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Applications of Artificial Intelligence Tools in Education

У статті розглядаються інструменти штучного інтелекту, такі як системи Deep Research і Thinking LLM, а також досліджується, як їх можна використовувати в математичній освіті. У статті також розглядаються пошукові системи на базі штучного інтелекту, платформи для вчителів та інструменти для навчання учнів, вказуючи як на переваги цих технологій, так і на необхідність керівництва вчителя при їх використанні в математичній освіті.

Ключові слова: *штучний інтелект, великі мовні моделі, глибокі дослідження, освітні технології.*

The article looks at AI tools, such as Deep Research systems and Thinking LLMs, and explores how they can be used in mathematics education. The article also reviews AI-powered search engines, teacher-focused platforms, and tutoring tools for students, pointing out both the benefits of these technologies and the need for teacher guidance when using them in math education.

Keywords: *artificial intelligence, large language models, deep research, educational technology.*

Introduction. Mathematics education in Ukraine faces a number of challenges that have been exacerbated by recent events, namely the COVID-19 pandemic and the ongoing war, which have resulted in significant learning losses and difficulties in both teaching and knowledge acquisition [1]. According to research, Ukrainian students have experienced substantial educational setbacks due to the war, equivalent to approximately two years of missed schooling [1]. This underscores the urgent need for innovative solutions to support mathematics education.

Over the past 10 years, the field of artificial intelligence has witnessed significant progress, moving from theoretical developments to practical implementation across various sectors, including education [2]. The number of job postings requiring AI-related skills increased by 257% between 2015 and 2023 [3]. In the field of education, a shift in attitudes toward AI is also evident, with a growing level of acceptance among students, teachers, and parents [4].

One of the defining features of current AI trends is the development of generative neural networks and large language models (LLMs), which hold considerable potential for application in education. The impact of LLMs on education is substantial, encompassing such aspects as personalized learning support, individualized assessment and feedback, access to a wide range of knowledge across disciplines, interdisciplinary learning, as well as assistance in problem-solving and real-time tutoring [5]. Generative AI and LLMs offer powerful opportunities that can be harnessed to personalize the learning process, provide instant support to students, and automate certain tasks for teachers in mathematics education.

This article does not cover basic AI chatbots like ChatGPT, Claude, Gemini, or Grok, as they are already well known. Instead, it examines four groups of advanced tools: enhanced chatbot features (Deep Research and Thinking Mode), AI-powered search engines, platforms for teachers, and services for students and general use.

Deep research tools. OpenAI Deep Research and Gemini Deep Research are two advanced features developed by OpenAI and Google, respectively, aimed at automating complex research tasks through artificial intelligence [6]. Both systems are capable of conducting multi-step investigations, analyzing large volumes of information from the Internet, and generating detailed reports complete with source references.

OpenAI Deep Research, integrated into ChatGPT, leverages the o3 model to conduct in-depth investigations. This tool can autonomously plan and execute multi-step research tasks, analyzing text, images, and PDF files to produce a comprehensive report that would typically require many hours of human labor. Each report includes explicit source citations and a summary of key findings, making it valuable for professionals in finance, science, and engineering.

Gemini Deep Research, developed by Google, is part of the Gemini ecosystem and is designed to simplify complex research tasks. This tool breaks down sophisticated queries into subtasks, searches for relevant information on the Internet, and synthesizes the collected data into an accessible format. A distinctive feature of Gemini Deep Research is its ability to generate audio summaries of research findings, enabling users to receive information in a convenient format. The service is aimed at researchers, educators, and students seeking to efficiently organize the process of information gathering and analysis. Both of these tools are intended to enhance the efficiency of research activities by reducing the time required for data collection and analysis.

Thinking mode. In 2024, researchers from Meta AI and the University of California, Berkeley introduced the concept of *Thinking LLMs* – large language models

capable of internal reasoning prior to generating a final response. This approach is implemented through the method known as *Thought Preference Optimization* (TPO), which enables models to produce internal chains of thought that improve the quality of responses without the need for human annotations [7].

Among the models that support the "Thinking" mode, notable examples include OpenAI's o1 and o3, Gemini 2.5 Pro, DeepSeek-R1, Anthropic's Claude 3.7 Sonnet, and Qwen QwQ-32B. These models demonstrate improved performance on benchmarks such as AIME, GPQA, and SWE-bench, particularly when tackling complex tasks that require multi-step reasoning.

AI-powered search engines. Perplexity AI is a search tool that combines the capabilities of artificial intelligence with real-time web searches to provide users with accurate and well-grounded answers to their queries. Its core features include generating concise responses with source citations, making it particularly useful for quickly accessing reliable information. The uniqueness of Perplexity AI lies in its interactive interface and the ability to engage in dialogue with users to refine their queries. This service is designed for students, educators, and researchers who require rapid access to high-quality information. Teachers can employ Perplexity AI in lesson preparation, the creation of educational materials, and in offering students a tool for independent exploration of topics.

Kagi Search is a subscription-based search engine that positions itself as an alternative to traditional free, advertisement-driven services. Developed by Kagi Inc., it operates as a metasearch engine, aggregating results from established search providers alongside its own indexes for websites and news. The platform's key features include the absence of advertising and user tracking, advanced personalization options through a domain-ranking system and specialized filters ("lenses"), as well as integrated artificial intelligence tools for content analysis and summarization.

AI services for educators. Developed by Microsoft, Reading Coach is a free tool designed to support the development of students' reading skills. Its core features include personalized reading practice, the identification of challenging words, and tailored recommendations to improve pronunciation. What makes this service unique is its integration with Immersive Reader and the ability to generate AI-created stories, which makes the learning process more engaging. Reading Coach is targeted at elementary and middle school students, as well as teachers seeking to enhance their students' literacy levels. Educators can employ this tool to individualize the learning process, monitor student progress, and design adaptive reading tasks.

Fetchy is an English-language platform powered by generative AI, designed specifically for teachers. It helps automate a variety of tasks, including creating engaging lesson plans, preparing informational newsletters for parents, and drafting professional emails. A key feature of Fetchy is its ability to adapt the style and content of generated material to the teacher's needs – the service allows customization of message tone, the level of explanation complexity, and other parameters. For mathematics teachers, the platform can, for example, generate a description of a lab activity or provide an engaging real-world case study for an algebra lesson. Fetchy offers a free basic version with paid advanced features, along with a trial mode for initial exploration.

AI services for students. MathGPTPro is a next-generation AI-powered online mathematics tutor launched in 2023. The service allows users to upload math problems in text or image form and receive instant solutions with step-by-step explanations. The platform emphasizes interactivity and personalization: students can ask follow-up questions if an explanation is unclear, and the AI will refine its response or provide an alternative solution method. MathGPTPro positions itself as a democratic educational tool aimed at lowering barriers to learning mathematics through accessible technology. Currently, the service is available free of charge. MathGPTPro illustrates how large language models specifically trained in mathematics can deliver substantially greater accuracy and usefulness for students compared to general-purpose chatbots.

Mistral OCR is a product from Mistral AI, launched in March 2025, which is an innovative optical character recognition (OCR) tool. Its main function is to accurately recognize and extract information from documents, including text, tables, images, and mathematical formulas. The uniqueness of Mistral OCR lies in its ability to preserve the hierarchy and formatting of documents, making it particularly useful for processing complex multilingual materials. This service is designed for educational institutions, researchers, and organizations that work with large amounts of documents. Teachers can use Mistral OCR to digitize teaching materials, create electronic versions of textbooks, and prepare interactive tasks for students.

Mathstral is another specialized large language model developed by Mistral AI. It is built on the Mistral 7B architecture with 7 billion parameters, and designed for solving advanced mathematical problems and supporting scientific research, particularly in STEM fields (science, technology, engineering, and mathematics). A key feature of Mathstral is its ability to perform multi-step logical reasoning and solve complex mathematical problems. The model has a context window of 32,000 tokens, enabling it to process long and complex inputs. Mathstral is available for further fine-

tuning and can be integrated into workflows using the mistral-inference and mistral-finetune tools. This makes it a convenient resource for researchers, educators, and students working in mathematics and related sciences. Thanks to its open access and adaptability, Mathstral contributes to the advancement of scientific research and education in STEM.

Conclusions. Thus, several key points can be highlighted. Artificial intelligence tools are already actively transforming approaches to education, particularly in the field of mathematics. They can serve as effective assistants for teachers in creating instructional materials, planning lessons, adapting tasks to students' levels, and organizing personalized learning environments. For students, AI provides access to continuous support, step-by-step explanations, and opportunities for self-directed learning. At the same time, pedagogical oversight remains a crucial factor: it is essential that teachers continue to act as central figures, guiding the use of these tools to foster critical thinking rather than mechanical answer-seeking. Proper integration of AI into the educational process does not reduce the teacher's role, but it enhances it, offering more opportunities for creative approaches and for addressing the individual needs of each student.

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