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TEACHING TECHNICAL SCIENCES USING ARTIFICIAL INTELLIGENCE AND INFORMATION TECHNOLOGIES: INNOVATIVE APPROACHES

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Abstract

This article explores innovative approaches to teaching technical sciences through the use of artificial intelligence (AI) and information technologies. It analyzes the potential of AI tools in optimizing modern educational processes, including remote and interactive learning platforms, as well as the creation of personalized learning pathways. The study highlights the advantages of employing technological solutions such as simulations, virtual laboratories, and data analytics to enhance teaching effectiveness. Additionally, the article provides recommendations for integrating AI and information technologies into the training of highly qualified specialists in technical fields.

Keywords

artificial intelligence, information technologies, technical sciences, innovative education, virtual laboratory, personalized learning.

INTRODUCTION

Nowadays, the role of artificial intelligence (AI) and information technologies (IT) in the education system is steadily increasing. In particular, in teaching technical subjects, these technologies make it possible to individualize the learning process, enhance interactivity, and significantly improve learning efficiency[1]. With the help of artificial intelligence, complex calculations, simulations, and automated assessment systems can be implemented, which helps develop students' practical skills[2].

Teaching technical sciences requires not only theoretical knowledge but also practical skills. Therefore, virtual laboratories, interactive 3D models, and

simulations make the learning process more effective. This article analyzes innovative approaches to applying artificial intelligence (AI) and information technologies (IT) in teaching technical subjects.

Firstly, artificial intelligence enables the analysis of students' knowledge levels and individual capabilities. Based on this analysis, AI can provide personalized exercises, additional resources, and tailored recommendations. For instance, when solving complex calculations or programming tasks, AI systems can detect students' errors and offer guidance for corrections. This allows learners to quickly and effectively improve their practical skills while learning from their mistakes.

Secondly, information technologies enhance the interactivity and engagement of the educational process. Virtual laboratories and simulations provide a safe environment where students can perform experiments and tasks without facing real-world hazards. For example, in mechanics, electrical engineering, or chemistry, complex processes can be observed and analyzed through 3D simulations. This helps consolidate theoretical knowledge with practical experience.

Thirdly, AI and IT reduce the workload of instructors. Tasks such as code evaluation, technical drawing analysis, or laboratory result assessment can be automated. Meanwhile, teachers can focus on monitoring the quality of the learning process and providing individualized support for complex topics.

Additionally, AI and IT facilitate collaboration and interactive learning among students. Online platforms allow for group projects, joint problem-solving exercises, and simulation-based activities. This fosters problem-solving skills and encourages practical thinking, which are essential in technical sciences.

MAIN PART

As a result, artificial intelligence and information technologies not only enhance efficiency in teaching technical subjects but also equip students with comprehensive practical knowledge and skills. These innovative approaches can further develop technical curricula and align them with modern educational standards.

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The Role of Artificial Intelligence and Information Technologies in Education.

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One of the main functions of artificial intelligence is to create learning programs tailored to the individual needs of students[3]. For example, AI algorithms provide fast and accurate assistance in mathematical calculations, programming tasks, or analyzing electronic circuits.As you know, in order to expand the use of artificial intelligence technologies, improve the system of digital data collection, storage and processing, a number of works are currently being carried out in our country to train qualified personnel in this field, support research projects in this direction. In short, artificial intelligence is a system or technology capable of imitating human behavior when performing certain tasks, gradually perfecting using the information obtained. Artificial intelligence in general is not a format or a function, but a process that includes data collection, analysis, etc. Today, the main goal of modernizing the system of continuing education in content and raising the effectiveness of education to a new level of quality is to ensure that our young people have modern knowledge and profession.

It is considered to consist in ensuring that he lives as alert, sensitive and alert to any risks, harmful effects and currents present in an extremely complex and threatening time and occupies a worthy place in the life of our society. Speaking about artificial intelligence, it is necessary to analyze its place in business and information technology. The slow penetration of artificial intelligence into these directions ensures that the number of AI tools increases. Artificial intelligence is an important element of the fourth industrial revolution.

Information technologies make the learning process more interactive. With the help of virtual laboratories, students can conduct experiments in a safe environment. For instance, they can observe the operation of a car engine or chemical processes in a 3D environment[4]. This not only enhances their practical understanding but also allows them to explore complex concepts at their own pace,

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reducing the fear of making mistakes. Furthermore, interactive simulations and digital tools encourage active participation, critical thinking, and problem-solving skills, making learning more engaging and effective.

Moreover, AI analyzes students' knowledge levels and identifies their strengths and weaknesses. This helps teachers adapt lesson plans and makes the learning process more effective. Additionally, by providing instant feedback and personalized learning paths, AI and IT foster students' critical thinking and problem-solving skills, preparing them for real-world challenges. Beyond this, these technologies can also facilitate collaboration among students through online platforms and interactive simulations, encouraging teamwork and the exchange of ideas, which are essential skills in today's digital and globalized world.

Innovative Approaches in Teaching Technical Subjects:

1. Virtual Laboratories and Simulations. Virtual laboratories expand the possibilities of real labs and allow students to perform practical exercises in a safe environment. For example, complex experiments in electrical engineering or mechanics can be simulated. This approach not only reduces the risks associated with real experiments but also enables students to repeat and refine procedures until they fully understand the concepts.

2. Automated Assessment Systems. AI-based systems reduce teachers' workload by evaluating code, mathematical calculations, and technical drawings quickly and accurately[1]. Automated assessments provide immediate feedback, helping students identify mistakes and improve their skills more efficiently.

3. Personalized Learning Programs. Exercises and supplementary materials tailored to a student's abilities and knowledge level are recommended through AI. This individualization enhances learning efficiency and increases student engagement. Personalized learning also allows students to progress at their own pace, addressing gaps in knowledge while reinforcing strengths.

4. Interactive and Innovative Methods. With AR/VR technologies, students can study complex systems visually. This represents an innovative approach in teaching technical subjects[4]. Moreover, such immersive methods promote active learning, critical thinking, and collaborative problem-solving, preparing students for real-world technical challenges.

Advantages and Limitations of Artificial Intelligence and Information Technologies:

Advantages:

- Individualization of the learning process.
- Development of practical skills and enhancement of interactivity.
- Analysis of large amounts of data and acceleration of decision-making.

Limitations:

- AI systems can make errors, so human supervision is necessary.
- Some experiments can only be conducted in real laboratories.
- Excessive reliance on AI may negatively affect independent thinking.

The integration of artificial intelligence (AI) and information technologies (IT) in technical education has introduced significant opportunities for enhancing the learning process. As highlighted in this study, virtual laboratories and simulations provide a safe and flexible environment for students to explore complex technical concepts. These tools not only reduce the risks associated with real-life experiments but also allow repeated practice, promoting mastery and deeper understanding of subjects such as electrical engineering, mechanics, and chemistry.

AI-based automated assessment systems further contribute to learning efficiency by providing instant feedback and reducing teachers' workloads. This enables educators to focus on guiding students through more complex problem-solving tasks while ensuring that evaluations are accurate and consistent. Moreover, personalized learning programs tailored to individual students' strengths and weaknesses enhance engagement and allow learners to progress at their own pace, which is particularly beneficial in technical disciplines where concepts can vary greatly in difficulty.

Despite these advantages, certain limitations must be considered. AI systems are not infallible, and human supervision remains essential to ensure the accuracy of assessments and the appropriateness of learning materials. Additionally, some practical experiments cannot be fully replicated in virtual environments, highlighting the continued importance of traditional laboratory work. Overreliance on AI may also pose a risk to students' independent thinking and problem-solving abilities if not carefully managed.

Overall, the findings suggest that the most effective approach to teaching technical sciences combines AI and IT tools with traditional methods. By integrating interactive simulations, automated assessments, and personalized learning programs with in-person guidance and hands-on laboratory experience, educators can create a balanced and innovative learning environment. Such an approach not only improves technical skills but also fosters critical thinking, collaboration, and adaptability, which are essential competencies for the modern workforce. Future research should explore long-term outcomes of AI-assisted learning and the development of strategies to mitigate its potential limitations while maximizing its educational benefits.

CONCLUSION

Artificial intelligence (AI) and information technologies (IT) serve as effective tools for innovative approaches in teaching technical subjects. They make the learning process more interactive, enable the creation of personalized learning programs, and support the development of practical skills. At the same time, it is essential to maintain human supervision, balance, and the importance of real laboratory exercises when using AI and IT. Furthermore, integrating these technologies with collaborative projects and problem-based learning can enhance students' critical thinking, creativity, and teamwork skills. In the future, the role of AI and IT in teaching technical sciences is expected to increase even further, offering new opportunities to improve educational outcomes and prepare students for the demands of a rapidly evolving technological world.

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