelligence significantly increases the level of mastery of physical concepts and practical skills of students.

Keywords: physics education, artificial intelligence, teaching methodology, educational management, digital education.

Introduction

In the modern education system, improving the methodology of teaching natural sciences, in particular physics, is one of the important tasks. Since physics includes complex theoretical concepts, models and abstract processes, the need for innovative pedagogical approaches and the use of digital technologies in its teaching is increasing.

Artificial intelligence (AI) technologies allow the creation of virtual laboratories, adaptive learning systems, automated assessment and individual learning trajectories in teaching physics. However, the effective use of these technologies requires their proper methodological and organizational management.

Literature Review

The role of artificial intelligence in natural science education has been widely covered in international research. Woolf (2021) notes that AI-based systems allow for the visual and interactive learning of complex scientific concepts. Holmes et al. (2019) note that AI is an important factor in developing students' problem-solving skills in physics education.

The issues of using virtual laboratories and simulations in physics were analyzed in the studies of Zhang (2020) and Baker (2019). Although issues of digitization of physics education have been raised in domestic studies (Karimov, 2021; Rakhimov, 2022), insufficient attention has been paid to mechanisms for managing the use of AI. This study aims to fill this scientific gap.

Research methodology (Methods)

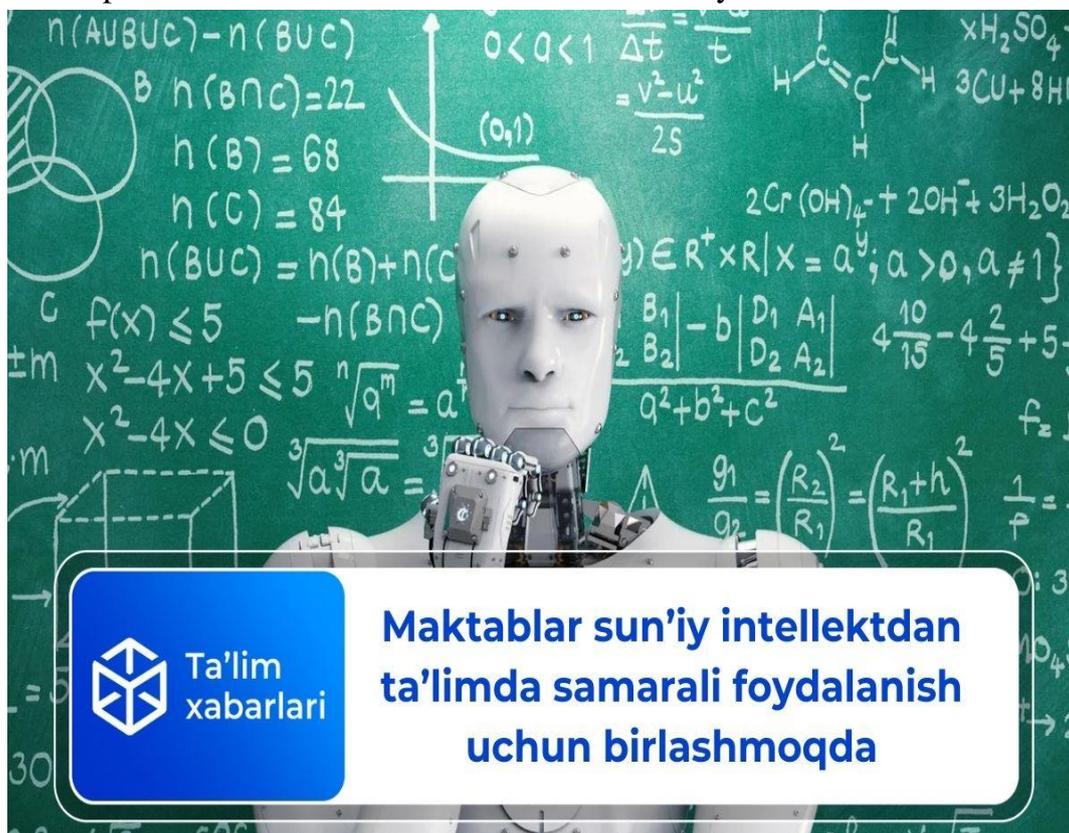


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The study was carried out based on the following methods:

- analysis of scientific and methodological literature;
- comparison of traditional and AI-based physics teaching methods;
- pedagogical observation;
- analysis of empirical data.

The experimental work was conducted in secondary school classes.



Results

According to the results of the study:

- simulations based on artificial intelligence facilitated the understanding of physical processes;
- students' problem-solving skills developed;
- the level of knowledge acquisition based on an individual approach increased;
- teachers' lesson planning and monitoring efficiency improved.

Discussion

The results of the study showed that the use of artificial intelligence technologies in teaching physics is not only a visual or technical aid, but also an important pedagogical management element that allows planning, managing and monitoring the educational process. Artificial intelligence-based systems serve to deepen students' conceptual understanding by modeling complex physical processes, conducting experiments in a virtual environment, and presenting abstract concepts in a clear and understandable form.

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The results obtained, consistent with international research, confirm the high efficiency of artificial intelligence in modeling physical processes in a dynamic, interactive and adaptive manner. In particular, with the help of virtual laboratories and simulations, students have the opportunity to safely, repeatedly and independently perform complex experiments. This is an important factor in connecting theoretical knowledge with practice.

During the discussion, it was found that the effectiveness of using artificial intelligence technologies largely depends on the teacher's methodological preparation, digital competence and the level of directing technology towards pedagogical goals. If artificial intelligence tools are used only as ready-made programs, without a clear didactic goal, their educational effectiveness will decrease significantly. Therefore, the process of using artificial intelligence should be carried out by the teacher on the basis of constant analysis, adaptation and reflection.

The results of the study also showed that organizing the use of artificial intelligence on the basis of a centralized and methodologically based management model ensures the consistency and stability of the educational process. Within the framework of such a model, the teacher can identify the individual needs of students, adjust educational strategies and systematically evaluate learning outcomes based on the information provided by artificial intelligence systems.

It was also found out during the discussion that ethical and psychological aspects are also important. In the process of using artificial intelligence in teaching physics, special attention should be paid to the issues of protecting students' personal data, not limiting their ability to think independently, and preventing excessive dependence on technology. In this regard, artificial intelligence technologies should not be considered as a complete replacement for the teacher, but as a tool supporting his pedagogical activities.

Diagram (Figure description)

Conclusion

In conclusion, improving the management of the use of artificial intelligence in the development of physics teaching methodologies in secondary schools is one of the important and strategic factors for improving the quality of education. The results of the study showed that the introduction of artificial intelligence-based technologies based on a systematic, targeted, and scientifically based management model helps students to deeply master physical concepts, understand complex processes, and combine theoretical knowledge with practical activities.

Also, the use of artificial intelligence in physics education allows for an individual approach, constant monitoring of students' mastery levels, and flexible organization of the educational process. This has a positive effect on the development of students' independent thinking, analysis, and problem-solving skills. The study found that artificial intelligence-



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based tools facilitate the teacher's pedagogical activities and increase the efficiency of lesson planning, assessment, and analysis processes.

However, the effectiveness of artificial intelligence technologies in education is closely related not to their direct application, but to their methodologically correct guidance and management. Therefore, in the process of using artificial intelligence, the leading role of the teacher should be preserved, and technologies should serve as a tool to support his pedagogical decisions.

In the future, it is advisable to widely introduce adaptive learning systems based on artificial intelligence in physics education, systematically develop teachers' digital and methodological competencies, as well as conduct additional research to strengthen the ethical, psychological and normative foundations for the use of artificial intelligence. Research in this area will contribute to the innovative development of physics education and a sustainable increase in the quality of education.

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