

Promoting a Positive Math Identity

Module 2

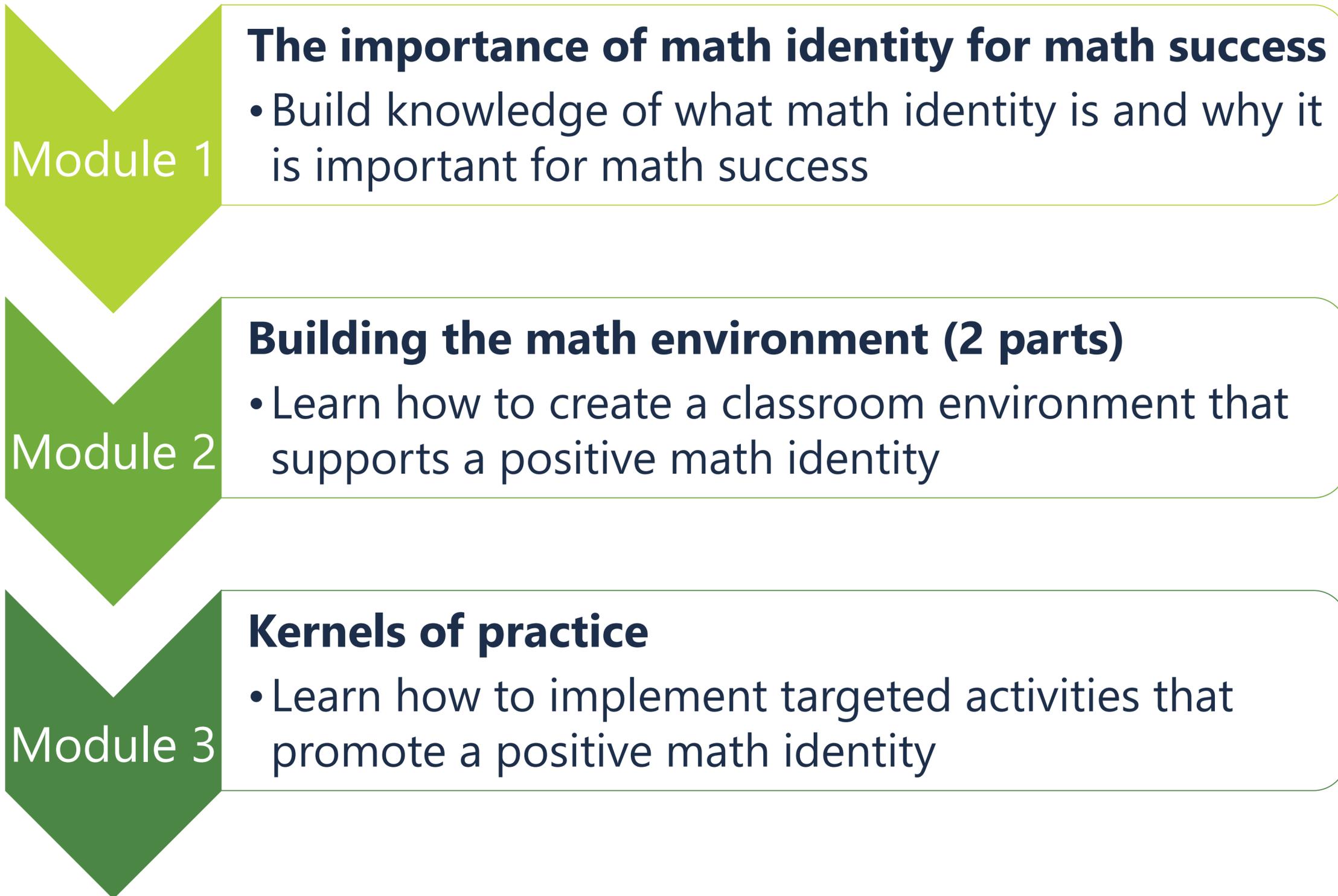
Building the Math Environment (Part 1)



Classroom Practices to Promote a Positive Math Identity, Module 2 of 3

Note. These materials were produced for the Idaho State Department of Education and the Idaho Regional Mathematics Centers and were presented on August 13, 2019 at the Idaho Council of Teachers of Mathematics conference.

Training series progression



Module 2 learning objectives

By the end of this session, you will be able to:



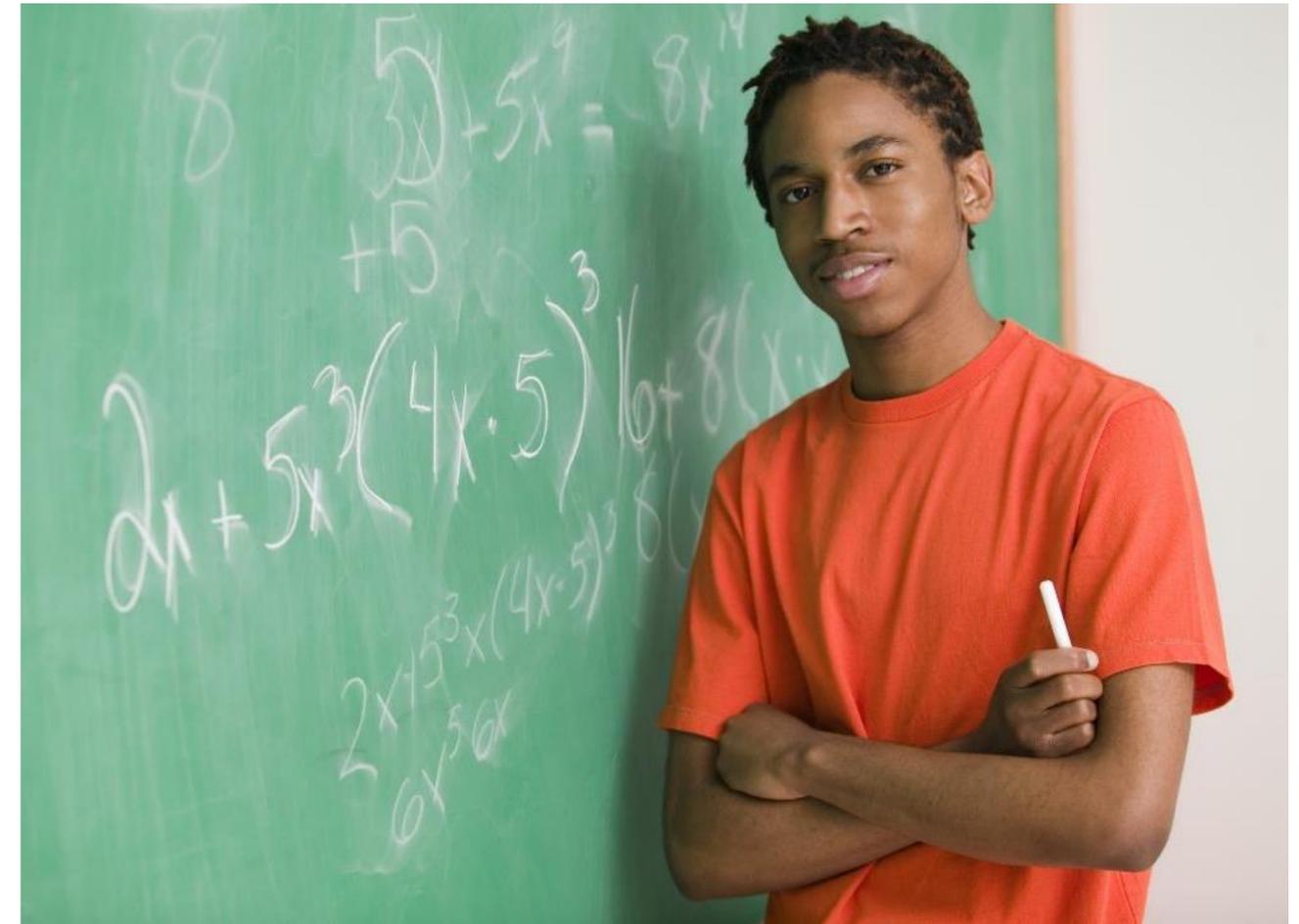
Reflect on your math attitudes and beliefs.



Understand how to create a classroom climate that is identity-affirming for all students and promotes math learning.



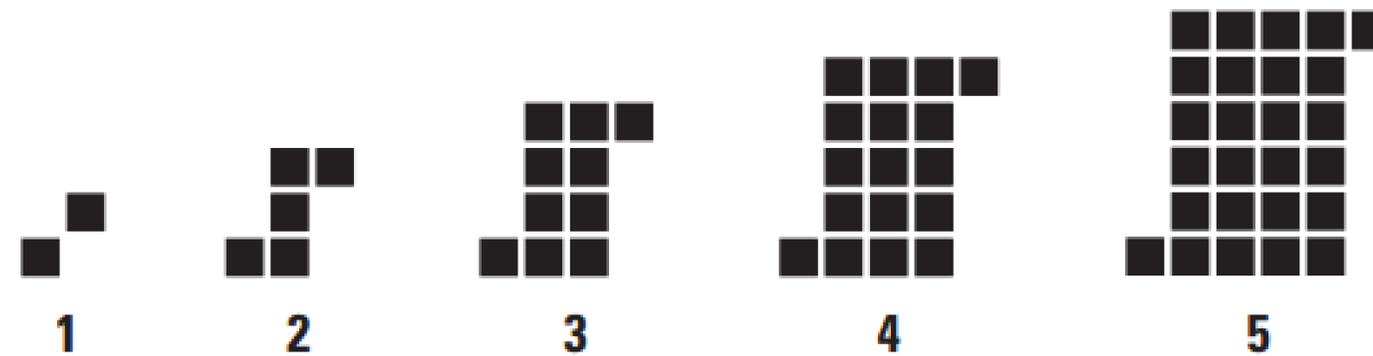
Develop instructional practices that foster positive math attitudes.



Icebreaker

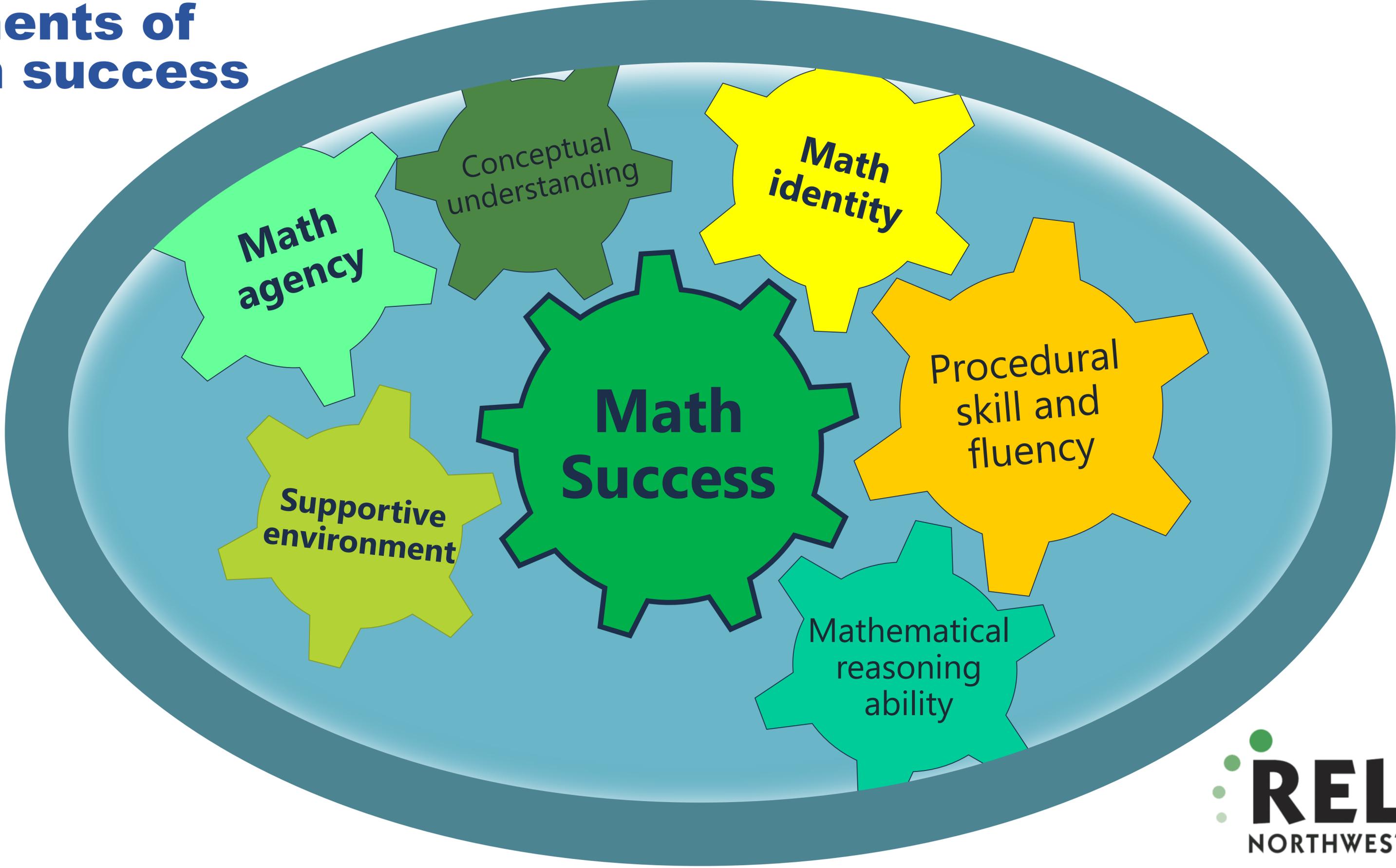


Icebreaker



1. What patterns do you notice in the set of figures?
2. Sketch the next two figures in the sequence .
3. Determine an equation for the total number of tiles in any figure in the sequence.
4. Is there a linear relationship between the figure number and the total number of tiles? Why or why not?

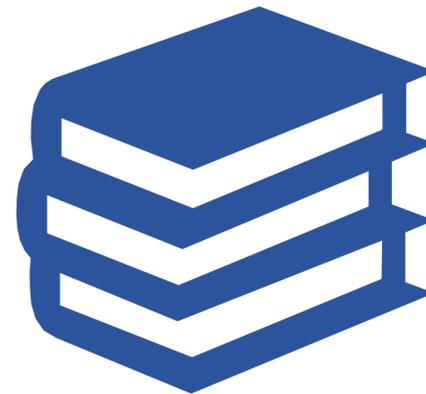
Elements of math success



Math identity and agency critical for math success



Math Identity



Math Agency



Academic Outcomes

Key aspects of math identity

Sense of belonging

- Feeling like an accepted, valued, and legitimate group member

Growth mindset

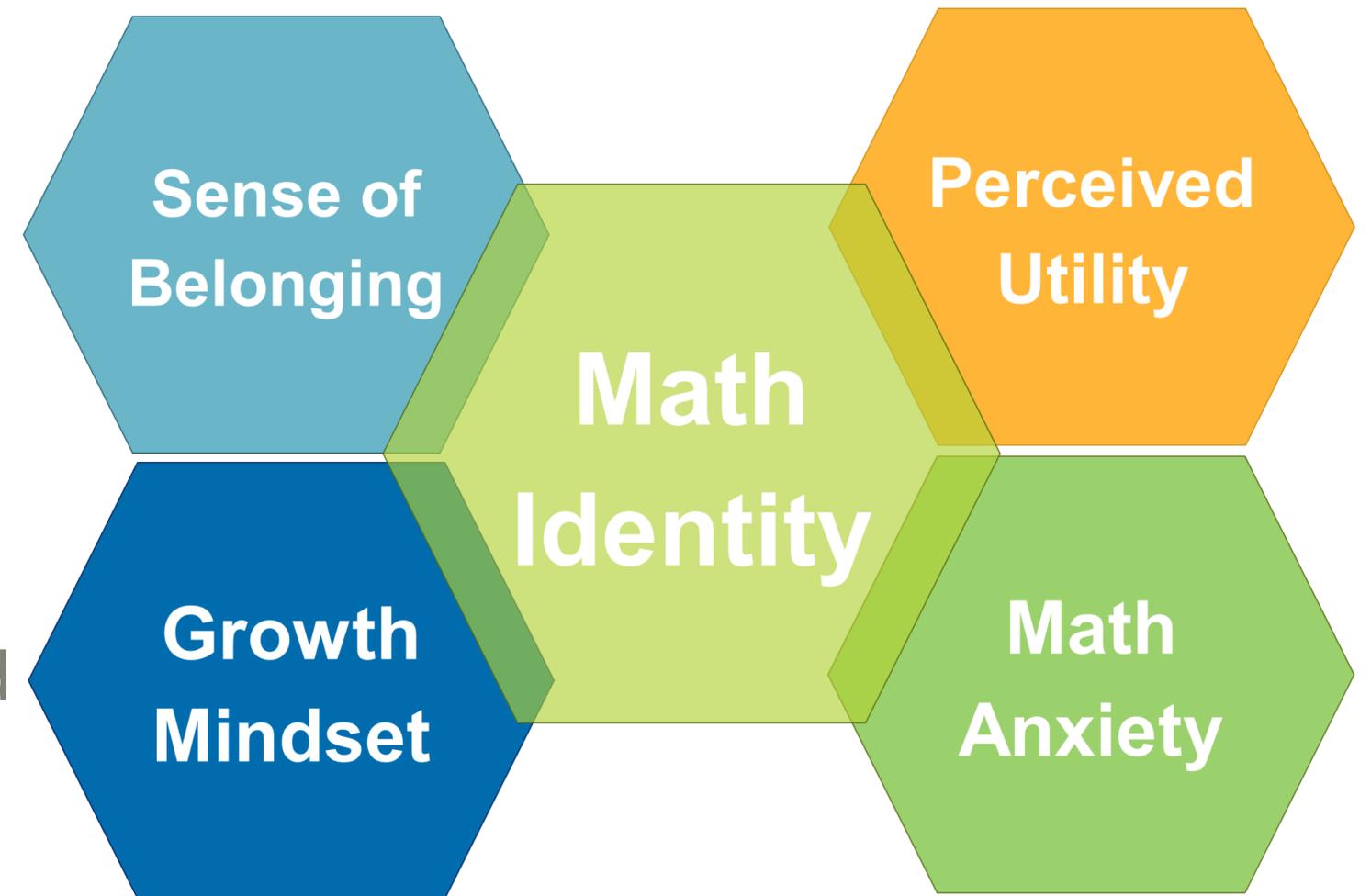
- The belief that intelligence and ability can be developed with effort, strategies, and support

Perceived utility

- The belief that math is useful, worthwhile, and relevant to life outside of school, now and in the future

Math anxiety

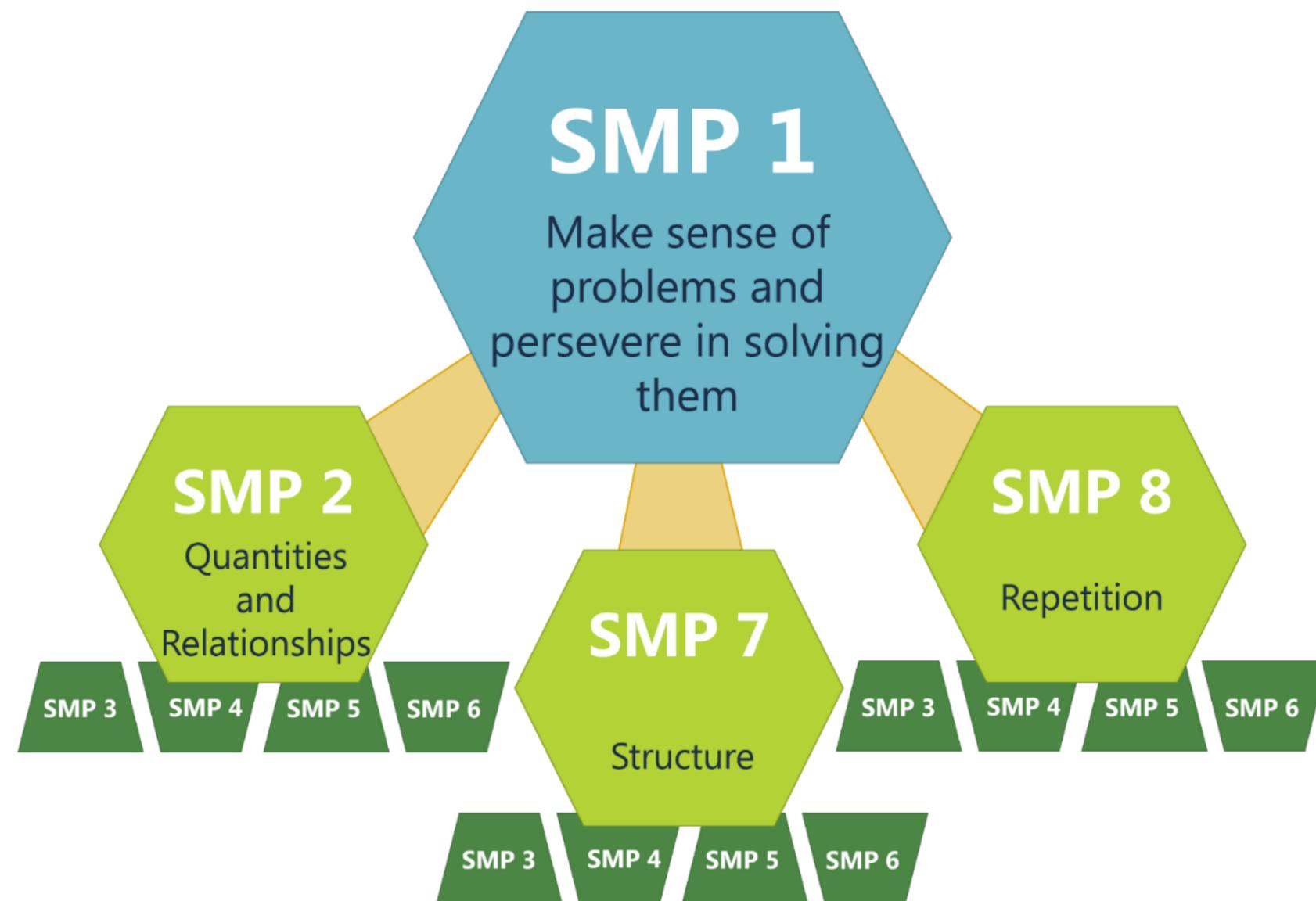
- Feeling apprehensive, tense, and fearful about situations involving math



Connection with the Standards for Math Practice

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.





Cultivating math self-awareness

How do teachers' math attitudes impact students?



- Teachers' *mindsets* influence their pedagogical decisions.
- Teachers' *math anxiety* influences their pedagogical decisions.
- Teachers' attitudes about *who belongs* influences students' math achievement.

Cultivating your own math self-awareness and skills



- Be aware of your own feelings about math and how you express them.
- Teachers must have a proficient understanding of the math concepts in which they are instructing.
- Be aware of the assumptions you make about students as math learners.

Discussion

Think back to the icebreaker.



How did you feel while teaching/working on this problem?



Did you notice any areas where the instructor/students did not seem comfortable?



How did this impact the instruction? How did this impact you as a teacher/learner?

Summary of evidence-based strategies

Focus	Strategy	Key Aspect(s) of Math Identity Affected			
		Belonging	Growth Mindset	Perceived Utility	Math Anxiety
Classroom Culture	Bust stereotypes	✓			
	Positive climate	✓			
	Honor mistakes	✓	✓		✓
	High expectations	✓	✓		
	Time pressures				✓
	Make math collaborative	✓			
	Messaging	✓	✓	✓	✓
	Process feedback		✓		

Summary of evidence-based strategies: Bust stereotypes

Focus	Strategy	Key Aspect(s) of Math Identity Affected			
		Belonging	Growth Mindset	Perceived Utility	Math Anxiety
Classroom Culture	Bust stereotypes	✓			
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	Honor mistakes	✓	✓		✓
	High expectations	✓	✓		
	Time pressures				✓
	Make math collaborative	✓			
	Messaging	✓	✓	✓	✓
	Process feedback		✓		

Create non-stereotypical environments



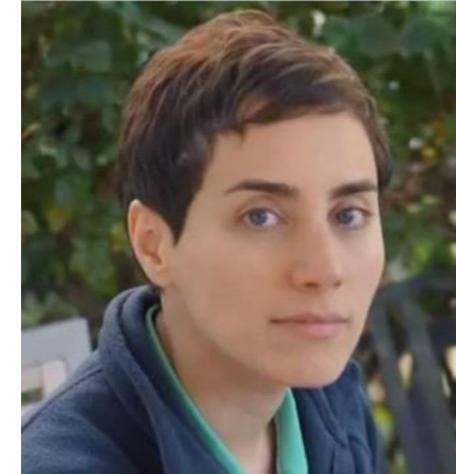
- Physical environments can communicate stereotypes. They can also discourage belonging and interest for students who don't fit those stereotypes.

Relevant factors

- ✓ Belonging
- Mindset
- Anxiety
- Utility

Content source: Cheryan, Plaut, Davies, & Steele, 2009

Who's a mathematician?



Who's a mathematician?



Trachette Jackson



Brooke Shipley



John Urschel



Maryam Mirzakhani



Ivan Corwin



Manjul Bhargava



Ming-Ying Leung



Andrew Wiles

Who's a mathematician?



John Urschel

- John was born in 1991 and grew up in Buffalo, New York
- He went to Penn State University where he majored in math and was on the football team
- After college, he played in the NFL for the Baltimore Ravens.
- He also began a Ph.D. in mathematics program through MIT.
- John retired from the NFL in 2017 to pursue his math career full-time.
- His goal is to be a college math professor.



His math research focuses on convex and discrete geometry, graph theory, machine learning, and numerical analysis.

Relevant factors

- ✓ Belonging
- Mindset
- Anxiety
- Utility

Summary of evidence-based strategies: Positive climate

Focus	Strategy	Key Aspect(s) of Math Identity Affected			
		Belonging	Growth Mindset	Perceived Utility	Math Anxiety
Classroom Culture	Bust stereotypes	✓			
	Positive climate	✓			
	Honor mistakes	✓	✓		✓
	High expectations	✓	✓		
	Time pressures				✓
	Make math collaborative	✓			
	Messaging	✓	✓	✓	✓
	Process feedback		✓		

Build a positive classroom climate

Create a welcoming, inclusive classroom culture

- Smile and greet students by name
- Make sure everyone's voice is heard by at least one other person
- Include elements of personal choice



Relevant factors

- ✓ Belonging
- Mindset
- Anxiety
- Utility

Purpose and consistency are key!



Build a positive classroom climate



Develop relationships

- Teacher-student
- Student-peers
- Teacher-family

Relevant factors

- ✓ Belonging
- Mindset
- Anxiety
- Utility

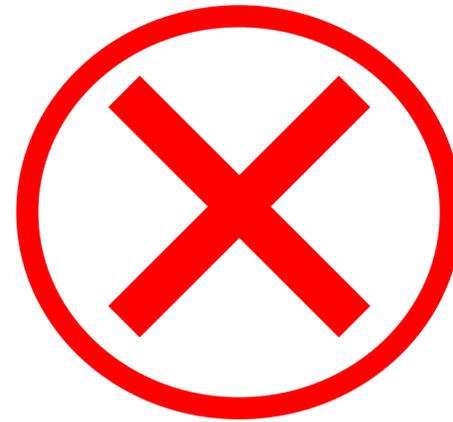
Content source: Miller, Kochel, Wheeler, Updegraff, Fabes, Martin, & Hanish, 2017

Summary of evidence-based strategies: Honor mistakes

Focus	Strategy	Key Aspect(s) of Math Identity Affected			
		Belonging	Growth Mindset	Perceived Utility	Math Anxiety
Classroom Culture	Bust stereotypes	✓			
	Positive climate	✓			
	Honor mistakes	✓	✓		✓
	High expectations	✓	✓		
	Time pressures				✓
	Make math collaborative	✓			
	Messaging	✓	✓	✓	✓
	Process feedback		✓		

Honor mistakes as part of the learning process

Math, more so than other subjects, focuses on finding the “right” answer.



But, the process students use to arrive at the solution is just as important.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- ✓ Anxiety
- Utility

Content source: Turner et al., 2002; Boaler, 2015

Honor mistakes as part of the learning process

Create the norm that making mistakes is OK and expected



- Let students know that you embrace mistakes as part of the learning process.
- Explain why mistakes are important—they are chances to learn.
- Help students understand how they got their mistake and provide specific tools and strategies to help repair their misconceptions.
- Encourage persistence and perseverance in solving problems.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- ✓ Anxiety
- Utility

Content source: Mindset Kit, n.d.



How does honoring mistakes as part of the learning process support and build on the SMPs?

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
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7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- ✓ Anxiety
- Utility

Content source: Common Core State Standards Initiative, n.d.



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Relevant factors

- ✓ Belonging
- ✓ Mindset
- ✓ Anxiety
- Utility

Content source: Common Core State Standards Initiative, n.d.

Honor mistakes as part of the learning process

Facilitating a student-led discussion to cultivate this norm in the classroom



Relevant factors

- ✓ Belonging
- ✓ Mindset
- ✓ Anxiety
- Utility

Inside Mathematics, n.d.

Honor mistakes as part of the learning process

You notice that one of your students has made a mistake while working on the problem below. What do you do?

$$10 + 10 \times 8 - 2^2 =$$

$$10 + 10 \times 8 - 4 =$$

$$20 \times 4 =$$

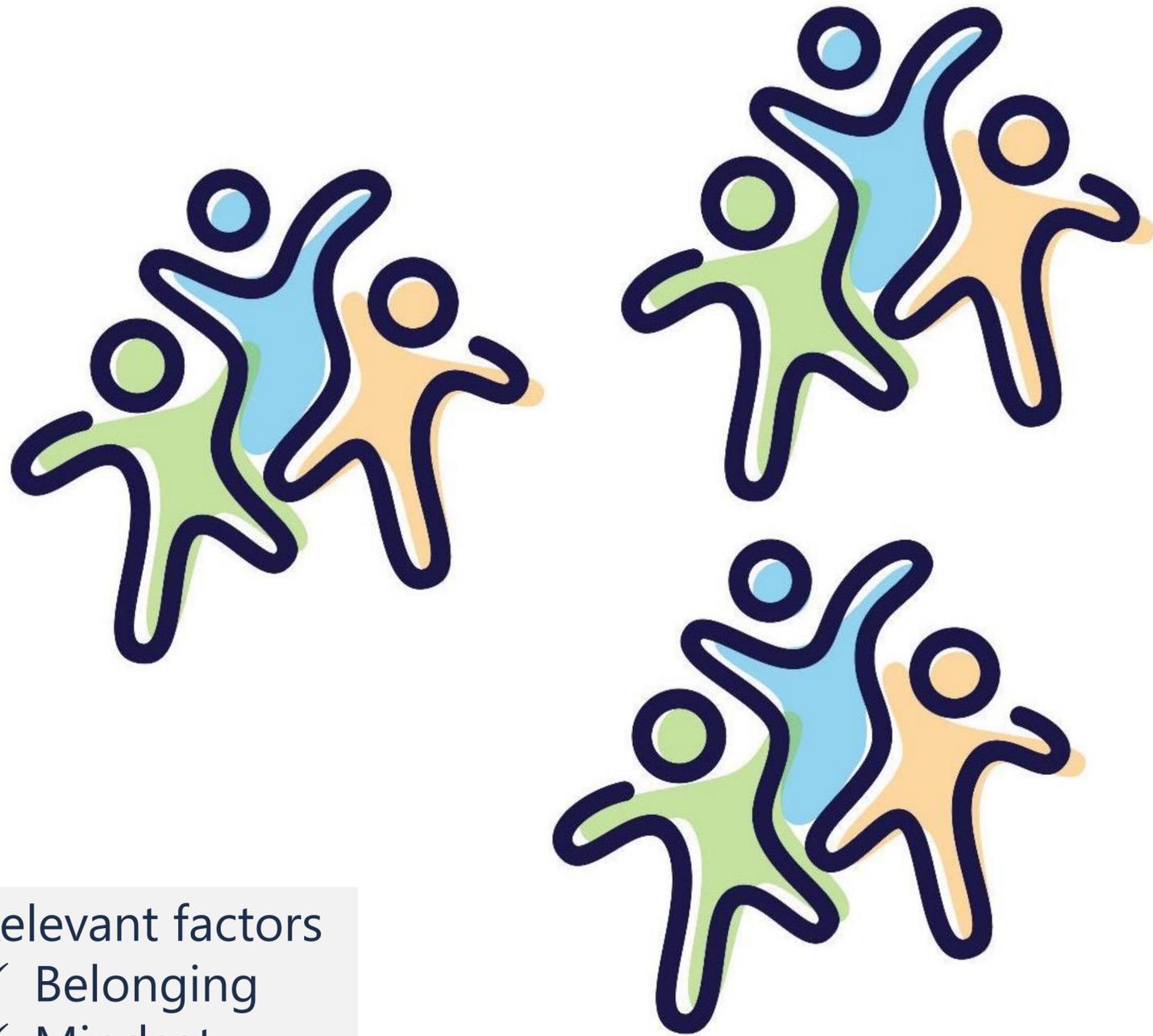
$$= 60$$

Correct answer: 86

Summary of evidence-based strategies: High expectations

Focus	Strategy	Key Aspect(s) of Math Identity Affected			
		Belonging	Growth Mindset	Perceived Utility	Math Anxiety
Classroom Culture	Bust stereotypes	✓			
	Positive climate	✓			
	Honor mistakes	✓	✓		✓
	High expectations	✓	✓		
	Time pressures				✓
	Make math collaborative	✓			
	Messaging	✓	✓	✓	✓
	Process feedback		✓		

Hold high expectations for all students



Ability grouping or tracking implicitly communicates that teachers have a fixed mindset about students' intelligence and potential.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility

Content source: Boaler, 2005; 2013

Hold high expectations for all students

Research has found that students in heterogeneous classes achieve more than students in ability-grouped classes

- When an American school district stopped using ability grouping in middle school math classes, so all students took rigorous math classes, the following happened:
 - ✓ More students took advanced math classes in high school
 - ✓ More students passed their math classes
 - ✓ Students earned higher scores on the state math exam
 - ✓ The achievement gap between white and minority students narrowed dramatically

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility

Content source: Burris, Heubert, & Levin, 2006



Hold high expectations for all students

Holding different expectations for different students is a common *signal influencer* in the classroom.

My teacher asks me easier questions than other students. She must think I'm not as smart.



Signal influencers are unconscious messages in teachers' daily interactions with students. They can signal to the student that they do not belong.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility

Content source: Carr & Kefalas, 2009; Matthews, 2018; Mckown, 2013

Hold high expectations for all students

Holding different expectations for different students is a common *signal influencer* in the classroom.

My teacher asks me easier questions than other students. She must think I'm not as smart.



Signal influencers are particularly pervasive in math classrooms.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility

Content source: Matthews, 2018; Mckown, 2013

Hold high expectations for all students



One of your colleagues joins you for lunch. She just finished teaching her sixth graders a lesson on using variables to represent an unknown number. She says, “They just can’t do it. It doesn’t matter how I teach it. It’s too hard for these kids.”

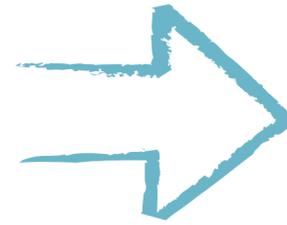
How would you respond to your colleague?

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility

Communicating high expectations

“I’m giving you comments on your math test, so you’ll have feedback on your work.”



“I’m giving comments on your math test, **because I have very high expectations and I know that you can reach them.**”

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility

Content source: Yeager et al., 2014

Communicating high expectations

This is challenging,
but all of us can
learn the material.

Our classroom is a place
for everyone to excel, and
I am here to help you.

I have high
expectations,
because I know that
you all have the
ability to do this.

Relevant factors

- ✓ Belonging
- ✓ Mindset
- Anxiety
- Utility



Reflection

What stood out for you, increased your knowledge, or changed your thinking during this session?

What is one thing you learned or discussed today that you will take back and apply to your work with teachers and/or your classroom?

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- Delivering customized training, coaching, and technical support
- Providing engaging learning opportunities



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