

The Effect of a Growth Mindset on Female Math Learners

Hayley N. Morrison

Background

Context. As a high school math teacher, I have seen female learners that have given up and labelled themselves as ‘bad’ math students before the semester even begins.

Educational Philosophy. This research originated from a care-based teaching philosophy, which understands the need for relevant curriculum and recognizes the uniqueness of each learner (Noddings, 1998, Noddings, 2005).

My curiosity of how to overcome the negative self-efficacy I was seeing in my students led me to the research of two mindset research pioneers:

1. **Albert Bandura - Social Cognitive Theory.** This theory suggests that “efficacy beliefs influence how people feel, think, motivate themselves, and behave” (Bandura, 1993)
2. **Carol Dweck – Implicit Theories of Intelligence.** This theory identifies growth mindset students, or those with an incremental view of intelligence, as more likely to try and improve by asking for help and applying effort (Dweck, 2016). On the contrary, fixed mindset students, or those with an entity view of intelligence, tend to be performance driven (Dweck & Leggett, 1998).

Positionality. As I approached this topic of study, I was aware that I was a student who loved math, was told I was gifted at math, and succeeded within a traditional learning environment. I relate to the fixed mindset, performance driven student described by Dweck (2016), who wants to ensure success and not make mistakes. I identify with the female students, as a female myself working in a male dominated department.

Research Problem and Thesis

- The Government of Canada has formed the Society for Canadian Women in Science and Technology (SCWIST) to address the fact that less than 30% of STEM careers are filled by women (Government of Canada, 2024).
- Research Question: How does having growth mindset affect the achievement of secondary female math learners?
- A lower self-perception in math for female learners can be perpetuated by stereotypes that they are less mathematically inclined than their male counterparts. Having a growth mindset can positively impact female math learners in Canadian high schools and can be encouraged by positive interventions by teachers.

Analysis

Stereotypes Lead to Increased Test Anxiety in Females

- Research conducted with grade eleven girls found that stereotype threat, or “when individuals’ awareness of negative stereotypes about their group becomes an apprehension about confirming such stereotypes” was detrimental to math achievement (Song et al, 2022, Plante et al. 2012, p. 225).
- Gender stereotypes and a difference in efficacy beliefs can suppress female achievement in mathematics (Yu et al, 2021, Plante et al, 2013).

Females Have Lower Self-Perception in Math

- Watt (2006) found among high school students that boys had higher self-perception than their female peers, even if their prior achievement was similar.
- Self-defeating thoughts and negative self-perception of math ability can be a barrier to females having high levels of achievement in math class (Degas et al, 2018).

A Growth Mindset is Beneficial for Female Learners

- Degol et al. (2018) studied teenage students in the United States and concluded that “females with a growth mindset had higher grades than males with a growth mindset” (p.984).
- Dweck (2007) found that females who had a growth mindset performed better than those who believe math is a gift.
- Song et al. (2022) found that growth mindset training weakened the negative effect of gender stereotypes.

A Fixed Mindset is Detrimental for Female Learners

- Both Dweck (2007) and Bowler (2013) acknowledge that high achieving females can be prone to a fixed mindset and can struggle to recover after facing confusion.
- The research shows that “female students’ fixed mindsets were negatively correlated with their ability self-concept and intrinsic motivation in math” (Heyder et al., 2021, p. 182).

Teachers can Influence the Mindset of Female Learners

- Di Battista (2025) argues that sometimes errors in females are interpreted as a lack of giftedness.
- Dweck focuses in on female learners and suggests instructing them how intelligence can be gained instead of simply praising ability (2007).

Recommendations

Change Assessment Strategies in the Classroom

- Teachers should consider how formative assessment can be used in the classroom.
- Dweck (2016) suggests that testing weekly and communicating grades to students continually will create performance driven, fixed mindset math students; these students sometimes will avoid challenges and making mistakes.
- Boaler (2016) relays how Finland has high math test scores, yet teachers do not rely on numerical data but instead uses interactions with students to report to parents.
- Allowing opportunities to resubmit work promotes a growth mindset in students (Boaler, 2016, Hecht et al, 2023).

Create a Classroom Culture of Growth

- Teachers can instruct female students on how intelligence can be built to promote growth mindset (Dweck, 2007).
- Giving students the time and support needed to work through challenging tasks can be a good step for teachers to take. (Boaler et al, 2021).
- Boaler (2016) asks educators to see math as a “creative, visual, connected and living subject” instead of seeing the “nuts and bolts” of curriculum, so that students can stretch their thinking and be more engaged (p.31).

Inconsistencies and Future Research

Inconsistencies

- The meta-analysis done by Sisk et al. (2018) “demonstrated only a very weak relationship between mindsets and academic achievement” and “a very small overall effect of mindset interventions on academic achievement” (no page).
- Plante et al. (2013) found that unless students internalize stereotypes, they do not have an impact on outcomes; furthermore, the “correlations between stereotype endorsement and grades and career intentions were somewhat smaller than would be expected from the experimental research” (p.233).

Future Research

- Further research could investigate the “profound underrepresentation of ethnic minorities in STEM fields” and see research on female minorities as a place for future research (Degol et al, 2018, p.987).

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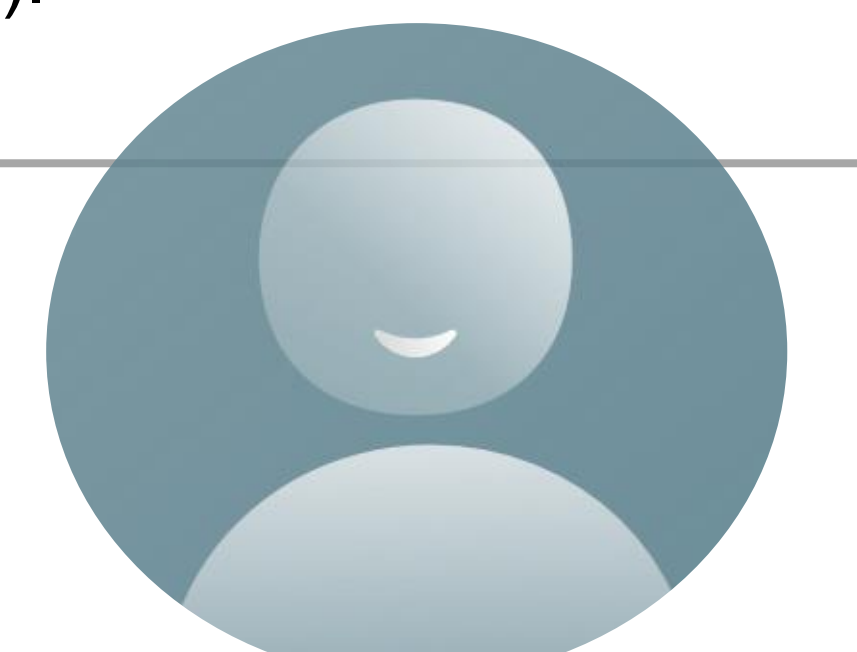
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