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IMPROVING THE METHODOLOGY FOR ENHANCING PEDAGOGICAL OPPORTUNITIES THROUGH THE USE OF ARTIFICIAL INTELLIGENCE IN THE ENGINEERING EDUCATION PROCESS

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Abstract:
This article analyzes the issues of enhancing pedagogical opportunities and improving learning efficiency in the process of engineering education through the use of artificial intelligence technologies. It also highlights ways to improve AI-based teaching methodologies, adaptive learning systems, the formation of individual approaches, and the advantages of automating the educational process. The research results demonstrate that artificial intelligence is a significant factor in modernizing engineering education.

Keywords: Artificial Intelligence, Engineering Education, Pedagogical Technologies, Digital Learning, Adaptive Teaching, Innovative Methodology, Competence, Automated Assessment, Learning Efficiency.

Ruscha tarjima

Ключевые слова: Искусственный интеллект, инженерное образование, педагогические технологии, цифровое обучение, адаптивное обучение, инновационная методика, компетенция, автоматизированная оценка, эффективность обучения.

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Аннотация:
В статье анализируются вопросы расширения педагогических возможностей и повышения эффективности обучения в процессе инженерного образования с использованием технологий искусственного интеллекта. Также освещаются пути совершенствования методик преподавания на основе ИИ, адаптивные системы обучения, формирование индивидуального подхода и преимущества автоматизации учебного процесса. Результаты исследования показывают, что искусственный интеллект является важным фактором модернизации инженерного образования.

Kirish:
Zamonaviy globallashuv va raqamli transformatsiya sharoitida ta’lim tizimi tubdan yangilanmoqda. Ayniqsa, muhandislik ta’limi sohasida innovatsion yondashuvlarni joriy etish zarurati ortib bormoqda. Bugungi kunda sun’iy intellekt texnologiyalari nafaqat sanoat va iqtisodiyotda, balki ta’lim tizimida ham keng qo‘llanilmoqda.
Muhandislik ta’limi o‘ziga xos murakkabliklarga ega bo‘lib, unda nazariy bilimlar bilan bir qatorda amaliy ko‘nikmalarni shakllantirish muhim ahamiyat kasb etadi. Shu sababli an’anaviy o‘qitish metodlari ko‘pincha etarli darajada samarali natija bermaydi. Sun’iy intellekt esa individual yondashuv, adaptiv o‘qitish, real vaqt rejimida tahlil qilish kabi imkoniyatlarni taqdim etadi.
Main Part: Integration of Artificial Intelligence and the Education System.Artificial Intelligence (AI) refers to the capability of computer systems to perform tasks that typically require human intelligence. In the education system, AI is applied in the following areas:
- Adaptive learning platforms
- Automated assessment systems
- Virtual laboratories

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- Intelligent assistant systems

In engineering education, these technologies play a crucial role in determining students' knowledge levels, facilitating individual development, and teaching them to solve complex problems.Role of AI in Enhancing Pedagogical Opportunities. AI improves the pedagogical process in the following ways: Ensuring Individual Approach.AI-based systems provide learning materials tailored to each student's knowledge level, learning pace, and interests. This enhances learning efficiency and comprehension. Adaptive Teaching. Adaptive systems analyze students' mistakes and suggest suitable tasks, thereby personalizing the learning process. Automated Assessment. AI allows for quick and objective evaluation of tests, laboratory works, and written assignments, saving teachers' time. Virtual and Simulation Environments. In engineering disciplines, AI enables virtual laboratories where students can conduct real-world experiments in a safe environment. Improving Methodology in Engineering Education Based on AI. Methodology improvement involves the following areas: Implementation of Digital Learning Platforms. It is necessary to integrate AI modules into modern Learning Management Systems (LMS). Competency-Based Approach. AI can develop specialized algorithms to identify and enhance students' competencies. Enhancing Teachers' Digital Competence. Educators need to acquire skills for effective use of AI technologies in teaching. Analytical Monitoring Systems. Systems that monitor students' activities in real-time and analyze results should be implemented.

Challenges and Solutions. The implementation of AI in education faces several challenges: Insufficient technical infrastructure , Low readiness and digital competence of teachers , Data security issues

Solutions include:Expanding digital education programs at the state level, Organizing professional development courses for teachers, Creating secure learning platforms

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Expected Outcomes. An AI-based improved methodology is expected to yield the following results: Enhanced quality of education, Broadened opportunities for deepening students' knowledge, Increased teaching efficiency, Preparation of competitive specialists in the field of engineering

Innovative AI-Based Teaching Models. To effectively use AI in engineering education, various innovative teaching models have been developed. Their main goal is to individualize the learning process, actively engage students, and develop their independent thinking skills.

Blended Learning Model. Blended learning combines traditional classes with online platforms. AI in this process: Adapts learning materials, Monitors student activities, Predicts learning outcomes

As a result, students can independently consolidate their knowledge. Flipped Classroom Model. In this model, students study new topics independently, and class time is devoted to problem-solving. AI: Recommends learning materials, Identifies difficult topics, Designs individualized tasks

Such systems are especially effective in programming, mathematics, and technical subjects. Improving Assessment Systems with AI. Assessment is a critical factor in determining education quality. Traditional assessment methods can be subjective, whereas AI ensures accuracy and objectivity through automation. Diagnostic Assessment. AI conducts initial tests to determine students' knowledge levels and identify weaknesses. Formative Assessment. AI continuously monitors students' progress, analyzes mistakes, provides recommendations, and suggests learning strategies. Summative Assessment. For final assessments, AI: Rapidly analyzes test results, Checks written assignments, Detects plagiarism

Application of AI Technologies in Engineering Disciplines. Programming. AI automatically checks code, identifies errors, and provides optimization suggestions. Mechanics and Construction. Simulation software models complex processes, allowing students to gain practical experience. Electronics and

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Robotics. AI is applied in robot control, sensor systems, and automation processes. Pedagogical Approaches Using AI Active Learning Methods

With AI, students:Solve problem-based tasks, Work on projects, Participate in collaborative activities

Project-Based Learning. Students consolidate knowledge by solving real-world problems. AI assists in: Selecting project topics, Analyzing data. Evaluating results

Problem-Based Learning. AI creates problem-based scenarios, and students independently find solutions. Creating a Digital Learning Environment. For AI to work effectively, a suitable digital environment is required, including:High-speed internet, Modern computer equipment, Specialized software platforms, Data repositories

Additionally, it is important to develop a digital transformation strategy for educational institutions. International Experience and Best Practices. AI is widely implemented in developed countries:

- In the USA, adaptive learning platforms are widely used
- In Europe, special emphasis is placed on developing digital competencies
- In South Korea, smart classrooms are implemented

These practices are also relevant for Uzbekistan’s education system.Future Prospects. AI is expected to fundamentally transform the education system, including:Fully automated teaching systems, Virtual instructors, Augmented Reality (AR) and Virtual Reality (VR)-based learning, Global online education platforms

CONCLUSION

In conclusion, the use of artificial intelligence in engineering education is one of the most important directions for modernizing the education system. In the context of digital transformation, traditional teaching methods are losing some of their effectiveness, while AI-based innovative approaches take the learning

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process to a new level. Research shows that AI plays a crucial role in ensuring an individual approach, optimizing the learning process, and deepening students' knowledge. Adaptive learning systems provide materials tailored to each student's knowledge level, learning pace, and interests, significantly enhancing education quality. Furthermore, AI eases teachers' workload by automating assessment, providing analytical monitoring tools, and offering intelligent assistance, allowing educators to focus more on creative guidance. Teachers become not only knowledge providers but also facilitators of the learning process. Another significant advantage of AI in engineering education is the development of practical skills. Through virtual laboratories, simulations, and digital modeling tools, students can study complex real-world processes in a safe environment, fostering professional competencies. AI-based methodologies also increase transparency and objectivity in the educational process. Reduced human bias in assessment ensures fairness, and data analysis enables continuous improvement of teaching methods. However, challenges remain, including underdeveloped technical infrastructure, low digital competence among teachers, and data security issues. A comprehensive approach is required, including state-level support for digital education, professional development for educators, and creation of modern technological infrastructure. From a future perspective, AI is expected to revolutionize engineering education. Fully digital learning environments, virtual instructors, smart platforms, and global education systems will develop, making education more open, flexible, and efficient. Overall, the use of AI in engineering education is strategically important for expanding pedagogical opportunities, enhancing education quality, and preparing modern specialists. Therefore, further research, development of innovative methodologies, and their practical implementation remain urgent tasks.

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