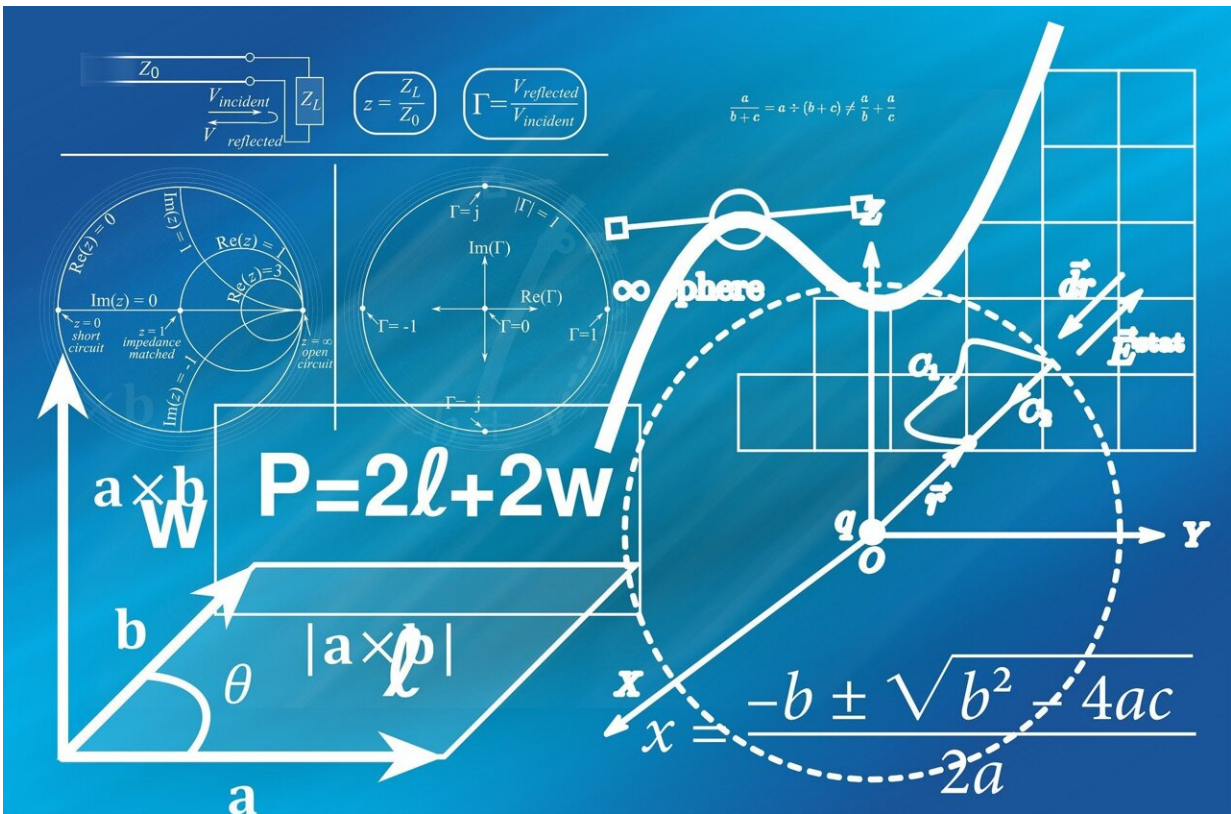


How to improve math skills among American children

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In the past two decades, researchers have made great strides in uncovering how children learn math, but little of that new knowledge has trickled down to teachers, according to a new book on math education.

The gap between research and practice is particularly unfortunate, given the current state of American students' [math](#) skills, said Nancy Krasa, co-author of [How Children Learn Math: The Science of Math Learning in Research and Practice](#).

"American children are not doing well at math," said Krasa, who is an adjunct assistant professor of psychology at The Ohio State University.

"In 2019, only about [one-fourth of high school seniors scored at or above the proficiency level in math](#). And all indications are that this has only gotten worse with the learning loss associated with the COVID-19 pandemic."

But there is a way to meet this challenge, according to Krasa, who is a [licensed psychologist specializing in children with learning difficulties](#), including those who have trouble with mathematics.

"The [scientific research](#) on how children learn math has exploded in the past 20 years, with thousands of new studies focused on how children come to understand numbers and various other aspects of math," she said.

"The problem is that little of this work has been accessible to teachers on the front line."

Krasa said she and her co-authors, [Karen Tzanetopoulos](#) and [Colleen Maas](#), wrote *How Children Learn Math* to bring the latest discoveries in math learning to teachers and parents and give them research-based ways to teach the fundamentals to [young students](#). The book focuses on toddlerhood through the learning of fractions.

A good example of one of the new discoveries is learning spatial skills. The importance of spatial skills in early math is one of those crucial

findings that hasn't made it to early education teachers, Krasa said.

Most people think of spatial skills in terms of geometry, but recent research suggests that a person's spatial skills are associated with their [math skills](#) more generally.

"That's something most teachers would have no idea about, but the results are remarkably consistent," she said.

"What is not yet entirely clear is how they are related—why do people with good spatial skills have an easier time with math?"

One hypothesis is that humans think of numerical quantities along a mental number line, as if they existed in space. One real-life classroom application is that a physical number line in the classroom, if properly used, may help teach young children about numbers.

But research shows that children begin developing spatial skills even before they get to school. One way very [young children](#) learn spatial skills is by playing with blocks.

One [study](#) Krasa and her co-authors mention in the book found that when mothers and their 3-year-olds build with blocks together, the amount of spatial language, related gestures, and planning support the mothers provide predicts the children's math skill in first grade.

The impact of playing with blocks and its effects on spatial skills goes well beyond the early grades.

Another [study](#) found that children's preschool block-building skills predicted their high school math course selections, math grades and standardized math scores.

One implication of recent research is that children should be screened for spatial skills early in life, just as they are for reading skills, Krasa said. The good news is that "spatial skills are trainable, especially if we can identify those who need help early."

Another important finding of recent research is the importance of language in learning mathematics, she said.

"Math language is very abstract. Students may understand math concepts better with familiar terms, such as 'and' instead of 'plus', for example."

"Also, math is not separate from reading. Research has shown that children with reading disabilities, particularly dyslexia, are at a great risk for math failure."

One study found that of children who had been diagnosed with a developmental language disorder in kindergarten, 55% had serious math difficulties by the fifth grade—more than 10 times the rate found in the general population.

Despite the alarming statistics about math knowledge among American children, Krasa said working on the book has convinced her that the situation is not hopeless.

"I believe that with the proper supports, all children in the normal range of intelligence can learn math. Even with challenges like poverty, reading and language disability, weak [spatial skills](#) and attentional issues, they can learn and understand the fundamental concepts," she said.

The key is that students have to begin early, or, if they don't, they have to go back and begin with the fundamentals. Math skills and concepts that students learn in high school are built on those from elementary school—and those are built on skills learned in preschool and at home.

That means many of the problems that students face in high school find their roots in early [math education](#).

"If we're going to get it right, we have to start from the beginning," Krasa said.

The U.S. failure in math education is not the fault of teachers, she said. They are doing the best they can given their training and the challenges they face.

"We want teachers to have the latest research on how [children](#) actually learn math so they can help turn things around. That's why we wrote this book."

The book offers activities that are easily understandable for teachers and parents, but that aren't currently being used in most classrooms, she said.

These new approaches are desperately needed.

"Clearly, something is not working in math education in this country. We could be doing much, much better," Krasa said.

Provided by The Ohio State University

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