Thinking Outside the Equation for High School Math Teachers: Learning Activity 1 of 6 - Mindset

Time Frame 60-90 session(s)

Essential Question(s)

- What is growth mindset?
- What are participant perceptions of growth mindset?
- How can teachers implement this into their mathematics classrooms?

Summary

Mathematics is sometimes perceived as one directional, but it doesn’t have to be. In this interactive professional development institute, participants will reflect upon what 'math' really is, how it looks and feels, and how intentional tasks can enhance overall understanding and critical thinking. Participants will experience mathematical concepts via non-routine tasks that reach beyond procedural 'steps' and shift into mathematical understanding that builds a flexible mindset for teaching and learning. Participants will construct instructional tasks for their classroom and return to reflect over the success of their task and how to move forward growing as teachers of mathematics.

Learning Goals

- Develop participants’ understanding of authentic researched-based mathematical practices.
- Explore and develop non-routine math tasks that correlate to appropriate grade levels.
- Demonstrate the incorporation of strategies and instructional tasks that foster a growth-mindset for flexible mathematics.
- Deepen participants’ understanding of number sense and mathematical concepts through interactive, non-routine tasks, and student inquiry.

Attachments

- Equitable Strategies.pdf
- I Think, We Think.docx
- Mathematical Mindset Norms.pdf
- Mistakes in Life.pdf
- Myth of Mathematically Gifted Child.pdf
- Power of Mistakes and Struggle.pdf
- Thinking 1.pptx

Materials

- Sticky notes
- Pens
- Paper
- Highlighters
- Designated area for PARKING LOT
- Attached slides: Thinking 1

Engage

Objective: Participants will use I Think, We Think while considering and answering the following questions with their team:

- What is your school's mindset towards mathematics?
- What does your typical day look like?
- What are your expectations for your students?

To begin, ask participants to work in small groups or teams of teachers.

The strategy I Think, We Think is used to allow participants to begin thinking critically about their practice.

Distribute the attached I Think, We Think document

Display the first question: What is your school's mindset towards mathematics?

Ask participants to think to themselves about the question. After about 1 minute, have small groups discuss their thinking.

Repeat the process for the following questions: What does your typical day look like? What are your expectations for your students?

Ask groups to then share their thoughts with the whole group.

Explore

Objective: Jigsaw Chapters 1-3 from Boaler's Mathematical Mindsets.

First distribute one of the following handouts to each participant, ensuring that there is a fairly even distribution of articles at each table: Mathematical Mindset Norms; Mistakes in Life; Myth of the Mathematically Gifted Child; Power of Mistakes and Struggle.

Ask each participant to read their article and to be able to summarize key aspects of it.

Once everyone has finished reading, have participant share what they read with their groups.

Participants are welcome to take notes while others share if they so choose.

Explain

Objective: Participants will be able to explain various aspects of mindset

First, break into new groups of three or four. An easy way to do this is to first determine the number of groups you want. For instance, say you want to have four groups, then number off all participants 1-4. Have those numbered 1 sit with the 1s, 2s with 2s, etc.

Using the What? So What? Now What? instructional strategy, ask participants to discuss the following questions in their new groups:

- **What?** What did you read?
- **So what?** According to the author, why does it matter?
- **Now what?** What did you take away?

Extend

Ask participant to be thinking about what shifts would need to take place in their classrooms and schools (that they can control).

Have participants jot down their thoughts and share with their groups.

Evaluate

Because of the nature of this series of sessions, this particular session was not written to initially have a designated EVALUATE. That being said, a simple exit ticket could suffice to help the facilitator understand where participants are in their thinking. If you would like to evaluate, here is a simple suggestion:

How am I feeling? What am I thinking?

Distribute sticky notes to participants.

Participants draw a line (vertically, horizontally, or diagonally) dividing the sticky note in half.

Participants draw how they feel about the content they have explored on one half of the sticky note.

On the other half, participants write a sentence explaining what they understand or think now. This could be a question or a comment they have regarding their learning or the experience itself.

Participants may share their feelings, thoughts, or questions recorded (this should be optional for all participants, not a requirement)

Participants place the sticky note on a board, door, wall, or other flat surface.

Facilitator collects these from the wall so they too can reflect on the participants' feelings, thoughts, and questions regarding the topic or concept.

Follow-up Activities

Parking Lot: As participants move through this learning activity and those that follow, have them jot down questions, comments, and concerns they may have regarding what they are learning, what is being presented, and what they are thinking. These can be written on a sticky note and placed on a designated area in the room labeled *Parking Lot*.

Periodically remind participants they can post sticky notes here with their questions, comments, and/or concerns.

Before and after breaks are good times to address quandaries posted to the parking lot.

Research Rationale

Mathematics education has a rich and complex history, shaped largely by major educational reform initiatives. At the turn of the twentieth century, mathematics classrooms were often seen as learning laboratories which incorporated hands-on lessons and inquiry-based learning scenarios similar to what one might see in a science lab (Kilpatrick, 2014). Influential educators, like Dewey, were at the forefront, implementing constructivist pedagogies hinged on students constructing knowledge and making meaning for themselves (Dewey, 1950; Kilpatrick, 2014; Schiro,2013). These pedagogies were in stark contrast to traditional, lecture-based disseminations of information during this period in history. Throughout the decades following, political agendas and industrial demands in the US aimed at producing more mathematicians and scientists, along with international competition to be the best in mathematics, have retrograded pedagogical strategies to less progressive eras in history. Major educational reforms driven by federal initiatives like “A Nation at Risk,” “No Child Left Behind,” and “Race to the Top” have placed major emphasis on efficiency in mathematics education, thus promoting a factory model for schools (Kilpatrick, 2014; Schiro, 2013; Teitelbaum, 2014). As a result, teaching and learning today looks very similar to how it did in the nineteenth century, but with more emphasis on holding teachers accountable to teaching prescribed standards. So, it is no surprise then that the US has consistently fallen behind other countries in terms of mathematics achievement (Kilpatrick, 2014; Teitelbaum, 2014). Despite pushes for efficiency in mathematics education, educators like Boaler (2016) have been essential to the survival of progressive mathematics education. She and others view mathematics learning as less of a gift and more of a learned discipline. She has championed for pushes to foster growth mindset in mathematics teaching and learning, which is where this professional development is rooted. Boaler (2015) shares that students’ mindset about mathematics greatly shapes their beliefs about themselves as learners and impacts their confidence in constructing mathematical knowledge. There exist two types of mindsets: fixed and growth. People who have fixed mindsets about mathematics tend to view themselves as being able to reach a limit for how much they can understand. On the other hand, those who have a growth mindset are more inclined to persevere through mistakes and tend to have positive beliefs about themselves as mathematics learners as they essentially have endless potential to learn (Boaler, 2015; Yeager & Dweck, 2012). Furthermore, mindset tends to be infectious. Students whose teacher has a growth mindset about mathematics were shown to have higher achievements and better mathematical performance, even those students who were tracked into lower-level courses (Dweck, 2010).

Resources

- Boaler, J. (2015). Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching. Jossey Bass: San Francisco, CA.
- Boaler, J. (2016). The importance of teaching in the promotion of open and equitable mathematics environments. In E. A. Silver & P. A. Kenney (Eds.), More lessons learning from research: Helping all students understand important mathematics Volume 2 (19-26). Reston, VA: National Council of Teachers of Mathematics.
- Dewey, J. (1950). The child and the curriculum (25th ed.). Chicago, IL:The University of Chicago Press.
- Dweck, C. (2010). Mind-sets and equitable education. Principal Leadership, 10(5), 26-29.
- Kilpatrick, J. (2014). Mathematics education in the United States and Canada. In A. Karp & G Schubring (Eds.), Handbook on the History of Mathematics Education (323-334). New York, NY: Springer.
- Schiro, M. (2013). Curriculum theory: Conflicting visions and enduring concerns (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Teitelbaum, M. (2014). Falling behind?: Boom, bust, and the global race for scientific talent. Princeton, NJ: Princeton University Press.
- Yeager, D. & Dweck, C. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. Educational Psychologist, 47(4), 302-314.