

Teacher Perspectives on Harnessing AI in Mathematics Classrooms

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With growing recognition of the need and potential to use artificial intelligence (AI) in education (U.S. Department of Education [DOE], 2023), mathematics teacher educators (MTEs) in the U.S. and around the world are expected to be aware of and ready to address the emerging need and potential for preservice and in-service teachers to use AI-integrated tools in mathematics instruction (National Council of Teachers of Mathematics [NCTM], 2024). In South Korea, the Minister of Education has actively pursued strategies to empower educators through AI integration within the national mathematics curriculum. Moreover, the Minister has issued a directive mandating the incorporation of AI-integrated e-textbooks into the educational framework, starting from Grade 3, effective March 2025.

It is critical to understand the perspectives of teachers about the use of AI in mathematics instruction. Also, teacher perspectives provide MTEs and stakeholders with ideas to support them in effectively integrating AI into their teaching. According to NCTM (2024) through its position statement, AI presents three significant potentials within education: AI tools do not replace the need to teach math or problem-solving; AI tools encourage teachers to reimagine teaching and assessment; and AI tools can personalize learning. Through our survey, we aimed to tap into whether the perspectives of in-service teachers align with the NCTM position statement regarding the benefits and challenges associated with AI integration in education. Ultimately, these collected perspectives will furnish MTEs and other stakeholders with insights to better support teachers in navigating the integration of AI tools into their instructional practices.

This report presents an analysis of responses from 131 teachers in South Korea. The teachers participated in an anonymous online survey, sharing their perceptions of the benefits and challenges of the future integration of AI in their mathematics instructions. We offer implications for the mathematics teacher education community on how they can support teachers in preparing to incorporate AI in mathematics instruction. We hope that the derived perspectives of South Korean teachers on AI integration in mathematics instruction will be valuable for MTEs in the U.S. because the perspectives of South Korean teachers may suggest some insights about those of US teachers who will be expected to integrate AI into mathematics instruction.

Survey Contexts

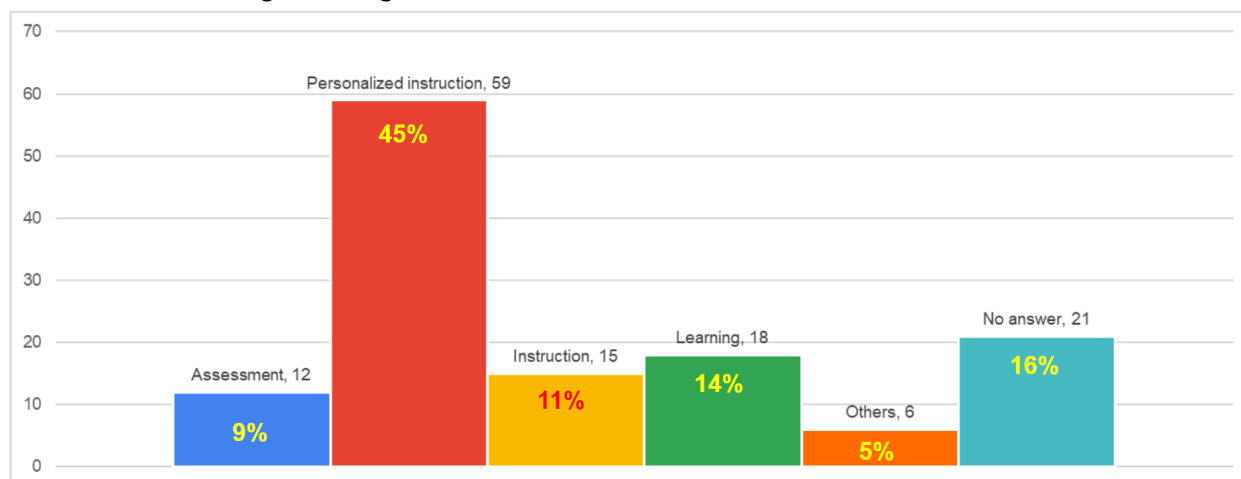
Between January and February 2024, we conducted an anonymous online survey targeting elementary and middle school teachers to gauge their perspectives on integrating AI into mathematics classrooms. We looked into what they said about the benefits and challenges of the use of AI in their mathematics classroom. The survey included two open-ended prompts asking about the benefits and challenges associated with AI incorporation. Our analysis focused on responses to these prompts from 131 teachers, predominantly aged 30 and above (96%) and with over five years of teaching experience (95%). Using open coding, we categorized each response. In the following section, we present our findings on the perspectives regarding the benefits and challenges of AI integration in mathematics teaching.

Survey Results

In exploring the benefits of using AI-integrated teaching and learning materials in mathematics instruction, teachers' responses to a prompt (Please write what benefits you would see if teaching and learning materials based on artificial intelligence were introduced into your mathematics classes) were organized into six categories—personalized instruction, learning, instruction, assessment, others, and no answer (Figure 1). Given the relevance of responses, this report focuses on only the first four categories. First, 45% of the participating teachers emphasized personalized instruction as the most significant benefit. They underscored AI's affordance for personalized assessment and support (“Providing personalized educational materials and feedback for learners”), which aids in addressing diverse academic needs on the part of students. Second, 14 % of the teachers identified student learning as another benefit. This category highlights how AI-integrated teaching and learning materials can help students improve their academic skills in mathematics. The responses include the potential of AI to intrigue students' interest in mathematics learning (“By reducing the process of simple calculations, students will become more interested in math classes”) and increase students' computational fluency through repeated practice (“It draws out the interest of children”).

Figure 1:

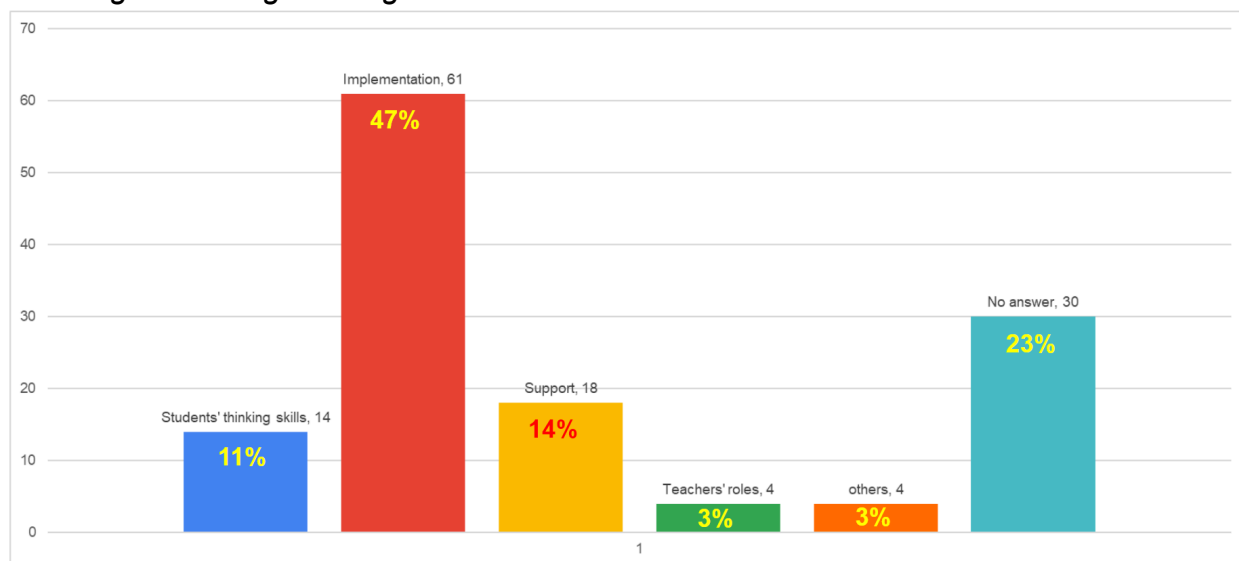
Benefits from using AI-integrated materials in mathematics instruction.



Third, 11 % of the teachers perceived instruction as another notable benefit. The category implies that AI-integrated teaching materials enhance their teaching efficiency. The responses include teachers' expectations of AI as a teaching aid by evaluating students' needs and progress and managing their learning trajectories ("It helps teachers with lesson preparation and improves learners' understanding"). Fourth, 9 % of the responses emphasized the benefit of improved assessment. The responses include real-time feedback on students' mathematical work ("It allows for immediate feedback to students"), alleviating teachers' assessment burdens ("Ease of grading"), and saving their time and effort in evaluating students' achievement of learning targets ("It helps in understanding students' academic status").

We also examined the challenges of using AI-integrated teaching and learning materials in mathematics instruction. Teachers' responses to a prompt (Please write what difficulties you would face if artificial intelligence were introduced into your math class) were put into six categories— implementation, support system, students' thinking skills, teachers' roles, others, and no answer (Figure 2). As the "others" category contains a few scattered ideas, we discuss the challenges in the first four categories.

Figure 2:
Challenges in using AI-integrated materials in mathematics instruction.



The survey responses highlighted several key challenges in implementing AI-integrated teaching materials in mathematics classrooms. First, implementation challenges comprised the largest portion, accounting for 47% of responses. These difficulties encompassed learning to use AI-integrated materials ("Since this is unfamiliar, there will be some difficulties for a while"), assisting younger students with the usage of the materials ("The burden that teachers must adapt well and assist students properly"), and requiring additional preparation time ("Time needed for lesson preparation"). Second, the support system emerged as the next significant challenge, constituting 14 % of the responses. This category emphasized the necessity for

consistent systemic support, particularly in professional development concerning AI integrated into mathematics instruction (“Training needed on using artificial intelligence, leading to frustration among teachers who are not proficient in managing AI-based devices”). Third, concerns regarding students' thinking skills were another notable challenge, representing 11% of responses. Teachers expressed their concern about potential decreases in students' thinking and problem-solving skills resulting from excessive reliance on AI (“In the long term, it is expected that the ability to think critically and problem-solve independently will significantly decline”). Lastly, concerns about teachers' roles accounted for 3% of responses. They expressed apprehensions about being replaced by AI and the dangers of over-dependence on it (“Teachers will be replaced by artificial intelligence”). Overall, these findings underscore the multifaceted challenges educators face in effectively integrating AI into mathematics education.

Implications

Understanding how teachers perceive the integration of AI in mathematics education is crucial for advancing effective support systems in mathematics teacher education. The survey results from 131 South Korean teachers' responses to benefits and challenges provide insights into teachers' perspectives, especially those who will use AI-integrated teaching and learning materials in the near future. Many teachers viewed AI as one way to personalize students' learning and enhance teaching and assessment processes. With AI's affordance for promptly identifying and addressing the specific academic needs of each student, teachers anticipated the potential of AI integration in mathematics education. However, some teachers raised apprehension regarding the use of AI in their teaching. They expressed concerns over the potential decline in students' critical thinking and problem-solving abilities, as well as anxieties about being replaced by AI. To address these misunderstandings and harness the benefits of AI, MTEs need to be an active part of the comprehensive support of teachers. This entails more systemic support in which teachers can strengthen their understanding of the benefits and adjust misunderstandings in utilizing AI in mathematics classrooms. Additionally, there was apprehension about their roles as teachers being replaced by AI. To address these concerns, MTEs need to support teachers in understanding that AI can help teachers develop students' thinking skills and help teachers see their roles boosted by the use of AI in their mathematics classrooms. Along with helping teachers effectively use AI in mathematics classrooms, MTEs also need to support teachers in thinking critically about AI and trying to mitigate the potential challenges and negative influences of AI.

In sum, this report underscores the perspectives of practitioners on the potential of AI in mathematics education and emphasizes the importance of proactive efforts to prepare teachers for its effective integration. MTEs need to be aware of concerns and misunderstandings regarding benefits and challenges to support teachers in leveraging AI technologies strategically.

References

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