ENHANCING MATHEMATICAL ENGAGEMENT THROUGH AI: A CASE STUDY FROM JIZZAKH PRESIDENTIAL SCHOOL

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Annotatsiya*: Mazkur tadqiqot Jizzax Prezident maktabida o‘tkazilgan innovatsion loyiha asosida o`tkazilgan va unda matematika o‘qituvchisi mustaqil ravishda sun’iy intellekt (SI) texnologiyasini qo‘llagan holda o‘quvchilarning matematik tushunchalarni o‘zlashtirishlari va darsga bo‘lgan qiziqishlarini oshirishga muvaffaq bo‘lgan. Ushbu tadqiqotda sun'iy intellekt vositasi har bir o‘quvchining qobiliyat va o‘quv tempiga moslashuvchi o‘quv imkoniyatlarini taqdim etib, turli xil ta'lim jarayonini qo‘llab-quvvatladi. O‘quvchilarning baholari va fikr-mulohazalaridan olingan ma’lumotlar tahliliga ko‘ra, SI yordamida olib borilgan darslar o‘quvchilarni faollikka undashi va ularning masalalarni yechish ko‘nikmalarini sezilarli darajada oshirgani kuzatildi. Bu esa SI texnologiyasining matematika ta’limidagi an’anaviy usullarni o‘zgartirishdagi salohiyatini ko`rsatib beradi.*

***Kalit so`zlar:*** *Sun’iy intellekt, Matematika o`qitish, moslashuvchan ta`lim, O‘quvchilarning faolligini oshirish, Individual ta’lim, Jizzax Prezident maktabi.*

Abstract*: This study presents an innovative AI-assisted learning project implemented in a mathematics class at the Jizzakh Presidential School. Here, a math teacher utilized adaptive AI software to increase student engagement and deepen comprehension of mathematical concepts without requiring direct input from AI developers. Through personalized, adaptive learning features, the AI tool tailored exercises to match each student’s progress, promoting differentiated learning. Findings from assessment data and student feedback showed improved engagement and problem-solving skills, emphasizing the potential for AI to transform traditional math education.*

Keywords*: Artificial Intelligence, Mathematics Education, Adaptive Learning, Student Engagement, Personalized Learning, Jizzakh Presidential School.*

Introduction. The integration of artificial intelligence (AI) in educational practices has gained traction, particularly within STEM fields, where adaptive learning technologies offer considerable potential to support diverse learning paces and styles. AI in the classroom can enable teachers to personalize learning experiences and facilitate active, student-centered environments, enhancing both comprehension and engagement (Luckin et al., 2016; Miao, Holmes, & Huang, 2020). This case study details an AI implementation at the Jizzakh Presidential School, where a math teacher independently employed AI-based software to foster engagement and comprehension in mathematics without requiring technical expertise

or developer collaboration. This project highlights AI's capability to support individualized learning experiences that meet each student's unique needs and pace.

Methodology

The study utilized both quantitative and qualitative data to evaluate the AI tool's effectiveness in improving engagement and learning outcomes in mathematics.

- Participants: A middle school math class of 12 students participated in the project, which was conducted during regular class hours.
- AI Tool Selection: The teacher selected a user-friendly adaptive AI application that could adjust difficulty levels, provide real-time feedback, and record student progress without extensive customization.
- Data Collection: Quantitative data were gathered from pre- and post-intervention test scores to assess improvements in academic performance. Qualitative data were collected through student surveys and focus groups to capture engagement levels and attitudes toward the AI tool.
- Data Analysis: Statistical analysis of test scores revealed knowledge gains, while thematic analysis of survey data identified key trends in student engagement and motivation.

Project Implementation: The AI project was implemented in three main phases to ensure a seamless integration into the classroom:

Preparation and Planning: The teacher researched and selected an AI tool with strong adaptive learning capabilities but minimal technical setup requirements. Training sessions were conducted to familiarize both the teacher and students with the AI platform's features and benefits.

In-Class Usage: During lessons, students used AI-powered exercises that adjusted in difficulty according to their responses. This real-time adaptability allowed students to work at their own pace and receive immediate hints or feedback as needed.

Ongoing Support and Guidance: The teacher encouraged students to utilize the AI tool as a learning aid, demonstrating how to engage with its feedback features to build resilience and independence in solving math problems.

Results. The implementation of AI in the classroom had a noticeable impact on both quantitative and qualitative metrics:

- Quantitative Results: Post-intervention test scores indicated a clear improvement in problem-solving and mathematical comprehension. On average,

students' scores increased, suggesting that the adaptive, AI-enhanced learning environment positively influenced their understanding of complex math concepts.

- Qualitative Results: Surveys and interviews reflected heightened student motivation and confidence. Many students appreciated the personalized challenge levels and immediate feedback, which helped them learn from mistakes without discouragement. Observations during class showed an increase in active participation, with students demonstrating greater curiosity and initiative in exploring math problems.

Classroom Dynamics

The adaptive nature of the AI tool shifted the classroom environment to a more student-centered model. The tool served as a digital tutor, offering individualized feedback and allowing students to engage with math concepts at their own level. This environment aligned with constructivist learning principles, which emphasize active learning and personalized support (Baker & Inventado, 2014; Dewey, 1938).

Discussion

The findings from this study support constructivist learning theories, such as Dewey's experiential learning framework, which suggest that students construct knowledge through meaningful, responsive interactions. By using an adaptive AI tool, the teacher enabled students to engage in self-directed learning, enhancing their problem-solving skills and independence. Additionally, the success of this implementation suggests that AI can be introduced in classrooms without technical collaboration with AI developers, making it a scalable option for various educational settings (Holmes et al., 2019; Zawacki-Richter et al., 2019).

Limitations and Challenges

While the project showed promising results, certain challenges arose. Some students needed additional encouragement to fully adapt to the AI-driven learning format. Additionally, the teacher experienced a learning curve when analyzing the data provided by the platform to adjust instruction. Future implementations may benefit from structured guidance on data interpretation to help teachers refine their instructional strategies based on AI insights.

Conclusion and Future Directions

This project at Jizzakh Presidential School demonstrated that AI can significantly enhance engagement and comprehension in mathematics by offering a personalized learning experience. AI's adaptive capabilities allowed students to

proceed at their own pace and receive real-time feedback, fostering a supportive and student-centered learning environment.

Future projects could explore the effects of AI across other subjects, age groups, and educational settings. Longitudinal studies may reveal sustained impacts of AI on student outcomes and learning attitudes. For schools considering similar projects, it is recommended to select intuitive AI tools, provide training for teachers, and integrate student feedback to maximize the tool's effectiveness.

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