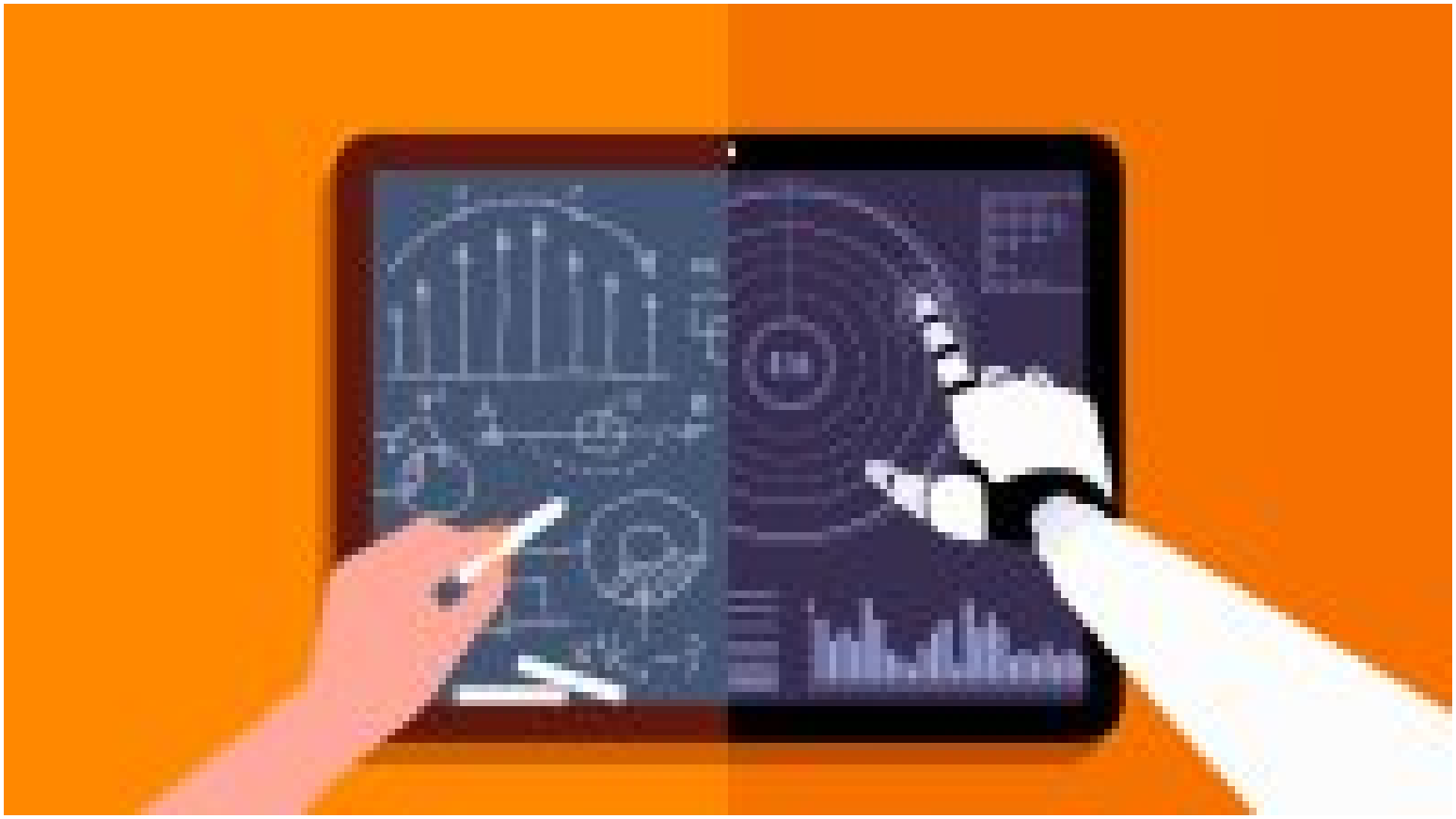
How Generative AI Can Support Research-Based Math Instruction

ChatGPT & Generative AI

Teachers can use artificial intelligence tools like ChatGPT to generate rich math tasks and differentiate instruction.



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While some may be skeptical about the use of artificial intelligence (AI) in education, there are compelling reasons why teachers should consider including generative AI in their math classes.

As STEAM (science, technology, engineering, arts, and math) professional development specialists, we've been investigating and sharing with our colleagues how generative AI can support teachers with more than just generalized ideas: with research-based mathematics instruction that changes learning outcomes for students.

Seeing the work of the leading thinkers in education and how those practices have changed student outcomes inspired our ideas for effectively utilizing generative AI in our math classrooms. We often refer to and utilize the work of Peter Liljedahl for rich math tasks, Jo Boaler for number sense, and Carol Ann Tomlinson for differentiation.

Some promising AI tools we've been exploring include ChatGPT, Conker, and Canva's Magic Design. In this article we specifically reference ChatGPT.

Keep in mind that the more specific and detailed your input, the better ChatGPT can tailor a response to meet your needs. AI can provide valuable support in generating suggestions, yet it's important to always review and adapt the generated responses to align with the curriculum, students' needs, and instructional goals.

The integration of ChatGPT as a tool in mathematics education presents immense opportunities for teachers to enhance their instructional practices. By leveraging ChatGPT's capabilities, teachers can effectively address the three critical areas of number sense, rich math tasks, and differentiation.

ChatGPT's ability to generate realistic and contextualized math problems enables teachers to foster students' number sense by applying mathematical concepts to real-world scenarios. Moreover, the generation of rich math tasks encourages deep mathematical thinking, problem-solving skills, and critical reasoning among students. Additionally, ChatGPT supports differentiation by providing personalized learning experiences tailored to individual students' needs, ensuring that each learner is challenged appropriately.

Here are three ideas for how AI can support teachers and students in mathematics.

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1. Number Sense

ChatGPT can generate examples of number sense activities and offer pedagogy tips and strategies to use in the classroom.

Activities: Ask ChatGPT to generate customized activities to assess or reinforce students' number sense skills. For example, a third-grade teacher working on division could use the language embedded in the standards and instruct ChatGPT to "generate five number sense activities for grade-three students connecting to interpreting whole-number quotients of whole numbers."

Pedagogy and strategies: ChatGPT can also offer pedagogy tips and strategies to support practices relating to number sense. A middle school teacher working on ratios and proportional reasoning, for instance, could ask ChatGPT to "provide a middle school math teacher pedagogy tips to develop number sense in students relating to ratios and proportional relationships."

Additional requests could involve the use of manipulatives, visual representations, or group activities that enhance students' understanding of mathematical concepts. Teachers can also request ChatGPT to generate customized strategies to support number sense. For example, a second-grade teacher could ask ChatGPT to "offer strategies to math teachers to promote number sense for second-grade students." More-focused requests could be specific to number talks or estimation activities.

2. Rich Math Tasks

ChatGPT can also generate real-world applications and low floor, high ceiling problem-solving scenarios.

Real-world applications: Ask ChatGPT to share real-world applications aligned to instructional goals or how math is used in various fields, like science, engineering, finance, or sports. For example, a fifth-grade teacher can request ChatGPT to "create real-world scenarios for fifth-grade math problems on how math is used in engineering." Teachers can narrow the focus and address various domains or skills such as measurement, geometry, fractions, area and perimeter, data analysis, volume, ratios, scaled models, and algebra.

Low floor, high ceiling problem-solving scenarios: Request ChatGPT to share low floor, high ceiling problem-solving scenarios that are open-ended and that allow for multiple solution strategies. Create additional inquiries for ChatGPT relating to problem-solving approaches, metacognitive thinking, extension questions that encourage deeper thinking, and problem variations to challenge students at different levels. Teachers can also ask ChatGPT to provide examples of case studies of how other math teachers have successfully utilized low floor, high ceiling problem-solving scenarios.

3. Differentiation

Use ChatGPT to differentiate instruction in its four areas: content, process, products, and learning environment.

Content (what students need to learn or how to access information): ChatGPT can generate problem sets based on a student's individual needs. Teachers can input a student's level of understanding, and AI can generate math problems that are appropriate for that level.

Process (activities that students engage in to master content): A teacher can request a sequence of instruction strategies for students who may be struggling with a particular math skill. For example, if a student is working toward mastery of fractions, a teacher can tell ChatGPT, "Provide me a list of activities to support equivalent fraction mastery in third grade."

Products (culminating project to show transfer of learning): ChatGPT can offer a wealth of project ideas for students to demonstrate their understanding of a particular math concept. A teacher can tell ChatGPT, "Provide me a list of culminating project ideas for high school geometry."

Learning environment (the way the classroom works and feels): To support how a student feels in their math classroom, ask ChatGPT, "How can I create an environment to promote a growth mindset in mathematics?" Additionally, ChatGPT can support teachers in how to organize their math classroom to best meet the needs of their learners by simply answering the prompt, "What is the best way to organize my math materials for my students?"

Through the thoughtful incorporation of ChatGPT into teaching strategies, math teachers can inspire a deeper appreciation for mathematics, nurture mathematical proficiency, and prepare students for success in mathematics and beyond.