Teaching Growth Mindset in a Secondary Mathematics Classroom

by

Katherine Sneider

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Capstone Project Facilitator: Julia Reimer
Content Reviewer: Jessica Baker

The aim of this capstone project is to answer the question: *How can teaching high school students about growth mindset affect their attitudes toward mathematics learning and academic achievement?* The project itself is a series of professional development seminars that will inform math educators about students' growth mindset, the effects of mindset on student achievement, and strategies that teachers may use to teach about mindset in their classrooms to increase achievement. There will be three professional development sessions to learn about the topics, understand strategies, create a plan for implementation in classrooms, and reflect upon the execution of these plans.

The first session will be dedicated to identifying the need for an instructional shift in teaching and learning in our classrooms as it relates to mindset. These sessions will include opportunities for reflections from staff about their mindsets and perceived mindsets of their students. This session will include definitions of fixed and growth mindsets (Dweck, 2016), the neuroscience behind growth mindset, and examples of its effect on student learning and achievement (Blackwell et al., 2007) to establish a need for more learning (Cox, 2015) and continued reflection.

The second of these sessions will be dedicated to sharing with participants teaching and learning strategies in secondary mathematics education that can improve student mindset. These theories and practices will include teaching the value of failing well (King, 2013; Robinson, 2017), the use of low-floor high-ceiling tasks to help all students see success (Kachwalla, 2021), the language teachers use to relay a growth mindset to students (Lee, 2009), and the importance of purposeful reflection for students about their learning (Suh et al., 2011). As a part of this session, teachers will devise a plan of implementation for some or all of these strategies in their classrooms. They will be able to work with colleagues that teach the same grade level or course

to discuss approaches for teaching and reframing student mindset in the coming weeks.

The last of the professional learning sessions will be dedicated to celebrating successes, reflecting on challenges in implementing learned strategies, and looking forward to new ideas for the coming school year to encourage a growth mindset. This session will include an overview of the first two sessions, but will be largely discussion-based to share and hear the scope of learning that took place over the school year to identify how *teaching high school students about growth mindset affects their attitudes toward mathematics learning and academic achievement.*

The primary participants will be approximately 20 math teachers and content coaches of grades 5-12 from the middle school, high school, and alternative learning center. Other participants may include curriculum coordinators and administrators from all schools. These individuals will take part in the professional development sessions throughout the year.

The first of the professional development sessions will take place before the start of the school year, during a week of training and professional development for all teachers. The first training will be an hour long. There will be two other longer professional development sessions, 2 hours long and 1 hour long, respectively. Shorter meetings throughout the year will take place before or after school, lasting about 30 minutes, to reflect on the goals of the previous session. While more time dedicated to this new learning in a larger group would be appropriate, once-monthly meetings in subject groups and grade-level teams will allow for adequate reflection with colleagues among participants.

Included in the project materials are presentations for each professional development session, a facilitator's guide for each presentation, a list of necessary materials for the facilitator and participants, a pacing guide, dynamic discussion protocol descriptions, and all necessary handouts.

Session 1: Introduction to Growth Mindset
August 2022 - 65 Minutes
[Google Slide Link for Session 1](#)

   The first session will be dedicated to identifying the need for an instructional shift in teaching and learning in our classrooms as it relates to mindset. These sessions will include opportunities for reflections from staff about their mindsets and perceived mindsets of their students. Questions for reflection may include:

- How does your mindset affect how you approach certain tasks in your personal life?

- How does your mindset affect how you approach teaching and learning mathematics?

- How might your students' mindsets affect their mathematics learning?

- How do you discuss mindset in your classroom teaching?

This session will include definitions of fixed and growth mindsets (Dweck, 2016), the neuroscience behind growth mindset, and examples of its effect on student learning and achievement (Blackwell et al., 2007) to establish a need for more learning (Cox, 2015) and continued reflection.

Presenter will need:	- Laptop for presentation and videos - Interactive writing board [Knowledge and Connections Worksheet](#) (1 per participant) [Culturally Responsive Protocols](#) for reference	
Participants will need:	- Laptop or phone - Writing utensil	
Slides	**Content and Notes**	**Timing, Resources, and Protocols**
Slide 1	Welcome and Presenter introduction	2 min.
Slides 2 & 3	Have participants access the poll using the Mentimeter website. A code will need to be generated the day of presentation.	5 min. Mentimeter

		● [Voting Link](#)
Slide 4	Key Points ● Clear difference between how we learned mathematics and how we want our students to learn ● The words on the left do not lend themselves to success in math learning ● There are barriers that need to broken to get our students to where we want them to go and where they deserve to go in math learning	2 min.
Slide 5	Read and review the goals of the session or ask a volunteer to read them to the participants	2 min.
Slide 6	Pass out Knowledge and Connections worksheet to participants ● Explain the worksheet ● Introduce next topic → growth mindset ● Allow 3-5 minutes to complete the worksheet with their current knowledge and connections to growth mindset	5 min. [Knowledge and Connections Worksheet](#)
Slide 7	Key Points ● Development, improvement, and learning are essential parts of a student's education ● Made possible by providing opportunities for challenge ● With every challenge students express either a willingness to continue working through the challenge or frustration and defeat.	3 min.
Slide 8	Play mindset video, then: ● Participants will use a Think-Pair-Share to answer the prompt. ● Give at least 30 seconds for thinking, 3 minutes for pairing and sharing.	2 min. [Mindset Video](#) Protocol: ● [Think-Pair-Share](#)
Slide 9	Write on an interactive board the response from participants. ● Try to get at least 3 different responses for each category from 6 different people. ● Use Compelling Moment for more responses	3 min. Interactive Board Protocol: ● [Compelling Moment](#)

Slide 10	Key Points ● Examples from our classroom solidify these notions of a fixed and growth mindset.	2 min.
Slide 11	Key Points ● Scientific research showed that individuals who had a growth mindset and attempted to learn from a mistake had more brain activity than individuals with a fixed mindset (Mangels et al., 2006). ● Adopting a growth mindset fundamentally changes the way your brain responds to new information or learning experiences ● Growth mindset = more brain activity ● Teaching our students this understanding empowers them to make connections between a growth mindset and their performance in academics	3 min.
Slide 12	Key Points ● Why is it so important that we understand mindset in teaching mathematics? ● In a study from the United States in 2019, Yeager et al. found that in a group of students who participated in growth mindset intervention programming, beliefs related to a fixed mindset were reduced and lower-achieving ninth-grade students earned higher grade point averages than students who did not participate in the intervention. ● Students with a growth mindset are more successful academically ● Participation in growth mindset intervention programming leads to higher grade point averages.	3 min.
Slide 13	Present the question: How do you think students develop a particular mindset? ● Use Shout Out Protocol to elicit responses. Key Points ● Historical studies have tried to predict that parents' perceptions of their child's ability will predict the child's mathematical mindset ● More recent research finds no correlation between parents' and child's intelligence mindsets	5 min. Protocol: ● Shout Out

	● Teacher mindset also does not predict student mindset	

Slide 14	Key Points
	● We know we can't predict a student's mindset from their parents or teachers.
	● However, we do know that we can teach mindset through behavior and belief.
	● Responses to success:
	  ○ praise for intelligence promotes a fixed mindset
	  ○ praise for process tends to develop a growth mindset
	● Responses to failure
	  ○ focus on ability and performance believe that it hindered other opportunities to achieve
	  ○ failure as a part of the learning process, including looking at other paths to improvement
		5 min.

Slide 15	Key Points ● We know that a student's growth mindset is important to better academic achievement, but "I told you so" from parents and educators does not help students reach that mindset. ● We need to help them practice this mindset through process-oriented learning and responding to successes and failures by recognizing processes.	3 min.
Slide 16	Key Points ● With the positive effects of a growth mindset so evident, we know our classrooms will change. ● We may take new perspectives on our building goals, how we address inequities, and both teacher and student mindset.	2 min.
Slide 17	Key Points ● Performance-based and mastery-based goals define perceived achievement for students and educators. ● Performance goals, while they may be successful in reaching some positive achievement outcomes, imply a student is	5 min.

	motivated extrinsically rather than intrinsically, as with mastery goals. ● By encouraging a mastery-approach to achievement, educators move students toward a growth mindset, focusing on process rather than ability, to contribute to long-term, positive achievement.	
Slide 18	Key Points ● There are measurable disparities in mathematics achievement based on gender, race, and sexual orientation, but these should not be the focus ● When we focus on negative results and data that doesn't engage the student as a whole learner, we miss opportunities to help them achieve. ● Could a growth mindset help offset some of the inequities that plague mathematics education? ● Can educators improve a student's self-image and achievement in mathematics by introducing strategies that encourage and insist on the development of a growth mindset?	5 min.
Slide 19	Key Points ● We learned that a growth mindset, in educators and students, has a positive impact on student achievement and learning. ● We want to use that understanding to improve our curriculum, teaching, and classroom cultures.	3 min.
Slide 20	We will be sharing, celebrating, and improving these tasks with new learning about growth mindset. ● Explain what participants will need to bring to the next session ● Answer any questions.	5 min.
Slides 21 - 23	References	

Monthly Meeting Discussions	Timing, Resources, and Protocols
Use the following discussion questions for a brief follow-up to this session. Have participants choose a partner and answer 1-2 questions from the list. ● How does your mindset affect how you approach certain tasks in your personal life? ● How does your mindset affect how you approach teaching and learning mathematics? ● How might your students' mindsets affect their mathematics learning? ● How do you discuss mindset in your classroom teaching?	8 min. Protocol: ● Silent Appointment ● Dyad

Session 2: Strategies for Teaching and Learning
November 2022 - 120 Minutes
Google Slide Link for Session 2

        The second of these sessions will be dedicated to sharing with participants teaching and learning strategies in secondary mathematics education that can improve student mindset. These theories and practices will include teaching the value of failing well (Robinson, 2017; King, 2013), the use of low-floor high-ceiling tasks to help all students see success (Kachwalla, 2021), the language teachers use to relay a growth mindset to students (Lee, 2009), and the importance of purposeful reflection for students about their learning (Suh et al., 2011). As a part of this session, teachers will devise a plan of implementation for some or all of these strategies in their classrooms. They will be able to work with colleagues that teach the same grade level or course to discuss approaches for teaching and reframing student mindset in the coming weeks.

Presenter will need:	- Laptop for presentation and videos - Knowledge and Connections Worksheet (1 per participant) - Culturally Responsive Protocols for reference - Reflecting on Problem Solving Prompts (1 per participant) - Mindset Quiz (1 per participant) - Sticky Notes - Participants sitting in groups of 3 or 4		
Participants will need:	- Writing utensil - Instructions, materials, and rubric for a task given in their class (can be digital) - Scored student assignment/assessment/rubric - Knowledge and Connections Worksheet from Session 1		
Slides	**Content and Notes**		**Timing, Resources, and Protocols**
Slide 1	Welcome and Presenter introduction		1 min.
Slide 2	Key Points In our last session we learned about growth and fixed mindsets, their relationships to learning		3 min.

	and achievement, and ways that we might adjust our teaching to have better achievement. ● Before we can expect students to move forward with a growth mindset, we must reflect on our own mindsets and adjust how we approach teaching and learning.	
Slide 3	Read and review the goals of the session or ask a volunteer to read them to the participants	1 min.
Slide 4	Pass out Knowledge and Connections worksheet to participants ● Remind participants of the purpose of the worksheet ● Participants may add to their previous chart or begin a new one	2 min. Knowledge and Connections Worksheet
Slide 5	● Pass out mindset quiz to participants. ● Explain directions. ● Give 3-5 minutes to complete.	5 min. Mindset Quiz
Slide 6	Key Points ● Use the scoring guide to score each question, then add them all together to get your overall mindset score. ● Explain the scoring guide to participants. ● Have participants score themselves.	4 min.
Slide 7	Key Points ● Find your overall score and read the description below. ● Pair-Share: Does this describe your mindset? Why or why not? ● Ask for Compelling Moments from participants	6 min. Protocol: ● Think-Pair-Share ● Compelling Moment
Slide 8	Key Points ● Language is a powerful tool used by teachers to establish expectations for learning and behavior, and it is also invaluable in developing a growth mindset in students ● What are other questions or comments you could give students to encourage a growth mindset?	3 min. Protocol: ● Chime In
Slide 9	Key Points ● With this kind of feedback, students can	2 min.

	evaluate their work, learn from mistakes, and will be encouraged to continue their understanding. ● By being intentional in the way that educators use language and feedback to encourage students, they will be able to cultivate a growth mindset in the students in their classrooms.	
Slide 10	Participants will study scored student work and reflect with peers. ● Look at the student work you brought with you. ● What feedback did you provide? ● How might you encourage a growth mindset with different feedback?	8 min. Scored student work Protocol: ● Dyad
Slide 11	Key Points ● The idea is not that teachers or students have to be brain scientists to have a growth mindset. ● However, our students are capable of understanding the science presented in images like this one. ● We can help them make the connection between growth mindset and brain activity.	3 min.
Slide 12	Key Points ● Students can react differently to failure, but by normalizing failure we encourage a student's growth mindset ● We can model this by sharing our own failures to create a safe environment for students to fail.	2 min.
Slide 13	Key Points ● We can model a growth mindset through language and feedback, but students must develop this mindset for themselves. ● Students who are able to respond to prompts or engage in discussions that reflect the varying depths necessary to solve difficult problems are more likely to develop a sense of deeper learning, consistent with a growth mindset. ● Reflection creates an active connection between what is being asked of the students and its connection to development of a growth	3 min.

	mindset.	
Slide 14	Pass out Reflecting on Problem Solving Prompts paper to participants. ● Give 2-3 minutes to participants to read the prompts. ● These reflection prompts can be used prior to an assignment/assessment, in the middle of a task, or after completing a task. ● These can be answered individually or with peers.	5 min. Reflecting on Problem Solving Prompts
Slide 15	Key Points ● To encourage students to develop a growth mindset, it is important for them to both find success in mathematics and challenge themselves with tasks. ● If the ceiling is too low, students lose out on opportunities to extend understanding. If the floor is too high, the task is not accessible to all students. ● Example: *What is the area of a rectangle whose width is 4 meters and length is 9 meters?* or *What are the dimensions of a rectangle whose total area is 36 square meters?* ● Using low-floor high-ceiling math tasks in class encourages students to take risks, make mistakes, and learn from a process of critical thinking rather than a rule, an important aspect of growth mindset.	4 min.
Slide 16	Participants may work individually, in pairs, or in grade-level teams to redesign the tasks they brought with them to the session.	1 min.
Slide 17	Answer any questions about the task.	1 min.
Slide 18	Break	5 min.
Slide 19	Play video timer while participants work.	30 min. 30 Minute Timer Video
Slide 20	Explain Silent Appointment to participants. ● With your partner, share what updates you	8 min.

	made to your assignments to encourage growth mindset in your students.	
Slide 21	Participants may meet with grade-level team. ● Teachers: Make a plan (individually or with your grade-level teams) to implement new learning to promote a growth mindset in students. ● Coaches and Administrators: Decide how you will support staff and students on this journey.	10 min.
Slide 22	Use the post-its from your table to answer the questions posted around the room. You may use as many post-its for a question as you need. You may also use the post-its to comment on others' responses.	8 min. Protocol: ● Post Your Thoughts ● Gallery Walk
Slide 23	We will be sharing and celebrating our plans at the next session. ● Explain what participants will need to bring to the next session ● Answer any questions.	5 min.
Slides 24 & 25	References	

Monthly Meeting Discussions	Timing, Resources, and Protocols
Use the following discussion questions for a brief follow-up to this session. Have participants choose a partner and answer 1-2 questions from the list. ● What strategies have you tried to implement in your classroom to improve student mindset? ● What might you change in the next week or month to improve student mindset? ● Review an upcoming assessment or learning activity. How might you incorporate intentional reflection into this learning experience? ● How have you or might you include other stakeholders in your journey to improve student mindset?	8 min. Protocol: ● Silent Appointment ● Dyad

Session 3: Reflection and the Future of Growth Mindset
April 2022 - 60 Minutes
[Google Slide Link for Session 3](#)

The last of the longer professional learning sessions will be dedicated to celebrating successes, reflecting on challenges in implementing learned strategies, and looking forward to new ideas for the coming school year to encourage a growth mindset. This session will include an overview of the first two sessions, but will be largely discussion-based to share and hear the scope of learning that took place over the school year to identify how *teaching high school students about growth mindset affects their attitudes toward mathematics learning and academic achievement.*

Presenter will need:	- Laptop for presentation and videos [Knowledge and Connections Worksheet](#) (a few extra copies for participants) [Culturally Responsive Protocols](#) for reference - Blank sheets of paper (1 per participant)	
Participants will need:	- Writing utensil - Updated learning materials with growth mindset focus - Knowledge and Connections worksheets from Sessions 1 and 2 - Plan of action (does not have to be written down)	
Slides	**Content and Notes**	**Timing, Resources, and Protocols**
Slide 1	Welcome and Presenter introduction	1 min.
Slide 2	Read and review the goals of the session or ask a volunteer to read them to the participants	1 min.
Slide 3	Key Points - Scientific research showed that individuals who had a growth mindset and attempted to learn from a mistake had more brain activity than individuals with a fixed mindset (Mangels et al., 2006). - Adopting a growth mindset fundamentally	3 min.

	changes the way your brain responds to new information or learning experiences ● Growth mindset = more brain activity ● Teaching our students this understanding empowers them to make connections between a growth mindset and their performance in academics	
Slide 4	Key Points ● We know we can't predict a student's mindset from their parents or teachers. ● However, we do know that we can teach mindset through behavior and belief. ● We know that mindsets can be taught! As educators, we have the power and responsibility to do just that.	3 min.
Slide 5	Key Points ● With the positive effects of a growth mindset so evident, we know our classrooms will change. ● We may take new perspectives on our building goals, how we address inequities, and both teacher and student mindset.	2 min.

Slide 6	Key Points
	● We can change student mindset by adjusting how we approach teaching and learning. For example,
	  ○ Using feedback that encourages improvement
	  ○ Using intentional language that focuses on student growth
	  ○ Setting goals for mastery instead of performance
	  ○ Responding to success and failure appropriately
	  ○ Creating opportunities for purposeful reflection
	  ○ Allowing all students to access the learning
	● All of these ideas can be used alone or in tandem.
		4 min.

Slide 7	Ask participants to take out Knowledge and Connections charts from previous sessions. ● You were asked to bring your previous	3 min. Protocol:

	Knowledge and Connections charts with you to look back on what you learned, what you made connections to in your practice, and how those ideas were channeled into your classrooms to improve growth mindset. ● Take a few minutes to read through what you wrote. ● As we continue to reflect on what we learn, we are practicing a growth mindset. Use this as a model for your students.	● Moment of Silence

Slide 8	Pass out blank sheets of paper to participants
	● Explain activity
	   ○ Divide paper into two halves
	   ○ On one side of paper, describe your assignment/task/rubric/plan. You may explain any changes you made, changes you intended to make, new reflections after teaching, etc.
	   ○ On the other side, explain how this moves you or your students to have a growth mindset.
		5 min.
		
		Blank sheets of paper (1 per participant)

Slide 9	Explain the protocol and give about 15 minutes for participants to view their peers' work. ● Participants should write directly on the reflection paper to give feedback. ● Share that you will choose participants at random to share what they loved, learned, or found interesting.	15 min. Protocol: ● Post Your Thoughts ● Gallery Walk
Slide 10	Explain Pick a Stick protocol again. ● Choose 3-4 participants at random to share what they loved. ● Ask for volunteers to share any new ideas they may have after looking at their peers' plans.	8 min. Protocol: ● Pick a Stick ● Compelling Moment
Slide 11	Pass out large pieces of paper ● On the paper you will answer the question, "What's next for growth mindset?" ● Explain Silent Conversation Protocol ● Give 5 minutes for silent conversation and 3 minutes for discussion afterwards.	8 min. Protocol: ● Silent Conversation

Slide 12	Review Gallery Walk protocol. ● Ask participants to move around the room to look at the other conversations. ● This time they **will not** be giving feedback. ● Ask for any compelling moments and final takeaways.	5 min. Protocol: ● Gallery Walk ● Compelling Moment
Slide 13	Thank you!	2 min.
Slide 14	References	

Monthly Meeting Discussions	**Timing, Resources, and Protocols**
Use the following discussion questions for a brief follow-up to this session. Have participants choose a partner and answer 1-2 questions from the list. ● What strategies have you tried to implement in your classroom to improve student mindset? ● How will you begin next school year to create a culture of growth in your classroom? ● What might you change in the next week or month to improve student mindset? ● Review an upcoming assessment or learning activity. How might you incorporate intentional reflection into this learning experience? ● How have you or might you include other stakeholders in your journey to improve student mindset? ● How have you seen a change in your students since you have made these adjustments to your teaching?	8 min. Protocol: ● Silent Appointment ● Dyad

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