Numeracy for All

U.S. kids were struggling in math even before the pandemic. Here are four key ways to help students understand.

By SHALINEE SHARMA

FOR THE FIRST TIME SINCE THE 1990S, in nearly every state, 4th graders and 8th graders who took the National Assessment of Educational Progress exam lost ground in math. Leading researchers have stipulated that low-income students may have lost up to 22 weeks of learning instruction. The surrounding rhetoric indicates that even with learning recovery efforts, we may have lost a generation of math learners.

While these sobering statistics have provided a long overdue wake-up call, kids have been struggling in math for decades. Even before the pandemic, the United States ranked 37th in math out of 77 countries that participated in the latest Programme for International Student Assessment. The pandemic has only intensified the need to ensure U.S. students deeply understand math.

As the CEO and co-founder of Zearn, I've spent the past decade working alongside educators and researchers studying real-time data on building math understanding. What I know for sure is that every kid can learn math and that we can take steps to create a numerate society. Among the key steps to doing that:

• Create learning experiences that equip students to make sense of math

As a 6th grader in Buffalo, New York, I was in the advanced math class. I remember math as flipping to the next chapter and seeing a brand-new thing that I was going to learn. With each new chapter, I memorized a list of often disconnected procedures.

My memory reflects what international rankings, like PISA, have shown: the traditional American approach to math is not a formula for deep understanding. U.S. students tend to learn by memorization and employ tricks rather than developing true understanding. Across the board, students who characterize themselves as memorizers score lowest on the PISA exam. By contrast, kids outside of the United States performed better on PISA because they are more than an inch deep in their math understanding. When teachers present math as a progression of a few big ideas, it leads to deeper understanding.

One of the most proven approaches to do this is the Concrete to Pictorial to Abstract framework. This teaches kids to understand math concepts in an intuitive and tangible way and helps them to see how they can apply their knowledge to real-world problems.

For instance, rather than tell students to memorize that 3 x 0 = 0 or N x 0 = 0 or anything times zero is zero, we start with the concrete. We take out three plates. If the three plates have one cookie each, then we have three cookies or 3 x 1 = 3. If the three plates have two cookies each, then we have six cookies or 3 x 2 = 6.

If we, however, have three plates and zero cookies on each plate, then we have zero cookies, so 3 x 0 = 0. Similarly, if we had 20 plates with zero cookies on them, then that is zero cookies

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too. It then becomes clear to kids why N x 0 = 0. It's not a rule to memorize. It's an idea to understand.

This is how the Concrete to Pictorial to Abstract framework provides students with a deeper understanding. The framework also gives students an anchor when they don't know how to start or solve a problem. Students who learn this way will look at equations and try to turn them into pictures or stories they can concretely understand. Ultimately, that helps them to tackle any problem.

• Accelerate the math learning of every student

During a short period of time in my childhood, I was very sick and missed a lot of school. When I returned, teachers would try to work with me on every concept I had missed. This was challenging, but we're talking about weeks of unfinished learning.

Today's teachers have an unprecedented task of addressing more than two years of disrupted learning, and they simply do not have enough time to go back and reteach everything.

The great news is they don't have to. A better way forward exists.

Learning acceleration is a promising approach that focuses on teaching students lessons appropriate for their grade level, and reteaching only the skills and lessons from earlier grades that are necessary to understand the new content.

Imagine a 7th grade lesson on negative numbers. Part way through the lesson, a student—let's call her Brianna—is confronted with this problem: 1.4 / 2 = ?

Brianna is stumped on operations with decimals, specifically division. She is supposed to be learning about negative numbers, a new idea, but she is stuck here.

In a traditional remediation approach, she would be stopped here, and she might not see negative numbers again for weeks or months. Because division of decimals is a 5th-grade concept, she would stop moving forward in and spend her time catching up on 5th-grade content.

Learning acceleration is a different way of helping Brianna. Instead of going back and doing an extensive review of decimal operations, she begins with what she knows: whole-number division (14 / 2=?). She is provided a short lesson that demonstrates how dividing decimals follows all the same rules as dividing whole numbers. Then she goes back to the negative number lesson.

The next few times she confronts decimal operations she needs these short lessons again in the context of her 7th-grade learning. After a little while, however, Brianna has caught up on decimal operations and all the while moved forward in her 7th-grade learning of negative numbers.

• Implement scalable and coherently connected extra learning time

Extra learning time—often in the form of tutoring—is something often only afforded to select students. My 6th-grade twin boys have been fortunate to receive extra support in areas where they have needed more help.

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Not everyone is so fortunate. To ensure all kids can catch up and move forward in math, we must implement extra learning time at scale. Moreover, this extra time must be coherently connected to what students are learning in core math time. It also must address any confusion on specific topics being taught. Absent this alignment, we are wasting students' extra learning time.

Recently, one of my sons needed help with ratios, which he was learning in his math class. To promote understanding, his teacher used extended time to address his specific questions and present ratios in a different way. I am grateful that this extra learning time was dedicated to understanding ratios versus having him spend time on concepts he may not have fully mastered from prior grades.

Tennessee and Texas educational leaders have approached their statewide, high-impact tutoring programs in this manner.

• Share real-time data to make ongoing, evidence-based improvements

Data must be used better to continuously improve: to identify what is and isn't working and to effectively communicate what needs to change to best support students' learning. Leaders must employ data to drive decisions from selecting curricula and leveraging technology to determining how extra learning time is spent.

By sharing real-time data and partnering with experts from various fields, we can answer the most important questions about how kids come to understand the big ideas in math and apply them in real life. Progress in teaching and learning will not come from making a single, massive change overnight, but from many small, yet critical, evidence-based improvements along the way.

Math is imperative for individuals and for society. It has been critical to my success and my enjoyment as a learner. For this to be true for every kid, we must build a system that ensures numeracy for all. For every student to deeply understand and, dare I say, love learning math, every adult who touches students' school experiences has a role to play.

Shalinee Sharma is CEO and co-founder of Zearn, a nonprofit educational organization behind the math learning platform used by one in four elementary-school and 1 million middle-school students nationwide.