EDITOR’S NOTE
Addressing dyscalculia and math anxiety is vital to improving student's mathematical development, overall academic success, and long-term educational and career prospects. This Spotlight will help you with strategies for supporting students anxious about math; investigate how the overlap between reading and math disabilities can improve math interventions; weigh what it’s like to struggle with dyscalculia; and more.
Math Anxiety Weakens How Students Study. Here’s What Teachers Can Do

By Sarah D. Sparks

Math anxiety doesn’t just make students choke on tests. It changes their approach to learning the subject in ways that sets them up for ongoing failure.

A new study in the Journal of Experimental Psychology suggests math-anxious students choose less-effective ways to study, like rereading textbooks instead of working through real problems. This, in turn, can make them less prepared for exams and heighten the risk students will also “freeze” on the math test itself.

“The anxiety that happens in the moment [is] really robbing you of the ability to focus and do your best, and that’s one of the reasons why math anxiety was often related to poor performance. But we knew that wasn’t the whole story,” said Jalisha Jenifer, lead author of the study and postdoctoral research fellow at Barnard College of Columbia University. “Now we’re able to start pinpointing the way in which highly math-anxious people also… walk in less prepared.”

While students who are initially low-performing are also at higher risk of developing math anxiety, the study focused on students in Advanced Placement calculus courses.

Even among these students, whose placement put them above average performance in math, those with high math anxiety were less likely to study efficiently than students with low levels of anxiety about the subject.

For example, researchers found math-anxious students dedicated more time to passive activities like reading their textbooks or looking at already-solved problems—which prior research has found tends to make students think they understand more than they actually do about content. By contrast, they spent less time actually practicing math skills.

“Solving math problems can help you to understand where gaps may be in your knowledge; you may not notice those things if you’re just reviewing practice problems,” Jenifer said. “Without challenging yourself in those ways … you may never practice in the ways that you need for the exam.”

Pandemic may have heightened math anxiety risk

The findings suggest that focusing on explicit study and anti-anxiety strategies may be critical for educators working to catch up students who lost significant ground in math during the disruptions of the last two years. General anxiety has increased for students during the pandemic, and “it’s reasonable to expect increased levels of anxiety around math, especially if [students are] getting signals that you’re not where you should be, that you’re behind,” said co-author Sian Beilock, math anxiety researcher and president of Barnard.

The vast majority of Americans report at least some levels of discomfort with math, and about a third report moderate to severe anxiety about the subject. More than 25 years of research suggests math anxiety can begin in the early elementary grades, but increases through middle and high school, particularly for students in groups stereotypically considered lower performers in math, such as women.

“Math may be a microcosm for what could play out in other areas,” Beilock said in an interview. “So if you have anxiety about biology or some other subject you're taking, I think what we’re showing here is, one of the reasons that anxiety tends to be correlated with poor performance is that anxiety pushes people to not engage in study material in a way that’s efficacious.”

In fact, a 2021 study in the journal Nature: Science of Learning found incoming college students with high math anxiety took fewer science, technology, engineering, and math classes, and underperformed in the ones they did take, compared to more-confident students with the same ability in math. Researchers led by Georgetown University psychologist Richard Daker concluded, “Math anxiety can account for associations between math ability and STEM outcomes, suggesting that past links between math ability and real-world outcomes may, in fact, be at least partially explainable by attitudes toward math.”

Simple changes can help math-anxious students

In a 2020 survey, 67 percent of teachers told the EdWeek Research Center that math anxiety was a challenge for their students. But Jenifer and Beilock said simple changes before and during testing can boost students’ confidence and performance.

As students prepare for a math test, Beilock said it’s important for teachers to explicitly describe what makes study methods effective or not.

“I don’t think people are always aware that their study strategies are ineffective and what might be pushing them in different ways,” Beilock said. “This research shows that there is a tendency for people who are anxious to stay away from more-difficult problems or...
Here’s How Test Prep Changes When You’re Worried About Math

Students with math anxiety consciously or unconsciously avoid active problem-solving, according to new Barnard College research published in the Journal of Experimental Psychology. That changes how they prepare for tests.

Teachers can help math-anxious students learn to study more effectively by providing both partially worked and unworked practice problems for review, which Jenifer said can ease students into practice. Similarly, teachers can give students more confidence to tackle challenging problems by asking students to solve them as part of games or puzzles, rather than for grades or homework.

On the day of a test, research suggests teachers can also help students reframe their physical symptoms of anxiety—such as sweating palms or a racing heartbeat—as signs of excitement or readiness. This reframing has been shown to help students avoid “choking” on exams.

Over time, helping anxious students learn to prepare more effectively and calm their anxiety in the moment can improve their math performance and help them gain more confidence in math—and even make them more likely to choose math and science work on their own.
Every student can master math.

A Complete Award-Winning Math Program

With 50 years of evidence-proven results, TouchMath consistently demonstrates that early intervention dramatically improves a student’s speed and accuracy, bolsters student confidence, and cultivates lifelong learning in both Special and General Education classrooms.

Aligned with your state standards, it includes interventions that work with any math curriculum, number sense to algebra through curriculum, manipulatives, classroom aids, and individualized instructional software.

TouchMath’s multisensory approach encourages students to see, say, hear, and touch, empowering them to achieve math mastery.

touchmath.com | 1-855-929-0880
Record numbers of U.S. students severely struggle with math, but only a fraction of them receive screening and support targeting potential math disabilities.

While math teachers in a nationally representative EdWeek Research Center survey this spring estimated that 40 percent of their students perform below grade level in math, only 15 percent of teachers said their students have been screened for dyscalculia, a learning disorder that affects a person’s ability to understand number-based information and math.

That’s why some researchers and educators are working to leverage what we know about the connections between dyscalculia and the much better-known dyslexia to identify new avenues to improve math learning for struggling students.

“We need to realize that children who have math difficulties will often also have difficulties in other domains,” said Daniel Ansari, a professor of developmental cognitive neuroscience at Western University in Ontario, where he heads the Numerical Cognition Laboratory. “There's lots of good reasons to think that is probably more the norm, and that very specific profiles of children who will only struggle with math and nothing else, they're more the exception.”

Dyscalculia, a severe, persistent learning disability in mathematics, affects about 5 percent to 8 percent of school-age children nationwide. That's roughly the same as those affected by dyslexia. Children with dyscalculia may have difficulties in a wide array of areas, including understanding the meaning of numerical symbols, such as number words and digits, and spatial processing, such as mentally rotating an object to match an example shape.

Dyscalculia and dyslexia often share underlying problems with attention, visual and working memory, and studies estimate a third to 75 percent of students with dyscalculia also have dyslexia, dysgraphia, or attention deficits.

While there are some potential genetic risk factors for dyscalculia, just as for dyslexia, strong classroom instruction and home support are the most important factors in mitigating both disabilities.

At first glance, reading and math disabilities may seem to have little overlap. “In reading, the skills do build upon each other more naturally than in math,” said Margaret Howells, a math teacher at the independent Wheeling Country Day School in West Virginia who specializes in helping students with dyscalculia. “In math you've got so many different types of things like telling time and fractions and multiplication, where you have so many different processes that you have to master.”

Yet there may be more overlap than first appears. Vanderbilt University research professor Lynn Fuchs and her colleagues are tracking indicators and interventions for math disabilities in early grades. They find that children's phonemic awareness and ability to verbally count Arabic numerals in kindergarten are strong predictors of their risks of both dyslexia and dyscalculia.

Interestingly, Fuchs said, the inability to count out loud predicts young children’s risk of math disability regardless of how well they understand the concept of ordinality, or putting numbers into a sequence.

Just as songs and rhymes are often used to teach the alphabet and early-phonics rules, experts say verbal counting songs (such as skip-counting songs) should be standard in early grades.

And Sarah Powell, an associate professor in special education at the University of Texas at Austin, found math interventions intended to improve calculations were more effective when they also focused on language comprehension, attention, and working memory.

“We want to move children to retrieval, to the extent possible, but we're not just trying to get them to memorize math facts—that's not a good intervention. In a good intervention, we're dealing with number sense, number knowledge, broadly defined number lines, counting strategies, decomposition [breaking a whole number into smaller numbers], all of it," Fuchs said.

EVIDENCE-BASED APPROACHES FOR MATH TEACHING

There are six basic approaches that the Institute of Education Sciences has found have significant evidence of effectiveness in helping students struggling with math.
**DYSCALCULIA AND MATH ANXIETY**

“By trying to capitalize on what we know about shared forms of cognitive processing for dyslexia and dyscalculia, we can improve outcomes in an efficient way,” Fuchs said, “which is important … because in schools, when you have difficulty across reading and math and really require intervention in both areas, you’re a lot more likely to get reading intervention than math intervention. Reading will take priority almost everywhere.”

**Leveraging dyslexia supports for math**

Howells came to her own approach to teaching students with dyscalculia through a reading intervention. A decade ago, Wheeling Country Day School developed a multisensory center to support students with dyslexia using a common intervention called the Orton-Gillingham approach, which uses visual, auditory, and tactile activities to help students better organize and process language.

Howells, a math teacher, had been using the approach for a few years when she began to adapt the model to help her students with similar behavior and attention problems in math.

One of the first dyscalculic students Howells worked with, “struggled greatly in subtraction with regrouping; we used blocks and blocks and blocks for a long time to help him understand that, but since he was in fourth grade, we were also working on understanding fractions … so we were kind of hitting it at both ends,” she said. “A structured literacy lesson does a lot of natural interweaving of previous activities or previous concepts that you’ve worked on, and it brings them back around in a patterned way so that students get that exposure and more practice.”

Now, the school is piloting a dyscalculia-adapted version of the dyslexia intervention, both through in-person sessions with students in Martinsburg, West Va., and in online sessions with students in Pittsburgh, Pa. and Waterville, Ohio.

Students may start a session with counting chants—by twos and tens, forward and backward, for example—before practicing mental math problems and pattern recognition or using manipulatives like base-10 blocks or a Dutch rekenrek, which is similar to an abacus.

“We used to think that maybe children with developmental dyscalculia were just born with a deficit in their ability to process quantity. I think that hypothesis has been quite resoundingly rejected at this point,” Ansari said. “I think [that’s] a very positive message, because we can also now assume that a lot of developmental dy-

---

**EVIDENCE-BASED APPROACHES FOR MATH TEACHING**

- Provide systematic instruction to develop math understanding. This includes reviewing and integrating prior concepts and sequencing instruction to build concept understanding gradually.

- Teach clear and precise mathematical language. For example, rather than using the terms “carrying” or “borrowing” in addition and subtraction, use the term “regrouping” to underscore that the operation involves changes to place value.

- Use well-curated concrete and semi-concrete representations of math concepts. Generally, concrete tools like manipulatives should give way to simpler representations like line drawings and finally to abstract representations like numerical equations.

- Use the number line to demonstrate math concepts and procedures. For example, number lines can be used to demonstrate comparing magnitude and operations for both whole numbers and fractions, measuring time or temperature, or graphing coordinates and data.

- Give explicit instruction on word problems focused on deepening students’ understanding and ability to apply math ideas. This includes teaching students how to identify and develop strategies to solve different types of problems, such as change or ratio word problems.

- Include regular, timed activities to build math fluency. Students may be motivated by beating their own time on successive timed math exercises. Timed activities can be used for more than just basic math facts like multiplication tables, including common tasks needed for complex problems, such as equivalents for fractions.

---

**SOURCE:** Institute of Education Sciences, U.S. Department of Education
Dyscalculia and Math Anxiety

If we’re going to catch up on our math gap in this country, we can’t dump it all on teachers.”

LAURA OVERDECK
Be Part of the Equation

Dyscalculia has to do with how children are taught math and how they are given opportunities to learn about numerical symbols very early on.”

Teachers need greater guidance

Integrating interventions for dyscalculia and dyslexia may also help ease in teachers who have not had as much experience delivering math interventions.

In the EdWeek Research Center survey, nearly 75 percent of teachers said they had received little to no preservice or in-service training on how to support students with math-related disabilities, and 40 percent said they have no math coach or interventionist at their school.

K-8 math coaches Elly Blanco-Rowe and Jen Gleason of Teaching Matters, a nonprofit professional-development organization in New York City, said most of the math teachers they work with had not previously been trained to provide systemic, evidence-based interventions for struggling math students.

“For example, there’s a strategy called the five practices, which is a more inquiry-oriented approach,” Gleason said. “It emphasizes the discourse that is really important for students to learn from each other: to be able to justify their solutions, compare solutions, agree and disagree. ... It is an important way to build conceptual understanding in the mathematics classroom that looks very different [from traditional teacher preparation].”

The dire headlines about students’ math performance in recent years may have a silver lining, as millions of dollars in federal and foundation money have been dedicated to developing more math interventions and professional development for teachers. Powell, for example, is training math educators to provide more explicit approaches to word problems to students with dyscalculia as well as English learners.

Nurturing parent advocacy in dyscalculia

There’s still a long way to go before math learning disabilities get the same attention as those in literacy, experts caution.

“I think the problem with dyscalculia is that it is still very much something that people don’t talk as much about. With dyslexia, it’s not just the research that’s further along; it’s also the advocacy for struggling readers. There’s not the same sort of advocacy for struggling math learners,” Western University’s Ansari said.

For example, while nearly all states have laws defining dyslexia, fewer, such as New York, Texas, and West Virginia, explicitly mention dyscalculia.

Laura Overdeck’s Be Part of the Equation initiative, launched earlier this school year, hearkens back to an old-school anti-drug campaign to impress on parents the need to educate themselves about math disability issues and “talk to their kids about math.”

The program provides math conversation starters and homework help sheets for parents. Overdeck, the founder of the nonprofit Bedtime Math, recommends schools educate parents about dyscalculia and encourage families to develop habits around math puzzles and games—in the same way schools often do with family read-a-thons.

“If we’re going to catch up on our math gap in this country, we can’t dump it all on teachers; we need more adults on deck, and the parent is the person closest to that child,” said Overdeck. “But parents are not confident with math. They’re nervous about their 3rd grader’s homework. We need to at least have parents able to do elementary math alongside their kids.”

Additional Resource

View this article’s charts
Dyscalculia is a learning disability that few people have heard of or understand, even though it affects roughly the same amount of school-age children—about 5 to 8 percent—as the well-known learning disability dyslexia.

While dyslexia affects the ability to read, students with dyscalculia experience difficulty in mathematics and number-based learning. These students can have trouble grasping meanings of numerical symbols or understanding spatial processing such as the rotation of an object in their mind.

Nationwide, only about 15 percent of students have been screened for the disability, yet many more seem to be struggling, especially now as schools work to close learning gaps widened by the pandemic. According to a nationally representative survey conducted by the EdWeek Research Center in April 2023, about 40 percent of math teachers nationwide say that their students are performing below grade level in math.

While the term “dyscalculia” was coined in the 1940s, it did not become more widely known until the 1970s. Research on the disorder picked up in the 1990s with the widespread use of MRI technology, but it’s still not widely understood, according to advocates.

Five adults with dyscalculia spoke with Education Week about what it was like to struggle in K-12 schools with a disability that was largely unrecognized and how they had to learn to accept their disability and get the help they need.

Dyscalculia affects everyone differently

Dyscalculia broadly affects an individual’s understanding of mathematical concepts, but the severity of the disorder and the tasks and concepts that each person struggles with vary.

Kendal Cladek of Washington state, who graduated from high school in 2020 and was diagnosed with dyscalculia in 5th grade, noted that “dyscalculia can affect anyone regardless how someone looks or acts.”

Svetlana Roseberry, a recent high school graduate from Greenville, S.C., was diagnosed with dyscalculia as a high school senior after struggling with math through her entire educational experience. Even outside of the classroom, dyscalculia affects her life today. She said everyday tasks, such as counting, reading clocks, and understanding directions have always been difficult for her.

“Graduating from high school to college, you should probably know that by now, but I don’t know how to do that.”

In the classroom, it is difficult for mathematical concepts to stick in her head, no matter how long she studies.

Nate Peters, who graduated from high school in 2012 in Galway, N.Y., had a similar experience. While he was diagnosed with a learning disability in high school, no one put the name “dyscalculia” to it. He was not diagnosed with dyscalculia until 2016. Although he was dedicated to studying and doing well, he could never remember the mathematical material he spent hours memorizing.

“I would kill entire evenings from 7 o’clock until 1 a.m. [studying] and come in the next day [to school], and it’s [the material] just not there,” Peters said.
Throughout school, Peters also struggled with standardized testing because of his learning disability. “Those terrify any person without a learning disability,” Peters joked. “I already knew I was going to bomb any state testing that I had to take that in any way concerned itself with mathematics.”

Peters said he believes that standardized testing practices need to be changed for students with learning disabilities because of the way that he struggled while in K-12.

“Extra time doesn’t always cut it as far as providing accommodations,” Peters said. “You can’t just test someone from memory when it’s literally incapable of being stored in their long-term memory. Giving someone extra time to sit there and not recall something does not get to the heart of the issue.”

Anna-Maria Hadbah was diagnosed with dyscalculia in 2019, in her senior year of high school. Although she is now a STEM major, taking up biology at the University of Michigan, she has struggled with math her whole life.

Her experience with dyscalculia differs slightly from Roseberry’s and Peters’, showing how the diagnosis exists on a spectrum.

“My brain speeds up when I am looking at numbers,” Hadbah said. “I will definitely mix numbers up and letters. Algebraic equations will confuse me.”

Because of her difficulty with numbers, she takes a lot of extra time when working on school assignments to ensure she gets everything correct.

“I will double and triple check to make sure everything is fine before I turn in an assignment,” Hadbah said. “Definitely I need a lot of reassurance and a lot of time to remind myself, ‘OK, don’t rush into it because if you rush you’re going to mess things up.’”

Self-esteem issues and dyscalculia

Navigating growing up alongside academic demands is a difficult phase of life for anyone. While going through puberty and life changes, students also must learn how to socialize and find their friend groups. Throughout K-12, many students focus on fitting in, while also trying to figure out who they are. Having dyscalculia adds one more challenge to the demands of growing up, juggling academics, and making friends.

“The hardest part of having dyscalculia in my K-12 experience was dealing with a disability on top of the normal aspects of growing up,” Cladek said.

She struggled with accepting her reality as a student with a learning disability.

“Growing up with dyscalculia greatly affected my self-worth and not feeling like I am enough,” said Cladek, who is now a college student. “If I could only be able to fit in with the rest of the kids and not have this anxiety and frustration every time I look at a math problem on my worksheet, then I’ll be enough, was a common thought I had.”

Others related to Cladek’s experience of dealing with low self-esteem and struggling with self-acceptance. Roseberry remembers how embarrassed she felt because of her inability to do math at the same level as her peers.

“When it came to other people knowing math a lot easier than I did, I would think ‘I should probably know this, but I don’t,’ and it’s embarrassing,” Roseberry said.

Hannah Pikula, another former student diagnosed late in her K-12 career, has fond memories of schooling, especially high school. But she still remembers feeling different from other students before receiving her diagnosis.

“I think there’s a sense of otherness especially if you haven’t gotten a diagnosis,” Pikula said.

Hadbah spoke about being overly concerned with what her peers thought of her and of those thoughts being magnified by feeling so different from them.

“Feeling and thinking like I was slower than everybody else,” Hadbah shared when asked about the hardest part of navigating K-12 with dyscalculia. “Having the fear of ‘if I ask this question, everyone’s going to think I’m stupid.’”

Accommodations and dyscalculia

These adults, whether they received their dyscalculia diagnoses while in K-12 or not, all had Individualized Education programs, or IEPs, while in school. IEPs legally require the school district to accommodate the students’ learning disabilities, but these former students said that this was not always the case with some teachers.

“Despite the diagnosis, it was a battle to get my accommodations followed by every teacher because they didn’t understand how badly I needed them,” Cladek said.

While some of the adults told Education Week that their accommodations were respected, Cladek had the opposite experience. Because it was a new diagnosis that not many people understood, she struggled to get teachers and students to believe how badly she was struggling with math.

“I didn’t feel supported ... but by going to other outside professionals, I was able to have others step in and advocate for me and introduce the school district to support me in the best ways that work best for me,” Cladek said.

Roseberry also said that teachers thought if she put extra work and time into the material, she would catch up to her peers.

“My brain doesn’t understand how [the math] works,” Roseberry said. “[Teachers think] ‘everybody can do math.’”

The diagnosis helped

While receiving the diagnosis can be scary, it was actually helpful for these adults. Once diagnosed, they were able to use resources that were available and understand why they struggled so much with math in school. They advised students struggling with math to get screened for dyscalculia as early as possible. Those who were diagnosed late in high school or after graduating from high school, in particular, said they wished they were diagnosed earlier.

Roseberry was diagnosed later in her high school career, but she felt relieved once she finally found out that she had dyscalculia.

“When I thought about it, I was happy that I got diagnosed with it,” said Roseberry, who is now a college student. “If you get diagnosed with it, try to get resources or the help that you need.”
Peters was not diagnosed until a few years after high school.

“Once you know what it is you can kind of get to the heart of the issue,” Peters said. “I really do think if they put some emphasis on actually diagnosing if someone has dyscalculia, I really do think that would benefit a lot of students.”

Pikula agreed.

“Being able to be more open to getting an IEP or looking into how you learn as an individual is a life skill,” Pikula said.

Some said the diagnosis can bring a sense of closure and relief after struggling for so long but not knowing why.

“I literally broke down in tears, because my entire life I was telling myself, ‘I’m stupid,’” Hadbah said.

**Words of encouragement**

As graduates of K-12 schooling, these adults offered words of encouragement and advice to students who may be going through similar experiences. They want other students to know they are capable of surviving school as well.

Because it was such a large obstacle to navigate, Cladek said having dyscalculia taught her how to overcome adversity and adapt to a difficult situation.

“The emotions you experience during cognitive development along with recognizing there are areas that require more effort and more time to fully grasp can make it more difficult to learn, but it will show you how to effectively deal with challenges and still have a good education experience,” Cladek said.

She said that navigating through the challenges brought by dyscalculia only make an individual stronger and more successful.

“The challenges you face only make you more successful if you don’t let it define you,” she said.

Pikula encouraged others to not be discouraged and know that no space is off limits to a person with dyscalculia.

“People that have this way of thinking see things very differently and uniquely and should be invited into more conversations that you would think they wouldn’t excel in,” said Pikula, who is now a social media manager.

“People with dyscalculia can become engineers, they can become scientists.”
Examining the Impact of Dyscalculia and Math Anxiety on Teaching and Learning

Mathematics, a subject that often separates students into those who ‘get it’ and those who don’t, can be compounded by a teacher’s confidence when teaching the subject. As an educator, have you ever wondered why some students struggle with mathematics more than others? Have you ever avoided teaching math or specific math concepts because it makes you uncomfortable? For students and teachers alike, this could be more than a dislike or disinterest in mathematics; it could be math anxiety or dyscalculia.

Despite dyscalculia being recognized for over a century, it remains under-researched and under-diagnosed, especially when compared to dyslexia. From its initial discovery in 1919, to its formal recognition as a learning disorder in 1974, only a handful of states have enacted specific legislation to support students struggling with math, and those who have dyscalculia. This lack of recognition is concerning, given the prevalence of math anxiety, a condition identified in the 1950s that affects one-fifth of children and adults in the U.S., including those with dyscalculia. With the U.S. Bureau of Labor Statistics predicting rapid growth in math-related jobs, there is a pressing need for effective multisensory instructional strategies to assist all students, including those with dyscalculia. These strategies must not only support students, but also bolster teacher confidence, as educators may also grapple with similar anxieties.

Dyscalculia: Knowing is Half the Challenge

Dyscalculia is a math specific learning disability that affects a person’s ability to understand and manipulate numbers. It often manifests as difficulty with number-related concepts, the use of symbols or functions, comprehending arithmetic operations, and performing accurate math calculations. Dyscalculia can significantly impact daily life activities that involve numerical information, such as time management, budgeting, or understanding distances. People with dyscalculia don’t simply struggle with complex mathematical problems; it is a fundamental and profound difficulty with basic numerical concepts.

When diagnosing dyscalculia, the DSM-5-TR focuses on evaluating four major areas: number sense, memorization of math facts, accurate and fluent calculations, and accurate mathematical reasoning. These areas are generally difficult for individuals with dyscalculia. However, not all children show weaknesses in every area, showcasing as much variety within the group as between those with and without dyscalculia (Kroesbergen et al., 2022; Menon et al., 2020). The cognitive and neuroscience fields highlight these deficits as specific to math domains and indicate they are predictive of future math performance.

TouchMath’s Way Forward

Research indicates that math anxiety interventions can benefit those with dyscalculia, a condition affecting 5-7% of students worldwide. Early interventions and support systems can significantly aid these students in mastering mathematics, regardless of a formal diagnosis. Crucial to this approach is the use of reliable dyscalculia screeners, like DySc by TouchMath. This universal tool helps identify potential dyscalculia indicators and assesses basic math skills predictive of future performance. The detailed report provided by DySc guides intervention efforts and outlines an action plan for future instruction based on individual results. Designed for early intervention from age three, DySc, a fully-subsidized tool, aims to support those with dyscalculia and students who struggle with math. The goal is to shift the educational paradigm to emphasize math development alongside reading, equipping educators and parents with research-backed strategies to assist students.

DySc evaluates students on number sense, memorization of math facts, accurate calculations, and mathematical reasoning — in alignment with the DSM-5-TR — filling a critical gap in early intervention and support for students struggling with dyscalculia.
Strategies for Overcoming Math Anxiety

For the Student

Break Tasks Down: Imagine your student sitting down to tackle a complicated word problem. They might start to panic, thinking, “I don’t even know where to start.” Teaching this student to break the problem into smaller steps can help reduce their anxiety. They might begin by identifying and labeling the subjects of the problem, then move on to applying the appropriate function. This approach turns a daunting task into a series of more manageable steps, easing the student’s anxiety.

Use Errorless Learning: Consider a student who often struggles with subtraction, particularly the idea of “borrowing” from the next digit. The student is faced with a problem: 52 - 27. They begin to feel anxious, worrying, “I always get these wrong.” You can employ the errorless learning strategy and walk through the problem with the correct steps. You can say, “Let’s try this together. We cannot take 7 from 2, so we need to borrow from the 5 in the tens place. Now we have 12 minus 7, which is 5. Then we have 4 minus 2, which is 2. So, the answer is 25. Let’s say it together: 52 minus 27 is 25.” By reinforcing the correct response, decreasing the chance of providing an incorrect response, you can help the student remember the correct process for subtraction, thereby easing their math anxiety.

Activate Prior Knowledge: As you prepare to introduce a new concept like mixed numbers for example, you might say, “Tomorrow, we’ll be learning about mixed numbers, which are very similar to the fractions we already know. Just like fractions, mixed numbers also have numerators and denominators, but they have an additional whole number component.” This prompt serves to activate the student’s prior knowledge about fractions, providing a familiar foundation upon which to build the new concept of mixed numbers. It helps to alleviate the student’s anxiety by highlighting the connections between what they already understand and the new material they will be learning.

For the Teacher

Plan for Road Bumps: As you start to plan your lessons for the week you may come across one that makes you feel anxious, worrying, “What if I can’t teach this effectively?” To alleviate this anxiety, review the lesson and break it down into smaller tasks so that if faced with a student who is also experiencing anxiety with the lesson, you can feel confident knowing how to model appropriate strategies to help them through the challenge. Teacher anxiety has been shown to heighten student anxiety.

Shadow a Peer: Teachers who experience math anxiety may benefit from shadowing a veteran teacher within their school or district. This observational learning experience allows you to gather effective teaching strategies, observe how the expert teacher manages doubt, and builds confidence in the subject matter. You’ll see firsthand that it’s possible to effectively teach math, even if it seems daunting at first.

Join a Learning Community: Your confidence in a certain subject affects your level of anxiety. It may be a good idea to join an online teacher community or a community in your school or district. There are many math specific communities online and these platforms are diverse, filled with experienced educators who exchange teaching strategies, discuss complex topics, and provide mutual support. The support and shared experiences from the community could significantly lessen your anxiety, helping you approach lesson planning and teaching with confidence and competence.

Every student can master math.
Undiagnosed dyscalculia may not only affect the way a student experiences math, but also the way a teacher perceives their mathematics teaching abilities. When diagnosing dyscalculia, the DSM-5-TR focuses on evaluating four major areas: number sense, memorization of math facts, accurate and fluent calculations, and accurate mathematical reasoning. Here are some common signs of dyscalculia that you can look for if one of your students may be failing to understand math concepts.

1. **Difficulties with number sense** which encompasses challenges in recognizing and understanding quantities, number words, Arabic numerals, and number skills like counting, number patterns, subitizing, using a number line, retrieving arithmetic facts, and problem-solving operations (Geary, 2013; Menon, 2020).

2. **Challenges estimating time, distance, and volume** can look like underestimating or over-estimating how long it will take to complete a task or being late, misjudging the appropriate amount of space needed to perform an activity, or difficulty estimating the quantity or capacity when pouring milk or another beverage into a glass.

3. **Trouble with memorization of math facts**, where students may experience trouble recalling arithmetic facts and rely on strategies like finger counting, leading to significant delays in problem-solving compared to their peers (Mahmud et al., 2020; Price & Ansari, 2013).

4. **Issues with money-related tasks**, which could look like struggling to make change, calculating a tip, or estimating sales prices with tax. It also involves struggling to keep and maintain a budget.

5. **Struggle with accurate and fluent calculations**, showing longer solution times and higher error rates, frequently using inefficient early developmental counting strategies for problem-solving (Mahmud et al., 2020; Szardenings et al., 2018).

6. **Challenges using analog clocks and maps** may also affect those with dyscalculia. This can manifest as an inability to judge time or being able to interpret the position of the minute, hour, and second hands. When using a map, this can look like confusion while utilizing symbols, legends, and scales as well as spatial orientation and visualizing the relationship between the map and the real-world environment.

7. **Trouble with accurate mathematical reasoning**, including difficulties in quantity and magnitude judgment, mapping numeral or symbol representation to actual quantities, and understanding number sequencing, which includes skip counting intervals with increasing or decreasing numbers. This difficulty extends to estimating time duration and spatial dimensions (Lewis et al., 2022; Menon et al., 2020).
Rates of anxiety have spiked among school-age children in recent years, and this chronic stress can hamstring students’ efforts to recover lost academic ground.

As part of the Teacher Anxiety Program for Elementary Students (TAPES) pilot program, educators learn and role-play ways to identify students who are experiencing anxiety in class and intervene to help them.

Golda Ginsburg, a professor in child psychiatry at the University of Connecticut who developed the program, spoke with Education Week about how anxiety affects student learning and how teachers can help their students become more resilient.

The interview has been edited for length and clarity.

Teachers aren’t therapists. What role do they have in addressing student anxiety in the classroom?

If we relegate mental health interventions only to the school psychologist or social worker, then there are so many students who are going to go on without help. The school psychologists and social workers just don’t have the capacity. Even if a student is receiving psychotherapy and medication from an outside provider or from a school based mental health provider, still there are things that the teacher can do in the classroom to reduce anxiety among all her or his students.

How can a teacher recognize when a student is anxious rather than bored or misbehaving?

Teachers often pay attention to the students who are acting out. Often teachers think [anxiety-driven behavior] is ADHD, attention-deficit hyperactivity disorder. For school clinicians, those are the kids who get referred.

Some teachers are good at identifying when [anxiety] is manifested behaviorally, but a lot of times students with anxiety fly under the radar: They sit in the back, they’re quiet.

We know that anxiety has a negative impact on academic performance and academic functioning.”

GOLDA GINSBURG
Professor in Child Psychiatry,
University of Connecticut

They might be teary-eyed, but they don’t ask questions, they don’t raise their hands. So they get ignored; they get overlooked.

With academic performance, there seems to be a chicken and-egg problem of whether students fail because they are anxious or are anxious because they struggle with a subject, like math. How can teachers break that cycle?

We know that anxiety has a negative impact on academic performance and academic functioning. There’s often a reciprocal relationship between academics and anxiety. But we know that anxiety doesn’t have to be related to their [initial] academic performance to interfere with learning.

There are kids more likely to have generalized anxiety disorder who are perfectionistic; if they begin to fail, or even have poor performance in their own minds, that increases their anxiety. So they’re spending hours and hours and hours every night, making sure there’s not one mistake on their homework and they are getting straight A’s. But they’re so preoccupied during the day by their worries that they can’t pay attention.

Any intervention for students struggling with anxiety who have poor academic performance has to be a multiple-component treatment. So they might need academic skills—tutoring, for instance—and an intervention to reduce anxiety.

What is the most common mistake teachers make when dealing with a student experiencing anxiety?

Teachers have a whole classroom of students to manage, and so typically they might say, ‘Yes, go to the school nurse,’ if the student says, ‘Oh, my heart’s racing,’ or ‘I have a stom-
achache’—when it’s really anxiety and not a medical condition. They’ll accommodate the anxiety, meaning they’ll allow the students to avoid anxiety-provoking situations.

The teachers’ intention is well-meaning, in that they don’t want to trigger anxiety in the student. However, what we know from the psychological treatment literature is that, if we avoid what we’re afraid of, and we allow students or our children to avoid what they’re afraid of, that maintains anxiety as opposed to reducing it. In the long run, the children never learn that they can handle that anxiety, and they never get a chance to develop the skills they need to do the task at hand, whether it’s presenting in front of a class, working with a group of kids, whatever it might be.

What, then, is the proper way to help students who show anxiety in the classroom?

We do teach methods for supporting the students to face their fears and also teaching them other coping skills. Because SEL, or social-emotional-learning programs, have infiltrated so many classrooms across the country, lots of teachers actually have been getting training around how to do, say, mindfulness, or relaxation strategies, or meditation strategies. All of these strategies are usually part of treatment programs to reduce anxiety.

There’s another kind of set of strategies related to growth mindset. Teachers are learning, how do I adjust my and my students’ thinking about failure and potential? That’s part of anxiety-treatment programs as well.

In order to help the student actually reduce anxiety, [the teacher is] going to have them answer the question in class, present in front of the class, using a gradual approach. It’s not as if the student on the first day is going to be expected to stand on the stage and recite poetry. It’s just one step at a time to gradually face your fears, so that you develop confidence and a sense of competence. And ultimately, that reduces your anxiety.
At least seven states have recently passed legislation targeting math instruction—laws that require schools to identify and support struggling students and mandate that teachers receive additional training.

The flurry of state action comes after several years of legislative focus on one of the other three Rs: early reading instruction. Laws in 32 states and the District of Columbia have required that states recommend evidence-based reading curricula, provide training for teachers in best practices, and create plans to support struggling readers.

The new math laws are pulling on the same levers.

Such a targeted focus on math improvement has been long overdue, said Karen Anderson, the director of the newly created Office of Mathematics Improvement at the Alabama State Department of Education. The state legislature passed a law last year that requires screening K-5 students for math difficulties and providing math coaches to elementary schools.

Alabama has expended significant effort to improve students’ reading skills over the past few years, Anderson said. “Math has just not received the same amount of attention,” she said.

In part, Anderson thinks, this has to do with a cultural assumption in the United States that some students just aren’t “math people.”

“If I told you I only knew half my letters and couldn’t read, that would be appalling,” she said. But it’s common for parents to say that their families are just bad at math, she added. Anderson hopes that the changes specified in the new law can challenge that kind of acceptance.

The new laws recognize that many students may need extra help in the subject, and call on schools to provide that support, said Sarah Powell, an associate professor in the department of special education at The University of Texas at Austin who studies math instruction.

The notion of different stages of intervention depending on student need—sometimes called “multitiered systems of support”—is often considered the provenance of special education, not a practice that can help in general education, too, she added.

“For a very long time, MTSS, it was like, ‘That’s a special education thing.’ And I think this is realizing … there’s a lot of kids who are struggling with math,” Powell said. “They’re looking at their test scores and saying, ‘This is a majority of kids who are in our schools.’”

Student need has deepened since the pandemic. Math scores fell across the board on the National Assessment of Educational Progress, and the proportion of lowest-achieving students grew.

Still, educators and researchers alike warn that passing these laws is just the first step. Questions of implementation, from overarching decisions about how to define “evidence-based” instruction to the nitty-gritty work of selecting diagnostic tools, will determine whether these new mandates actually improve student outcomes. (Education Week documented the challenges of putting the reading laws into practice in a special reporting project.)

Carrie DeNote, an elementary math coach in Brooksville, Fla., and the president of the Florida Council of Teachers of Mathematics, said she still has a lot of questions about the law passed this year in her state.

Florida’s law requires schools to provide support for students in grades K-4 who show a “substantial deficiency in mathematics or dyscalculia.” The state’s department of education recently released guidance for identifying these deficiencies.

“Sometimes legislation comes out, and they don’t really have all of the details worked out,” DeNote said.

How to define ‘evidence-based’ instruction

Several of the new laws say that instruction should be based on evidence. Colorado requires training for teachers on “evidence-informed practices.” Alabama mandates “evidence-based” teaching methods and curricula. Florida calls for “evidence-based” interventions.

“A big question is always, ‘What is their definition of evidence?’” said Powell.

“Often it’s a very small group of people,
sometimes one person, who is making decisions for thousands, tens of thousands, hundreds of thousands of kids and their teachers, and it kind of just depends on the background of that person,” she said. “I think states are struggling with that.”

This focus on “evidence-based” practice is present in reading instruction, too, and debate over what that means has demonstrated how difficult it can be to pin down a definition of the term.

In reading laws, many states outline the five components of reading listed in the National Reading Panel’s 2000 report, mandating instruction in each. But an analysis of the laws’ content released in July noted that most don’t highlight newer findings published over the two decades since the panel’s report was issued. Some laws invoke the phrase the “science of reading,” but define it differently.

Questions about what kind of evidence to prioritize, and how to define evidence-based instruction, will likely surface in math, too.

Over the years, one of the biggest sticking points in conversations about early math instruction has been about how much emphasis to place on fact fluency vs. conceptual understanding. Research shows that developing these skills and knowledge is an iterative process—students do need to be able to quickly recall their times tables, for example, but understanding why numbers make the products that they do helps students anchor the facts to broader mathematical knowledge.

Thoma Thacker, a math instructional facilitator in Little Rock, Ark., and a vice president of the Arkansas Council of Teachers of Mathematics, said she’s “fearful” that districts will interpret the state’s new law to mean a focus on rote memorization—even though young students also need to be taught strategies for solving word problems and have opportunities to create visual representations of math ideas.

Defining what “evidence-based” means can seem like a nebulous task, but it’s a key piece of the implementation process, influencing everything from what screening tools states decide to use to which interventions they choose to how teachers are trained.

There are intervention approaches that researchers have shown can help struggling students, said Powell, referencing practice guides developed by the Institute of Education Sciences’ What Works Clearinghouse, part of the U.S. Department of Education.

But while there may be proven practices, there aren’t as many off-the-shelf intervention programs in math as there are in other subjects—especially reading, said DeNote, the Florida math coach.

“It is important for us to figure out what those interventions are going to look like—past a workbook page,” DeNote said.

In Alabama, the state department of education has struggled to find tools to meet some of the law’s requirements, Anderson said.

“I think sometimes, when you have groundbreaking legislation, it really shines a light on needs that have always been there but heretofore have not been fulfilled,” she said.

Focusing on teacher training

Administering all of these assessments and interventions requires trained educators—teachers, math interventionists, and specialists.

Some laws require hiring new staff, such as Alabama’s, which allocates one to two math coaches for every K-5 public school. Others, including Colorado, Louisiana, and West Virginia, focus on additional training for teachers.

Hiring new personnel and training in-service educators requires funding, said Powell. “That stuff is not cheap, and it’s also not a one-time thing.”

Then there’s the problem of finding appropriate professional development. In reading, many states have turned to Language Essentials for Teachers of Reading and Spelling, or LETRS, a well-known early reading training. Others, like Texas and Tennessee, created their own professional learning courses, and still others have provided a menu of options for districts to choose from.

With math, “there’s not as much out there,” Powell said. She’s currently working with Kansas to create their own training for math professional learning.

Alabama is also providing its math training in house, offering professional development for coaches through the state education department’s Alabama Math, Science, and Technology Initiative.

As more teachers receive training, and more students are screened in math, DeNote thinks that these changes could prompt a larger-scale reevaluation of how math is taught. If Florida’s new policies identify many students who need extra support, it could indicate that curriculum and teaching need to change, she said.

“There’s a large volume of students that need math intervention,” she said. “But I think, also, we need a closer look at how we’re working [on] our tier 1 instruction.”
One State’s Approach for Struggling Math Learners: IEP-Style Plans

By Lydia McFarlane

Students struggling with math in Florida may get more attention in the classroom this upcoming school year.

Earlier this week, Florida’s Department of Education announced an unusual proposal that is aimed at helping students in kindergarten through 4th grades who are identified with substantial gaps in their math knowledge.

Under the plan, schools would be required to develop individualized education programs for students, much like the IEPs that are mandated under federal law for students with disabilities.

The Florida plan targets a wider range of students struggling with math and the qualifications differ by age.

For example, for kindergarteners, the evaluation is based on the students’ ability to identify and compare three-dimensional figures and shapes. For 4th graders, the evaluation is based on the students’ abilities to interpret data and understand mathematical concepts such as mean, median, and mode.

Florida’s Department of Education wants to implement this proposal to ensure students who are struggling with math are receiving the support and help that they need to succeed for the rest of their educational experiences.

While this plan is now just a proposal, if it were implemented into Florida schools, it would be unconventional.

Many students with IEPs are diagnosed with learning disabilities that ensure their protection under the Individuals with Disabilities Education Act, or IDEA, which then identifies them as special education students. Students protected under this act are given resources from the school that are funded by the state.

However, if Florida’s Department of Education follows through on its proposal, the students that would potentially be getting IEPs would not necessarily be protected under the Individuals with Disabilities Education Act.

“I think it is an interesting proposal to address math deficiencies and potentially very helpful to many students, but because these students would not be determined eligible under the IDEA in the manner required by federal law, schools could not receive federal IDEA money to help defray the costs of the proposal,” said Mitchell Yell, a professor in the Educational and Developmental Science College of Education at the University of South Carolina whose research often focuses on IEP development.

School districts could potentially be responsible for funding the new plan, which could cost districts significant amounts of money even as it helps the students targeted.

“This additional help will be costly to school districts, and because the method of identifying students as needing extra assistance does not adhere to the requirements of the federal law, schools would likely have to come up with these extra funds. If the state would provide funding for these additional services, that would certainly help the school districts financially,” Yell said.

Rather than giving each student who is identified as having a substantial math deficiency an IEP, Florida schools have other options to consider, Yell pointed out.

“They [Florida schools] could have small group math instruction with more individual help for students who are identified through the new system,” he said.

While the best way to help students who would be identified by this proposed plan has not yet been decided, extra math help for students who are struggling, especially after the pandemic, could prove to be valuable.

“I think the notion of giving students extra help through an IEP-type plan is laudable,” Yell said. “We know that students who have reading challenges with math would benefit from such additional help.”
Math Trauma Is Real. Here’s How You Can Prevent It

Why too many students end up deciding, “This math stuff isn’t for me”

By Viveka Vaughn

O
toward the end of last school year, I sat on a virtual mathematics panel discussing the resilience of students in the face of COVID-19’s traumatic educational consequences. I began to examine the social-emotional implications of the pandemic in a field I have been teaching in for over 20 years: mathematics.

The pandemic exacerbated the inequities of educational resources, leaving many students, especially those from high-needs districts, behind mathematically. These widening disparities are particularly damaging for students already at risk for “checking out” of math because of hostile classroom experiences.

Whenever I inform people of my occupation, they are animated with a look of joy or misery as they remember their feelings for math—and it’s usually the latter. They often regale me with stories of negative classroom experiences or encounters, usually involving a teacher embarrassing or ridiculing them in class.

“I writhed like a snake over coals if it came near me,” writes poet Chase Twichell in the poem about “Math Trauma.” This sentiment is echoed in many of the anecdotal stories about people’s math experiences.

One person vividly remembered trying to gain clarity on a math concept and the teacher replying, in front of the class, “That was a dumb question.” They never asked a question in a math class again. For many, that one experience became so traumatic that it led them to ignore math and any of its adjacent fields of study.

For me, math trauma is an event (or a sequence of events) where an educator or another person of authority chooses to embarrass, scorn, or deride students for their mistakes rather than celebrate their courage. That math trauma is then triggered whenever they encounter a math problem or math conversation for the duration of their academic years. Even outside of school, they refuse to recognize daily habits such as balancing a checkbook, counting money, or estimating prices as practicing math.

As an undergraduate, an academic advisor told me that I would never complete a math degree, let alone get a Ph.D. in anything. That, for me, was a traumatic moment. It was commonplace for people to underestimate my abilities based on my race, gender, and public school background.

Instead of letting those negative comments and assumptions dominate and traumatize me, they became my motivation and launching pad for success. I always remembered the teachers I had in middle and high school who reinforced courage, leadership, and discipline.

As a first-generation college student, I took inspiration from the television show “A Different World” as a positive image of a Black college experience. In one episode, a professor made her class stand up and recite the chant, “You are a voice in this world and you deserve to be heard.” As I faced discrimination in math, this mantra continued to resonate with me. I also had a community of family, friends, and mentors that helped me counter those negative stereotypes and prevent math trauma from taking root.

However, many students who don’t receive such encouragement and support end up reacting to negative experiences in the classroom by concluding, “This math stuff isn’t for me.” Math trauma may be amplified for underrepresented groups in math. As a field historically dominated by white men, mathematics is rife with norms that have excluded women and students of color. Stereotype threat and teachers’ preconceived notions of students’ math abilities can further hinder minoritized groups. If we want to diversify the math arena, alleviating math trauma and encouraging math curiosity from all races and gender is necessary.

Why focus on this issue now? As educators...
recovery from the pandemic, we are channeling our creativity, innovation, and imagination through our pedagogy and curriculum. Let us extend this same gift to our students, especially in math. Now is our chance to reset, recalibrate, and create new norms in countering the previous standards that have been a disservice to our students.

We must eliminate bias and assumptions about our students and permit time for them to process, develop, and construct math abilities, comprehension, and reasoning. As we plan novel ways to teach in this new normal, let us move forward with a renewed zeal to leave outdated standards in the past.

For educators, especially those teaching students of color, I caution you to be careful on the assumptions, biases, and predispositions you bring to the classroom. Focus on supporting and encouraging young minds in math class and appreciating their ingenuity.

My teaching goal is to convey a culture of acceptance and appreciation of differentiated math abilities. At the beginning of each semester, I introduce my students to psychologist Carol Dweck’s concept of fixed mindsets vs. growth mindsets. We focus on why it’s important to understand how the brain grows and how learning is malleable and not static. However, I wonder if we educators have more of a fixed perspective when it comes to believing in our students.

For the past 12 years, I have attended an improvisation class, where I learned a valuable technique that I now incorporate into my math instruction: the “Yes, and...” principle. With this approach of accepting and expanding on whatever was just said, no question is ever unimportant. With each question that a student asks, we can recalibrate. This creates a teachable moment and the chance to revise my strategy to help students find the correct answer. Many times, I encourage students to explain their reasoning of a problem without providing a final answer. This encourages students to see themselves as math thinkers.

Let us not be the reason students feel deterred or traumatized from pursuing math or another STEM subject. We must encourage and acknowledge our students’ strengths whenever we can. We can also provide all our students with the necessary tools to become effective and proficient in math. Once we institutionalize these strategies in our classrooms, then perhaps the next time you tell someone you teach math, you’ll get a smile of delight.

Viveka Vaughn is an associate professor in the mathematics department at Spelman College. Her research focuses on equity issues in mathematics.