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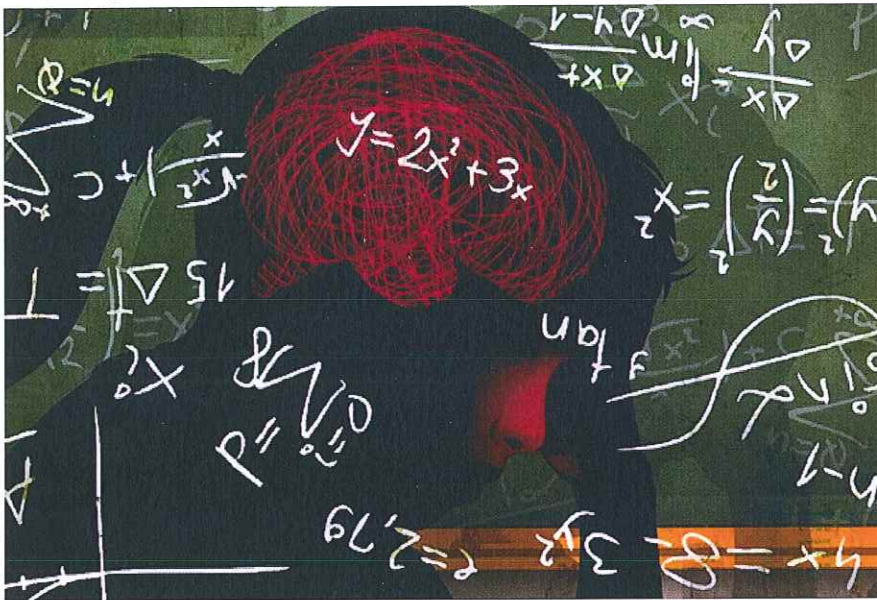
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The Myth Fueling Math Anxiety



—Taylor Callory for Education Week

By **Sarah D. Sparks**

January 7, 2020

My 2nd grader finishes his math enrichment, then gleefully creates blank versions for his dad and me to try: a subtraction-based, number-placement logic puzzle, intended to be challenging. My husband withdraws for 10 minutes or so, returns and hands over the completed puzzle.

I stare at my blank triangle.

"Mom, aren't you done yet?" my son asks. "Are you struggling?"

A dull pressure starts to thud behind my eyes. "I'm thinking," I say, a little too sharply.

By some estimates, nearly 1 in 5 U.S. adults report severe math anxiety, and the vast majority report at least some level of discomfort with the subject. In a representative survey of U.S. teachers, 67 percent told the EdWeek Research Center that math anxiety was a challenge for their students, and 1 in 4 said they often feel anxious doing math themselves.

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Sarah D. Sparks

Before my son's question, I wouldn't have considered myself anxious. I performed reasonably well in school math. As the senior research and data reporter for a national education news site, I'm often happily up to my eyeballs in data and algorithms, fascinated by how changing the weight of a few variables can dramatically change the focus of a problem or its potential solutions. Yet, knowing I wasn't answering an elementary math puzzle instantly and effortlessly sparked tension, frustration, and even shame that was obvious to my 8-year-old. And below the surface, those feelings raised an even more insidious question that has helped drive math anxiety in American education for more than a century:

Am I not a math person?

Emerging cognitive and neuroscience research finds that math anxiety is not just a response to poor math performance—in fact, 4 out of 5 students with math anxiety are average-to-high math performers. Rather, math anxiety is linked to higher activity in areas of the brain that relate to fear of failure *before* a math task, not *during* it. This fear takes up mental bandwidth during a math task—creating, for example, my feeling suddenly blank and unable to think. In turn, that discomfort tends to make those with math anxiety more reluctant to practice math, which then erodes confidence and skill. In part for that reason, anxiety has been linked to worse long-term performance in math than in other academic subjects like reading.

But unlike reading, seen as a joy and necessity for all children, math too often has been “feared and revered” as a frustrating, boring, mostly irrelevant subject for all but a few elite students with inborn talent.

Children aren't born fearing math. Their anxiety tends to rise as they age, as they confront more challenging content and “exposure to other people's negative attitudes to mathematics; to social stereotypes, for example about the general difficulty of mathematics or about supposed gender differences in mathematics,” according to one recent analysis.

Those negative attitudes about math—who is capable and worthy of learning it—have bubbled under the surface of math education debates for more than a century.

1 in 4 U.S. teachers often feel anxious doing math.

Source: EdWeek Research Center

In the early 1900s, William Heard Kilpatrick, a protege of John Dewey and one of the originators of U.S. math pedagogy, considered math “harmful rather than helpful to the kind of thinking necessary for ordinary living.” His peer, David Snedden, a highly regarded Teachers College professor and later education commissioner for Massachusetts, similarly called algebra a “nonfunctional and nearly valueless subject for 90 percent of boys and 99 percent of girls.”

This perspective formed the foundation of the progressive approach to math education through the 1950s, although it wasn't without detractors. In fact, they sparked the creation of the National Council of Teachers of Mathematics, which with the Mathematical Association of America argued for teaching comprehensive math concepts to “every educated person,” not just those going into highly technical fields like astrophysics or engineering.

Off and on in the decades since, arguments have flared among educators, policymakers, and the public about whether most children will ever need and can even understand algebra, geometry, or trigonometry. It leads to straw man choices between teaching “rigorous higher math”—envisioned as abstract, pure, completely divorced from any connection to students' lives—or teaching “applied math,” seen as limited to the most low-level, utilitarian concepts, with few attempts to help students see connections among them.

Today, the sense of saving higher math for “math people” still holds some sway in K-12 education. A nationally representative EdWeek Research Center survey of U.S. teachers

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bears this out: While half of those surveyed believed math instruction should help students understand “deep concepts and structures” and use them to think about the world, 37 percent said that most students’ math instruction should be limited to basic algorithms, with conceptual math taught to “students who show particular ability or interest in entering a math field.” Another 7 percent of teachers viewed math mainly as a college gatekeeper and prioritized teaching math that would help students pass college placement exams like the SAT.

In many classrooms, the fallout from this debate has surfaced in curriculum and instructional practices that experts say exacerbate math anxiety and strengthen a so-called “fixed” academic mindset—the belief that math skill is innate and cannot be improved through effort. Students who plow through lists of equations unconnected to each other are less likely to understand how their progress builds over time. In classes where students are praised for rapidly churning out the right answer using “approved” methods rather than for solving problems creatively or collaboratively, students tend to compete and judge their own ability only in comparison with how others see them.

Regardless of whether a student starts out performing well or poorly in math, a fixed mindset leads students to fear that making a mistake or failing a test could “prove” they have no innate math ability. Colleen Ganley, who studies how teachers affect their students’ math attitudes and performance, said educators with higher math anxiety tend to choose to work in lower grades (with more basic math), and she has found even though anxious teachers explicitly try to speak positively about math in class, they often “stick to the script” and discourage broader class discussions for fear of being asked a question they don’t know how to answer.

It’s hard to break such a strong, socially ingrained idea as, “math people are different from the rest of us.” It’s also necessary to prepare our children for a world revolving around big data, a world in which economic, political, environmental, and health debates all call for us to understand more than just basic arithmetic. And it would be tragic if the vast majority of children only ever learn to associate math with dread and tedium and never with the beauty of nature’s chaos, or the little eureka moment of understanding why pi describes a circle ... or the satisfaction of persevering and finally finding the solution to a math puzzle in your own time, even if it takes two pages of erasures and different approaches.

My son likes that my husband and I come to totally different right answers.

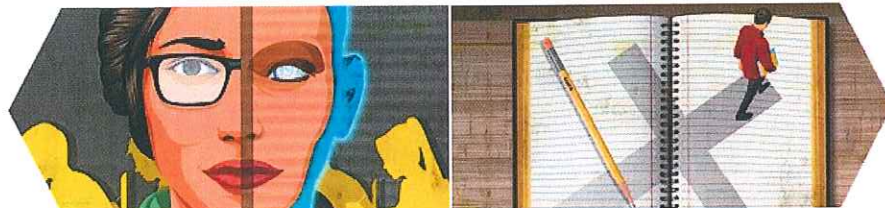
There aren’t “math people” and “non-math people,” only those who work through the challenging lesson and those who surrender too soon. Helping children understand that math doesn’t define them, but can help them redefine their world, could be key to turning math anxiety into joy.

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Vol. 39, Issue 17, Pages 10-11

Published in Print: January 8, 2020, as [You Are Not Your Math Anxiety](#)

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