Frequently Asked Questions

Attitudes to Math

"This curriculum…is based on the belief that all students can learn mathematics and deserve the opportunity to do so."

Ontario Curriculum for Mathematics, Grades 1-8

"There is a huge elephant standing in most math classrooms, it is the idea that only some students can do well in math."

Jo Boaler

1. What is a growth mind set?

A growth mindset is a belief that our skills and abilities can grow and develop over time with careful and patient practice and application. A fixed mindset is a belief that our abilities and intelligence are fixed traits that we are born with, and cannot be changed. Research done in recent years by Carol Dweck shows that, "students tend to have more of a fixed view of math skills than of other intellectual skills" ("Mindsets and Math/Science Achievement").

We believe that everyone can do math. The goal in our math classrooms is to help all our students shift from fixed to growth mindsets in mathematics. We want our students to stop saying, "I can't do math." Instead, we want all our learners to say, "I can't do it…yet", when confronted by challenges in mathematics.

"Students (and their teachers) can have different beliefs about intellectual abilities. Some believe that intellectual abilities are basically fixed—that people have different levels of ability and nothing can change that. In contrast, others believe that intellectual abilities can be cultivated and developed through application and instruction."

Dweck, (2008)

2. Why is a growth mindset important?

Dweck's research shows that students achieve more highly when they are given growth mindset messages. For example, when effort, struggle, and mistakes are praised, rather than ability, students are more likely to persevere with difficult work. Conversely, presenting the viewpoint that deeper mathematical thinking is accessible only to those who are born with it (so-called "math people"), gives students the opposite message. Students are more likely to give up if they feel that true math understanding is attainable for only a select few.

Careful and patient practice will lead to growth in mathematical skills and understanding over time. As Dweck notes, "even Einstein wasn't Einstein before he put in years of passionate, relentless effort." We also only hear about his successes, not his many struggles and mistakes which caused him great self-doubt and worry.

Growth mindsets in math can be built through careful and deliberate teacher messaging. Building a positive and open culture of math talk and collaboration, praising effort, not ability, and learning from mistakes are all actions that will help.

> *"Students' beliefs are correlated to their attitudes about, and achievement in, mathematics; if these dispositions are negative, learning is impeded and academic success is limited."*
>
> Colgan (2014)

3. What is math anxiety, and how do we help our students to overcome it?

We recognize that math anxiety is a very real thing for many of our students. Mathematical anxiety can be defined as "a feeling of tension, apprehension, or fear that interferes with math performance" (Ashcraft, 2002). The problem is compounded by the fact that many parents themselves experienced math anxiety in school, and math is portrayed as something to be loathed and feared in many popular culture and media sources. Children may hear from a young age that "math is hard", or "I can't do math", and internalize these messages themselves.

Students can become trapped in a very vicious cycle: they are anxious about math, and their anxiety interferes with their understanding and achievement, causing them to become even more anxious. A fixed mindset about their own ability becomes internalized, adding to their anxiety.

Three things we can do in our growth mindset math classrooms to reduce anxiety are: removing the emphasis on speed; focusing "on math making sense" (Small); and giving students open questions and rich tasks that allow for a variety of responses, not just "right" or "wrong". Boaler, Small and others have noted that an emphasis on speed promotes competition and anxiety. Those who are slower thinkers feel that they are not as smart as faster thinkers. In the past, math has often been reduced to a set of rules to be memorized, rather than a meaning making activity. Using more open questions and

interesting and rich tasks will allow students to focus on the growth in their own thinking, and not just on getting the right answer.

> *"The emphasis on "black and white" or "right and wrong" answers- no middle ground- is something that has contributed to math anxiety."*
>
> Small (2013)

4. How does having a growth mindset support me as a numeracy teacher?

First and foremost, as co-learners in math classrooms, we need to have growth mindsets ourselves. We believe that a collaborative math classroom should promote risk-taking, perseverance, and confidence, in both teachers and learners.

Teachers themselves should not be afraid to puzzle through math problems, activities, tasks, and investigations with our students. Being in front of a class of students causes our own anxiety, and fear of making mistakes. We need to give ourselves the same "breaks" we give our students, if it takes us time to find an answer, or if we're not sure of the answer right away (Small).

All teachers are numeracy teachers, just like all teachers are literacy teachers. Students will have the greatest belief in themselves as numerate learners if they see math connections across the whole curriculum. Schools should build communities of numeracy practice through a collaborative approach, beginning with conversations "about how we might support one another in working with students to develop their full potential in mathematics", and by exploring numeracy links across subjects and disciplines ("Supporting Numeracy" monograph, Ministry of Education). Helping our students make numeracy connections across the curriculum will make them more confident and persistent learners, and help them to demystify math.

> *"When we help our students make numeracy connections throughout the day, we are engaging them in understanding the many dimensions of our interconnected world."*
>
> Ministry of Education (2012)

5. Video clips can we use to build our understanding of math and mindsets.

Jo Boaler
A Growth Mindset in Math Class
Growth Mindsets
Develop a Growth Mindset
Timed Learning and Math Anxiety
Mindsets and Mistakes

Eduardo Briceno
The Power of Belief

Carol Dweck
Fixed vs. Growth Mindsets
A Study on Praise and Mindsets

References and Ministry Resources

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