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Boys in poorest study environments more anxious about mathematics - study

New research by a PhD graduate at the University of Cape Town (UCT) found boys in the poorest study environments to have higher mathematics anxiety and poorer mathematics performance than boys in more stable study environments.

"It is important to teach boys to notice and reinterpret their feelings of mathematics anxiety. It may seem less socially normal for boys to talk about anxiety than girls, which may be harming their performance," said Dr Katherine Morse. She graduated on Friday, 22 July, with a PhD in psychology.

The thesis titled "Closing the mathematics achievement gap: exploring the applicability of growth mindset in South Africa" found that mathematics growth mindsets were also most important for those from the poorest study environments, although not so important for boys with more stable economic situations.

"Promoting growth mindsets for boys living in lower-income circumstances could help improve mathematics performance. Boys could also benefit from a positive study attitude that helps them relate the relevance of mathematics to their current and future identity and career plans," she said.

Mathematics mindsets are personal beliefs encapsulating an individual’s response to mathematics challenges. These beliefs exist on a continuum between growth and fixed mindsets.

"Individuals with growth mindsets are characterised by the willingness to embrace challenge and failure as part of the learning process and to interpret difficulty as indicating a worthwhile activity. They believe that mathematics ability can be changed and improved with effort.

"Individuals with fixed mindsets interpret failure as meaning that they are not intelligent enough for the task at hand. They interpret difficulty as evidence that they should stop trying. Their response to challenge might include avoidance or helplessness," said Morse. Growth mindset interventions have been shown to give small but significant boosts to mathematics performance. These interventions are brief and cheap, making them attractive

for boosting mathematics performance. Mindset assessments and interventions have predominantly been developed in the United States.

In a series of four studies, Morse established that South African high school students have mathematics mindsets akin to the fixed and growth mindsets elsewhere. Using an iterative design process and item analysis, she modified a mathematics mindset assessment for use with disadvantaged students in South Africa.

In two correlational studies, Morse established validity and reliability for a mindset assessment called "Thinking About Maths". She examined the contribution of mathematics mindsets to mathematics performance, with mathematics anxiety, study attitude, and study environment.

The research found that mindset was important across all study environments for girls. Girls also had positive study attitudes contributing positively to performance.

"Girls in poor study environments are likely protected from the negative effects felt by boys by the stronger relationships between mindsets and performance, and study attitude and performance. It may be that girls in poorer study environments place a higher value on mathematics and its relevance to their lives," she noted.

Historically, girls have been less inclined towards mathematics careers. Morse said this was not found in the sample group.

"In discussion, girls appeared much more likely than boys to highlight the relevance of mathematics to their future career goals. They talked about mathematics as being integral to life. Even when career goals were not dependent on mathematics, they stated that plans could change and that they should leave their options open," she said.

According to Morse, a deeper understanding of gender differences in response to poverty could lead to better targeted, gender-oriented interventions. With assistance from teachers and students, Morse developed a mindset intervention that is culturally appropriate and relevant. 305 grade 9 students participated in a field-based quasi-experiment with a positive control group.

The intervention was delivered on WhatsApp over four weeks. Each week contained a growth mindset message, a YouTube clip, advice on a learning strategy, and an integration activity.

"It was clear that WhatsApp groups were an effective mode of delivery, and there was good evidence of student participation. Mathematics performance at the intervention school improved significantly beyond that of a control school. The strength of the intervention seems to lie in the combination of mindset messaging and the teaching of effective strategies," said Morse.

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