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MUHANDISLIK TA'LIMI JARAYONIDA SUN'IY INTELLEKTDAN FOYDALANISH ORQALI PEDAGOGIK IMKONIYATLARINI OSHIRISH METODIKASINI TAKOMILLASHTIRISH

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Abstract
This article discusses issues related to improving the methodology for enhancing pedagogical opportunities through the use of artificial intelligence in the engineering education process. Considering the specific nature of engineering subjects (complex calculations, modeling, projects, and practical assignments), the article proposes mechanisms based on AI for planning educational goals, conducting diagnostics, organizing differentiated (level-based) learning, providing rapid feedback, and assessing both the process and the outcome. The article also addresses the instructor's role in monitoring and methodical guidance, as well as ensuring academic integrity and the alignment of AI recommendations with pedagogical objectives.

Keywords: Artificial intelligence, engineering education, pedagogical methodology, diagnostics, differentiated learning, feedback, assessment criteria.

Introduction

Аннотация
В данной статье рассматриваются вопросы совершенствования методики повышения педагогических возможностей за счет использования искусственного интеллекта в процессе инженерного образования. С учетом специфики инженерных дисциплин (сложные расчеты, моделирование, проектные и практические задания) в статье предлагаются механизмы на основе АИ для планирования образовательных целей, проведения диагностики, организации дифференцированного (уровневого) обучения, оперативного предоставления обратной связи, а также оценки процесса и результата. Также в статье затрагиваются вопросы роли преподавателя в контроле и методическом направлении, а равно обеспечение академической добросовестности и соответствия рекомендаций ИИ педагогическим целям.

Ключевые слова: искусственный интеллект, инженерное образование, педагогическая методика, диагностика, дифференцированное обучение, обратная связь, критерии оценивания.

Annotatsiya
Mazkur maqolada muhandislik ta'limi jarayonida sun'iy intellektdan foydalanish orqali pedagogik imkoniyatlarni oshirish metodikasini takomillashtirish masalalari yoritiladi.

Muhandislik fanlarining o‘ziga xosligi (murakkab hisob-kitoblar, modellashtirish, loyiha va amaliy topshiriqlar) inobatga olingan holda SI asosida o‘quv maqsadlarini rejalashtirish, diagnostika qilish, differensial (darajalashtirilgan) ta’limni tashkil etish, tezkor feedback berish, hamda jarayon va natijani baholash mexanizmlari taklif qilinadi. Maqolada o‘qituvchining nazorat va metodik yo‘naltiruvchilik roli, shuningdek, akademik halollik va SI tavsiyalarining pedagogik maqsadga mosligini ta’minlash masalalari ham ko‘rib chiqiladi.

Kalit so‘zlar: sun’iy intellekt, muhandislik ta’limi, pedagogik metodika, diagnostika, differensial ta’lim, feedback, baholash mezonlari.

The use of artificial intelligence (AI) in the process of engineering education makes it possible to increase the quality of education, introduce flexible methods to the individual needs of students, and ease the work of the teacher. And in the fields of engineering, the educational content is often related to complex concepts, modeling, analysis of technical processes, projects and practical work. In such conditions, SI-based pedagogical tools play an important role in adapting educational materials, forming a personal "educational trajectory", diagnosing knowledge, and constantly monitoring the effectiveness of teaching. At the same time, the use of artificial intelligence is not limited to the introduction of technology. The main issue is the improvement of methodological approaches aimed at increasing SI capabilities in the process of engineering education. In this article, within the framework of the topic "Improving the methodology of increasing pedagogical capabilities through the use of artificial intelligence in the process of engineering education", an effective teaching model based on SI, practical stages, the teacher's methodological role and assessment mechanisms are covered.

The Main Part

Pedagogical significance of SI in engineering education. Engineering subjects (for example, mathematics, physics, mechanics, electronics, programming and design) have the following characteristics: the learning material becomes progressively more complex; it is important to analyze the results of practice and experience in advance; errors (for example: incorrect algorithm, incorrect calculation or construction defect) must be detected quickly; students have different abilities, and each of them needs to develop at their own pace. Artificial intelligence expands pedagogical possibilities by: individualization (providing materials and exercises suitable for each student's level), rapid diagnostics (identifying the cause of errors and appropriate recommendations), strengthening feedback (immediate comment on the result and guiding advice), simulation and virtual experience ("seeing the error" and learning through models), optimizing the educational process (saving the teacher's time). Methodology: stages of improved pedagogical approach based on SI. Below is a practical methodical approach to engineering education. Adaptation (planning) of educational goals to the possibility of SI. For each module: expected competencies (knowledge, skills, competence, engineering thinking); assessment criteria; type of educational tasks (calculation, programming, model, project) is determined. Then the expected result from the use of SI is

determined: which part requires diagnostics, which part requires differential training, and which part works in a virtual laboratory or simulation.

Diagnostic content and customized education (differentiation). SI creates a "profile" to determine the student's starting level: short tests, logical/technical questions, questions that test prior knowledge. Then tell the student: the level of complexity is appropriate; step-by-step explanation; explanatory exercises focused on errors are recommended. "project-activity + SI" model for engineering practice. In engineering disciplines, SI is especially effective at the "project" stage: the student forms the initial concept, and SI helps in requirements analysis, method selection, preparation of technical document structure, interpretation of model/simulation results, structuring of the report and reflection questions at the end of the project. Important: SI should not become a "ready-made answer", but should strengthen the student's engineering thinking. Reinforcement feedback: error detection and interpretation. During evaluation, SI provides feedback in the following formats: a comment on the steps in the solution; to distinguish the type of error (calculation error, conceptual error, algorithmic error); refer to a "mini-lesson" for guidance or re-explanation; give the next exercise according to the student's mistake. Evaluation methodology: emphasis on "result + process". In engineering education, not only the final result should be evaluated, but also: the process of arriving at a solution, the conceptual basis, methods of inspection (verification), and the quality of the report. SI supports: analysis of process steps (steps, code architecture, model parameters); evaluation based on the rubric (criteria table); In addition to automatic plagiarism detection, support for "logical consistency" checks. Methodological role of the teacher and pedagogical control in the use of SI. When SI is introduced, the role of the teacher does not decrease, but instead it is directed to: check whether the recommendations of SI are suitable for the pedagogical purpose; make the reader ask "why is that?" encourage thinking with questions like; control: making methodical corrections if incorrect or unreasonable recommendations appear; strengthening requirements for ethics and academic integrity. Also, the teacher must control the compatibility of SI results with real technical laws and principles in the field of engineering.

Practical recommendations for improvement (summary directions). To effectively use SI in engineering education: In each module, ``Where is SI useful?" making a clear methodical map. Forming a bank of differential assignments (by levels)

Integration of project and laboratory assignments with SI (simulation + analysis).

1. Evaluation based on the rubric (result and process).
2. Short trainings for teachers: diagnosis, feedback, control and ethics.
3. Analysis of results: indicators of student growth, motivation and participation.

Summary

The use of artificial intelligence in the process of engineering education significantly increases pedagogical opportunities. However, this process requires not only the addition of technology, but also the improvement of methodological approaches. The methodology proposed in this article (planning → diagnosis → differentiation → project activity → feedback → evaluation

of the process and result) helps deepen the knowledge of students in engineering subjects, quickly correct mistakes, form competencies, and effectively organize the teacher's work.

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