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USING ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN MATHEMATICS EDUCATION: POSSIBILITIES AND METHODOLOGICAL APPROACHES

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Annotatsiya: Ushbu maqolada matematika ta’limida sun’iy intellekt texnologiyalaridan foydalanishning zamonaviy imkoniyatlari, didaktik afzalliklari va metodik jihatlari tahlil qilinadi. Sun’iy intellekt o‘quvchiga tayyor javobni beruvchi vosita sifatida emas, balki matematik fikrlashni rivojlantirishga xizmat qiluvchi yordamchi texnologiya sifatida qaraladi. Maqolada individual ta’lim, murakkab masalalarni bosqichma-bosqich tushuntirish, xatolarni aniqlash, test va topshiriqlarni differensiallashtirish, o‘qituvchining darsni rejalashtirishdagi ishini yengillashtirish kabi yo‘nalishlar yoritilgan. Shuningdek, sun’iy intellektdan foydalanishda akademik halollik, noto‘g‘ri javoblar ehtimoli va o‘quvchining mustaqil fikrlashini saqlab qolish masalalariga ham e’tibor qaratilgan.

Kalit so‘z: sun’iy intellekt, matematika ta’limi, raqamli texnologiya, individual ta’lim, matematik tafakkur, masala yechish, differensial yondashuv, raqamli savodxonlik.

Аннотация: В данной статье анализируются современные возможности использования технологий искусственного интеллекта в математическом образовании, их дидактические преимущества и методические аспекты. Искусственный интеллект рассматривается не как средство предоставления учащимся готовых ответов, а как вспомогательная технология, способствующая развитию математического мышления. В статье освещаются такие направления, как индивидуализация обучения, пошаговое объяснение сложных задач, выявление ошибок, дифференциация тестов и заданий, а также облегчение работы преподавателя при планировании учебных занятий. Кроме того, особое внимание уделяется вопросам академической честности, вероятности получения неправильных ответов при использовании искусственного интеллекта и сохранения самостоятельного мышления учащихся.

Ключевые слова: искусственный интеллект, математическое образование, цифровые технологии, индивидуальное обучение, математическое мышление, решение задач, дифференцированный подход, цифровая грамотность.

Abstract: This article analyzes the contemporary possibilities, didactic advantages, and methodological aspects of utilizing artificial intelligence (AI) technologies in mathematics education. AI is viewed not as a tool that provides students with ready-made answers, but as an assistive technology that fosters the development of mathematical thinking. The article covers areas such as personalized learning, the step-by-step explanation of complex problems, error identification, the differentiation of tests and assignments, and the streamlining of lesson planning for

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teachers. Furthermore, it addresses critical considerations regarding the use of AI, including academic integrity, the potential for incorrect answers, and the preservation of students' independent thinking.

Keywords: artificial intelligence, mathematics education, digital technology, personalized learning, mathematical thinking, problem-solving, differentiated approach, digital literacy.

Today, the rapid penetration of digital technologies into the educational process is also making new demands on the methodology of teaching mathematics. In a traditional lesson, the teacher is the main source of information, while in a digital environment, the student has the opportunity to independently search, verify and process knowledge using various interactive tools. In particular, the development of tools based on artificial intelligence is generating new forms of work with mathematical tasks.

1. Mathematics requires logical reasoning, consistency, proofing, and coping with a problem in several ways. For this reason, the main purpose of using artificial intelligence should not be to solve the issue in the place of the reader, but to direct the reader to thinking. For example, if a student makes an error solving a quadratic equation, the technology can be used to show at what stage the error occurred and direct it to the correct path.

2. The role of the teacher does not diminish in this approach. On the contrary, the teacher evaluates the results of the technology, observes the student's thought process, and provides the necessary pedagogical commentary. Therefore, artificial intelligence should be considered not as a substitute for a teacher, but as a means of expanding his methodological capabilities.

1. The main possibilities of artificial intelligence in mathematics education

The first important opportunity is an individual approach. The mathematical training of students in the same class will not be the same. While some students master the topic quickly, others need more examples and comments. AI-based tools help to customize assignments according to their level of complexity. For example, on the subject of interest, one student may be given simple computational issues, while another student may be given more complex issues related to discount, credit, or profit.

The second possibility is quick feedback. In mathematics, it is very important to identify the error in time. All subsequent calculations can also go wrong if the reader performs the wrong action in the first step in solving the equation. When a digital tool helps to detect an error, the reader sees his mistake and tries to fix it independently.

The third possibility is to compare different solution methods. For example, a linear equation can be solved algebraically. And the geometric content can be shown by describing it in the coordinate plane. Artificial intelligence helps to formulate various comments and approaches to the task given by the teacher.

The fourth opportunity is to prepare methodological materials for the teacher. Artificial intelligence can be used as a preliminary assistant in developing lesson plans, exercises of various levels, test questions, problem situations, and independent work assignments. However, the prepared material must be checked by the teacher.

2. Methodological model of application in the lesson process

For the effective use of artificial intelligence, the lesson can be divided into three stages. The first stage is to put the problem. The teacher presents the students with a

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realistic or mathematical situation and gives them time to think independently. The second stage is exploration. Students develop their own solutions, using digital tools as needed for advice or scrutiny. The third stage is discussion and conclusion. The teacher compares the solutions of students, analyzes errors and summarizes the mathematical conclusion.

For example, in the topic" function graph", students are instructed to determine the properties of the function y = x2. Students first make a table and draw the graph themselves. Then they check the graph using a digital tool. As a result, the technology becomes not a ready-made source of answers, but a means of checking the reader's own solution.

3. Maintaining mathematical thinking and independent thinking

One of the most important methodological issues in using artificial intelligence is preventing the learner from becoming overly dependent on a ready-made answer. If a student only asks for the answer to each problem, their independent mathematical thinking may not develop sufficiently. Therefore, it is advisable to formulate tasks in the form of "justifying the solution", "identifying the error", "comparing two methods", and "creating a new problem by changing the given condition" rather than "finding the answer".

For example, a student might be given the answer x = 3 and asked to "Create at least three different variations of the equation that would lead to this answer." Even though technology is present, the main activity will be related to the student's creative and logical thinking.

Artificial intelligence tools may not always respond mathematically correctly. In particular, complex formulas, vague conditions, or incorrectly entered information affect the result. Therefore, it is necessary for students to abandon the approach that “technology said — so right” and learn to mathematically substantiate the answer.

In addition, the issue of academic integrity is also important. Completing an independent job or control assignment using full artificial intelligence will interfere with determining the student's actual level of knowledge. For this reason, the teacher must clearly distinguish between assignments in which the use of technology is allowed and not given.

Artificial intelligence is creating new pedagogical opportunities in mathematics education. He can help the teacher in the preparation of an individual approach, quick feedback, differentiation of assignments and methodological materials. However, the effectiveness of technology depends on what purpose and on what methodology it is used. The most optimal approach is to organize artificial intelligence not as a ready-made answering tool, but as an assistant activating the student's mathematical thinking.

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