Anxiety affects test scores even among students who excel at math

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UChicago researchers find that the better a student does at math, the more strongly his or her performance will be dragged down by anxiety. Credit: UChicago Creative

The term math anxiety doesn't call to mind a person who excels at the subject. But students who perform extremely well on math exams can suffer from such anxiety, which has a surprisingly powerful effect on just how well they do.

A study led by researchers at the University of Chicago finds that the better a student does at math, the more strongly his or her performance will be dragged down by anxiety. And that relationship between anxiety and achievement holds not just in the United States, but around the world, according to the authors.

"Math anxiety is disrupting these students' ability to fulfill their potential," said Alana Foley, a postdoctoral fellow in psychology and co-author of the study published in the February issue of *Current Directions in Psychological Science*. "Even though they're still doing better than kids who are overall performing lower, they're not performing as well as they could because they have math anxiety."

The study's authors considered the findings of 40 different laboratory experiments combined with analysis of data collected by the Program in International Student Assessments, which administers standardized math tests to 15-year-old students around the world. The lab studies provide insight into the test results, and the test results help contextualize the lab studies, the authors said.

"The effects of anxiety are true, even in countries that we think of as being really high-performing in math—Singapore, Korea, Japan, China," said co-author Julianne Herts, a doctoral student in psychology. "Even students in those countries who perform very well in math and score very high on tests still show this relation. That's something we didn't know would be the case."

Behavioral and neuroimaging studies reviewed by the researchers suggest why anxiety has such a powerful and universal impact. To do math, humans need to be able to hold information in their minds and manipulate and remember it.

"The students who normally do really well have a large capacity to hold

information in their minds and use advanced strategies that require a lot of cognitive resources," Foley said. "But when they're math anxious, the anxiety and the emotion system of the brain interfere with their ability to hold onto information, so they end up performing much worse than they otherwise would if they weren't anxious."

So what can be done to lessen the effects of math anxiety on high performers? The study cites research showing that students perform better if they're told that symptoms associated with anxiety, such as a rapid heartbeat, actually will help them do well. "Research also shows anxious students' performance improves when they write about their feelings before taking a test. Externalizing the anxiety seems to help alleviate its deleterious effects," said co-author Sian Beilock, the Stella M. Rowley Professor of Psychology.

But the authors warn that no intervention can be expected to work in every culture. "We have to look at how math anxiety might operate differently in different countries, even though it has the same effect," Herts said.

Understanding how math anxiety works becomes increasingly important as countries across the world encourage more students to go into math-based fields such as the sciences, technology and engineering.

"Given the relationship of math anxiety and math performance across the globe, it is very important to increase our understanding of the origins of math anxiety, the kinds of interactions that can prevent math anxiety from developing in the first place and the kinds of interventions that can effectively treat this problem if it emerges," said Susan Levine, the Rebecca Anne Boylan Professor of Education and Society and chair of the Department of Psychology. "Schools regularly assess students' math achievement, but rarely if ever assess math attitudes. Our findings indicate that assessments of math attitudes are also important."

More information: Alana E. Foley et al. The Math Anxiety-Performance Link, *Current Directions in Psychological Science* (2017). DOI: 10.1177/0963721416672463

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