Intervening Early to Improve Students' Math Self-Efficacy

In this article in *Theory Into Practice*, Jeesoo Lee, Hyun Ji Lee, and Mimi Bong (Korea University) say that self-efficacy "is arguably the most powerful motivational resource that drives individuals to engage, persevere, and accomplish goals in various domains." In classrooms, self-efficacy is "the strongest predictor of students' academic achievement."

But self-efficacy in math – students' belief that their efforts will produce success – declines during the elementary grades. Lee, Lee, and Bong suggest the following causes:

- There's a shift from a mastery orientation toward math in the lower elementary grades to a performance orientation in the upper grades, with increasing emphasis on demonstrating one's ability, outperforming peers, and getting high test scores.

- As they encounter frustration in math, many students adopt a fixed mindset about math ability – that it's innate, you either have it or you don't – versus a growth mindset – that ability can be developed.

- Young children initially believe that peers who work hard at math have high ability, but they gradually shift to believing that having to put in a lot of effort for the same result is a sign of less ability.

- Students are exposed to the belief that boys are naturally better at math than girls, triggering stereotype threat – this despite the fact that in the elementary grades, girls do as well as, or better than, boys.
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These factors undermine elementary students' self-efficacy in math – especially girls'. The authors say it's urgent to counteract this negative trend before students reach adolescence, and suggest communicating these core messages to all students:

• *Anyone can get smart and do well at math*. Students need to hear loud and clear that math ability improves with effort and practice. A growth mindset message should be conveyed without referring to the opposite mindset, say the authors, because that "could inadvertently strengthen the fixed mindset of children who already hold this undesirable belief."

• *My brain is like a muscle, and I can train my math muscles*. Giving students vivid examples of neural plasticity – for example, how aspiring London cabbies' brains change as they study for The Knowledge (the extraordinarily difficult test to get a London taxi license) – and making an explicit link to math ability.

• *I can do math better by working hard, using good strategies, and getting help*. Studies have shown the efficacy of students embracing this three-part belief.

• *Overcoming difficulty is part of doing well in math*. It's helpful to tell analogous stories of athletes and musicians who overcame handicaps and challenges to master their skills.

• *Girls can perform just as well at math as boys*. The authors suggest classroom activities such as *Draw a Mathematician* and tabulating responses, or guessing the occupation of a series of photos of people who turn out to have counter-stereotypical jobs (e.g., a male nurse, female mathematician), and then following up by eliciting from students the negative consequences of holding gender stereotypes. Again, the authors say that "it is essential not to explicitly inform children of the stereotype because direct messaging can trigger the stereotype threat effect."

Conveying these messages well can change students' fixed mindsets and gender stereotypical beliefs. The messages are most effective if they are presented in engaging classroom activities that make good use of the following processes:

- Internalization – Students might be asked to write a letter to a friend or a struggling student, explaining what they've learned about brain plasticity or gender stereotypes.

- Modeling – "Involving successful figures or influential role models in the intervention makes the delivery of messages more effective," say the authors – another student, a cartoon character, or a story to which students can relate.

- Attributional feedback and strategy – Students might be presented with the story of two people who tried hard: one succeeded, the other didn't – the difference was strategies.

- Goal-setting – If targets are specific, short-term, and seem attainable, they can increase self-efficacy and allow students to measure progress on the road to mastery.

- Interest – The concept of neural plasticity is not easy for young children to grasp, say the authors, so it needs to be embedded in a variety of fun activities – for example, after learning about the parts of the brain, coloring in areas used by a pianist or someone solving a math puzzle.
- Surprise – A good example is students guessing wrong about the professions of people working outside stereotypical occupations.

The authors say it's better to conduct these activities with a classroom of students rather than individually, because some of the beliefs being counteracted are social in nature. It's also important that teachers and parents be included in the interventions, since these adults have a major impact on the way children think about their math ability.

If this intervention is handled well, conclude the authors, children's math self-efficacy will improve markedly and they "can face math with stronger convictions in their abilities to succeed and greater tenacity to overcome challenges and setbacks."

"Boosting Children's Math Self-Efficacy by Enriching Their Growth Mindsets and Gender-Fair Beliefs" by Jeesoo Lee, Hyun Ji Lee, and Mimi Bong in *Theory Into Practice*, Winter 2022 (Vol. 61, #1, pp. 35-48); Bong can be reached at mimibong@korea.ac.kr.