AI might disrupt math and computer science classes – in a good way

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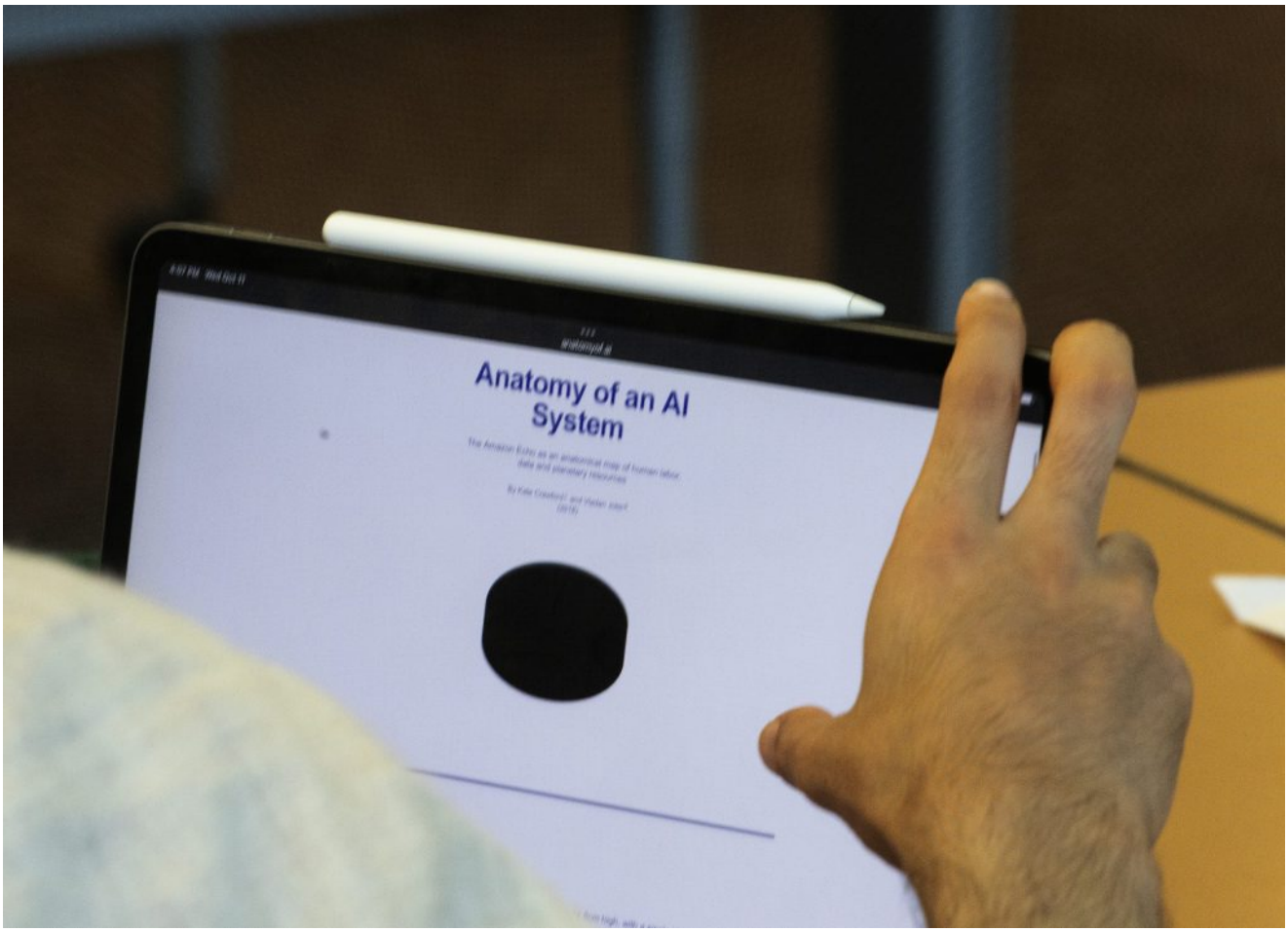
By Claire Bryan October 24, 2023



For as long as Jake Price has been a teacher, Wolfram Alpha — a website that solves algebraic problems online — has threatened to make algebra homework obsolete.

Teachers learned to work around and with it, said Price, assistant professor of mathematics and computer science at the University of Puget Sound, in Tacoma, Washington. But now, they have a new homework helper to contend with: generative artificial intelligence tools, such as ChatGPT.

Price doesn't see ChatGPT as a threat,and he's not alone. Some math professors believe AI, when used correctly, could help strengthen math instruction. And it's arriving on the scene at a time when math scores are at a national historic low and educators are questioning if math should be taught differently.

> **“Computers are really good at doing tedious things. We don’t have to do all the tedious stuff. We can let the computer do it. And then we can interpret the answer and think about what it tells us about the decisions we need to make.”**
>
> *Jake Price, assistant professor of mathematics and computer science at the University of Puget Sound, in Tacoma, Washington*

AI can serve as a tutor, giving a student who is floundering with a problem immediate feedback. It can help a teacher plan math lessons, or write a variety of math problems geared toward different levels of instruction. It can even show new computer programmers sample code, allowing them to skip over the boring chore of learning how to write basic code.

As schools across the country debate banning AI tools, some math and computer science teachers are embracing the change because of the nature of their discipline.

“Math has always been evolving as technology evolves,” said Price. A hundred years ago, people were using slide rules and doing all of their multiplication with logarithmic tables. Then, along came calculators.

The Math Problem

Sluggish growth in math scores for U.S. students began long before the pandemic, but the problem has snowballed into an education crisis. This back-to-school season, the Education Reporting Collaborative, a coalition of eight newsrooms, will be documenting the enormous challenge facing our schools and highlighting examples of progress. The three-year-old Reporting Collaborative includes AL.com, The Associated Press, The Christian Science Monitor, The Dallas Morning News, The Hechinger Report, Idaho Education News, The Post and Courier in South Carolina, and The Seattle Times.

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Price teaches with human-capable technologies in mind, making sure to give students the skills in class by hand. Then, he discusses with them the limitations of the technologies they might be tempted to use when they get home.

“Computers are really good at doing tedious things,” Price said. “We don’t have to do all the tedious stuff. We can let the computer do it. And then we can interpret the answer and think about what it tells us about the decisions we need to make.”

He wants his students to enjoy looking for patterns, seeing how different methods can give different or the same answers and how to translate those answers into decisions about the world.

“ChatGPT, just like the calculator and just like the slide rule and all the technology before, just helps us get at that core, real part of math,” Price said.

Conversely, ChatGPT has its limits. It can show the right steps to solving a math problem — and then give the wrong answer.

This is because it’s “not actually doing the math,” Price said. It’s just pulling together pieces of the sentences where other people have described how to solve similar problems.

Min Sun, a University of Washington education professor, thinks students should use ChatGPT like a personal tutor. If students get lost in class and don’t understand a mathematical operation, they can ask ChatGPT to explain it and give them a few examples.

The Khan Academy, an educational nonprofit that provides a collection of online learning tools and videos and has long been a go-to for math homework, has created exactly that.

The tutor is called Khanmigo. Students can open it while completing math problems and tell it that they are stuck.

They can have a conversation with the AI tutor, telling it what they don’t understand, and the AI tutor helps to explain, said Kristen DiCerbo, the chief learning officer at Khan Academy.

“Instead of saying, ‘Here’s the answer for you,’ it says things like, ‘What’s the next step?’ or ‘What do you think might be the next thing to do?’” DiCerbo said.

Sun, the UW education professor, wants teachers to use ChatGPT as their own assistant: to plan math lessons, give students good feedback and communicate with parents.

Teachers can ask AI, “What is the best way to teach this concept?” Or “What are the kinds of mistakes students tend to make when learning this math concept?” Or, “What kinds of questions will students have about this concept?”

Teachers can also ask ChatGPT to recommend different levels of math problems for students with different mastery of the concept, she said. This is particularly helpful for teachers who are new to the profession or have students with diverse needs — special education or English language learners, Sun said.

“I’m amazed by the details that sometimes ChatGPT can offer,” Sun said. “It gives you some initial ideas and possible problem areas for students so I can get myself more prepared before walking into the classroom.”

And, if a teacher already has a high-quality lesson plan, they could feed that to ChatGPT and ask it to create another lesson in a similar teaching style, but for a different concept.

Sun hopes ChatGPT can also help teachers write more culturally appropriate word-problem questions to make all their students feel included.

“The current technology is really a technical assistant to support them, empower them, amplify their creative abilities,” Sun said. “It is really not a substitute to their own agency, their own creativity, their own professionalism. They really need to keep that in mind.”

A year ago, if you asked Daniel Zingaro how he assesses his introductory computer science students, he would say: “We ask them to write code.”

But if you ask him today, the answer would be far more complex, said Zingaro, an associate professor at the University of Toronto.

Zingaro and Leo Porter, a computer science professor at University of California San Diego, authored the book Learn AI-Assisted Python Programming with GitHub Copilot and ChatGPT. They believe AI will allow introductory computer science classes to tackle big-picture concepts.

A lot of beginner students get stuck writing very simple code, Porter and Zingaro said. They never move on to more advanced questions — and many still can’t write simple code after they complete the course.

“It’s not just uninteresting, it is frustrating,” Porter added. “They are trying to build something and they forgot a semicolon and they’ll lose three hours trying to find that missing semicolon” or some other bit of syntax that prevents a code from running properly.

AI doesn’t make those mistakes, and allows computer science professors to spend more of their time teaching higher-level skills.

The professors now ask their students to take a big problem and break it down to smaller questions or tasks the code needs to do. They also ask students to test and debug code once it is already written.

“If we think bigger picture about what we want our students to do, we want them to write software that is meaningful to them,” Porter said. “And this process of writing software is taking this fairly big, often not-well-defined problem and figuring out, how do I break them into pieces?”

Magdalena Balazinska, director of the University of Washington’s Paul G. Allen School of Computer Science and Engineering, embraces the progress AI has made.

“With the support of AI, human software engineers get to focus on the most interesting part of computer science: answering big software design questions,” Balazinska said. “AI allows humans to focus on the creative work.”

Not all professors in the field think AI should be integrated into the curriculum. Some interviewed for a UC San Diego research paper and in an Education Week survey prefer blocking or negating the use of ChatGPT or similar tools like Photomath, at least in the short term.

Zingaro and Porter argue that reading a lot of code generated by AI doesn’t feel like cheating. Rather, it’s how a student is going to learn.

“I think a lot of programmers read a lot of code, just like how I believe the best writers read a lot of writing,” Zingaro said. “I think that is a very powerful way to learn.”

This story about AI and math was produced by The Seattle Times in cooperation with the Education Reporting Collaborative, a coalition of eight newsrooms that is documenting the math crisis facing schools and highlighting progress. Members of the Collaborative are AL.com, The Associated Press, The Christian Science Monitor, The Dallas Morning News, The Hechinger Report, Idaho Education News, The Post and Courier in South Carolina, and The Seattle Times.