Math Self-Efficacy

Note. These materials were produced for the WA STEM partnership coaching meeting on 3/15/18.

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Icebreaker

Think of a time when your performance surprised you—a time when you succeeded or failed unexpectedly. How did your success or failure impact your feelings about yourself and your abilities?

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Learning Objectives

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

- Define self-efficacy and understand how it is formed
- Understand the importance of self-efficacy for student engagement and success in math
- Apply actionable strategies to build students' math self-efficacy

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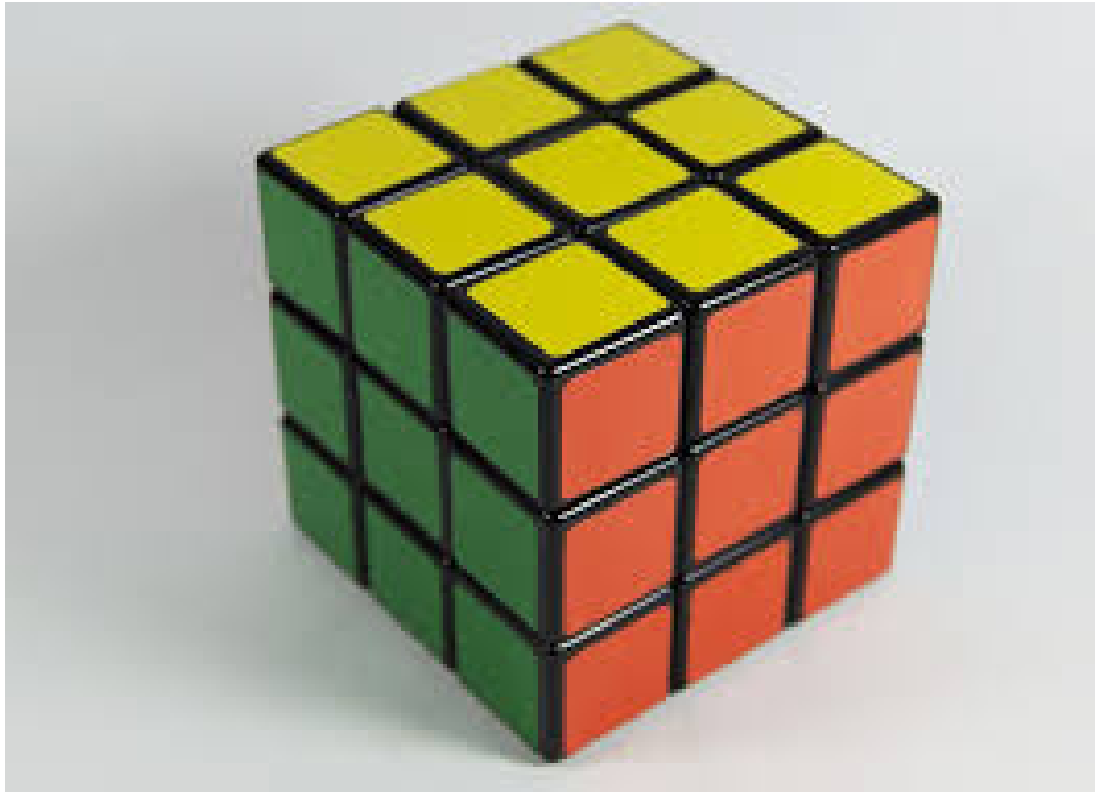
What is Self-Efficacy?

A person's **belief** they can succeed at a given task.



Bandura, 1986

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Students' Mindsets Influence Behaviors and Achievement

Academic Mindset

Academic Behaviors

Academic Outcomes

Adapted from Farrington (2013)

Students' Mindsets Influence Behaviors and Achievement

Farrington's Four Key Academic Mindsets:

1. I belong in this community
2. **I can succeed at this**
3. My ability and competence grow with my effort
4. This work has value for me

This is self-efficacy

Adapted from Farrington (2013)

Why Does Self-Efficacy Matter?

“ Whether you think you can, or you think you can’t, you’re right.”

– Henry Ford

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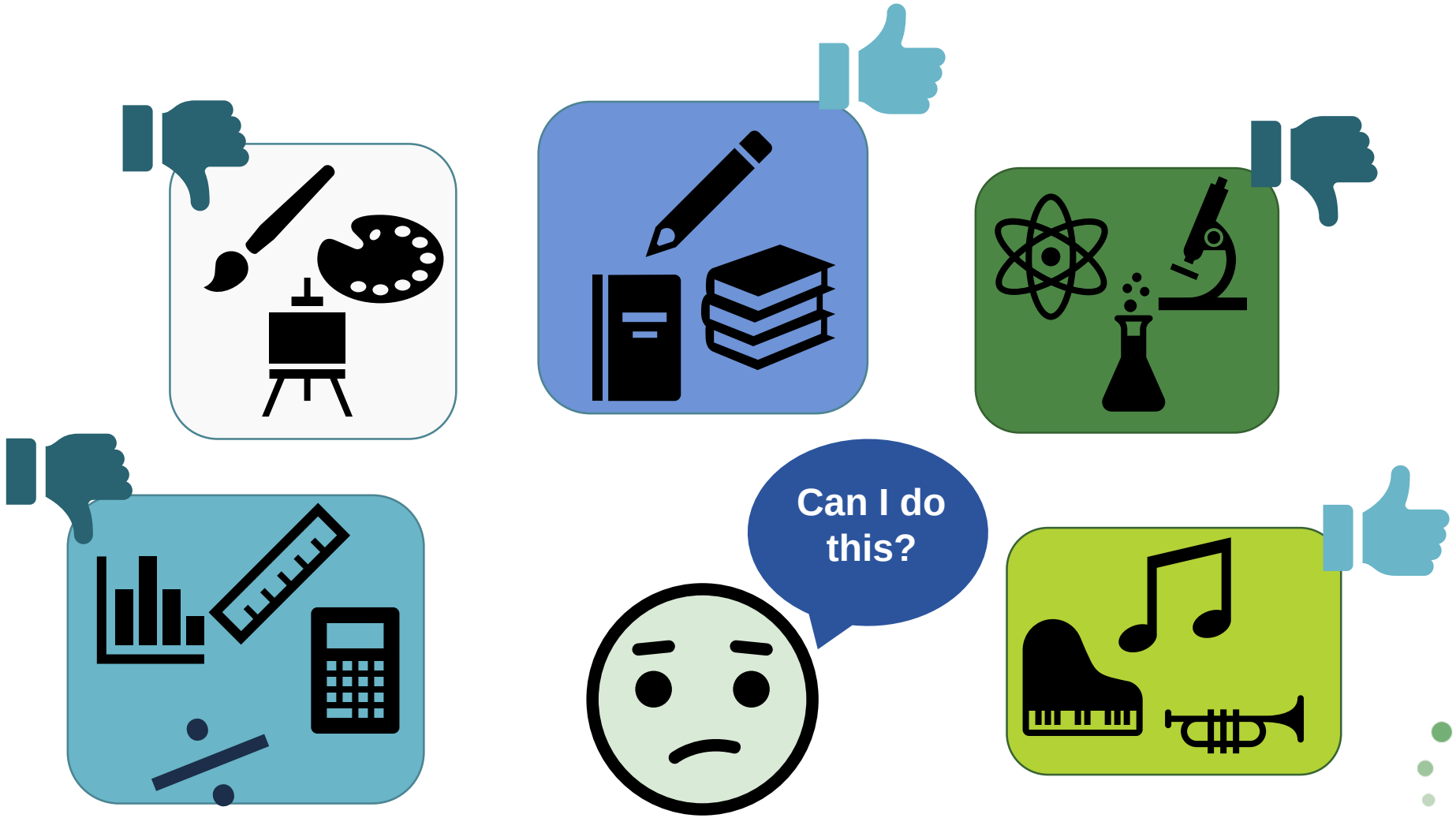
Self-Efficacy is Domain Specific



Bandura (1986)

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Self-Efficacy vs. Self-Esteem and Growth Mindset

	Self-Esteem	Self-Efficacy	Growth Mindset
Definition	Refers to a person's more **general sense of self-worth**.	Refers to a person's **belief that they can** do what's necessary to successfully achieve a **specific** goal or task.	Refers to the belief that a person's **abilities can change over time** as a result of effort, perseverance, and practice.
What does this answer?	Who am I? What is my worth?	Can I do this?	Can I grow in this area?
Example	"I am a competent person and a good learner."	"I am confident I can solve these factoring problems."	"I can't do this yet. But I know I can get better at it if I study hard, try new strategies, and seek help."

Adapted from Transforming Education (2017)

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Self-Efficacy in Schools

Zimmerman (2000)

Students with higher self-efficacy:

- Are more interested
- Persist longer and are more engaged
- Respond more adaptively when they encounter challenges
- Show stronger academic performance

Students also seek situations in which they are confident in their abilities and avoid those in which they are not.

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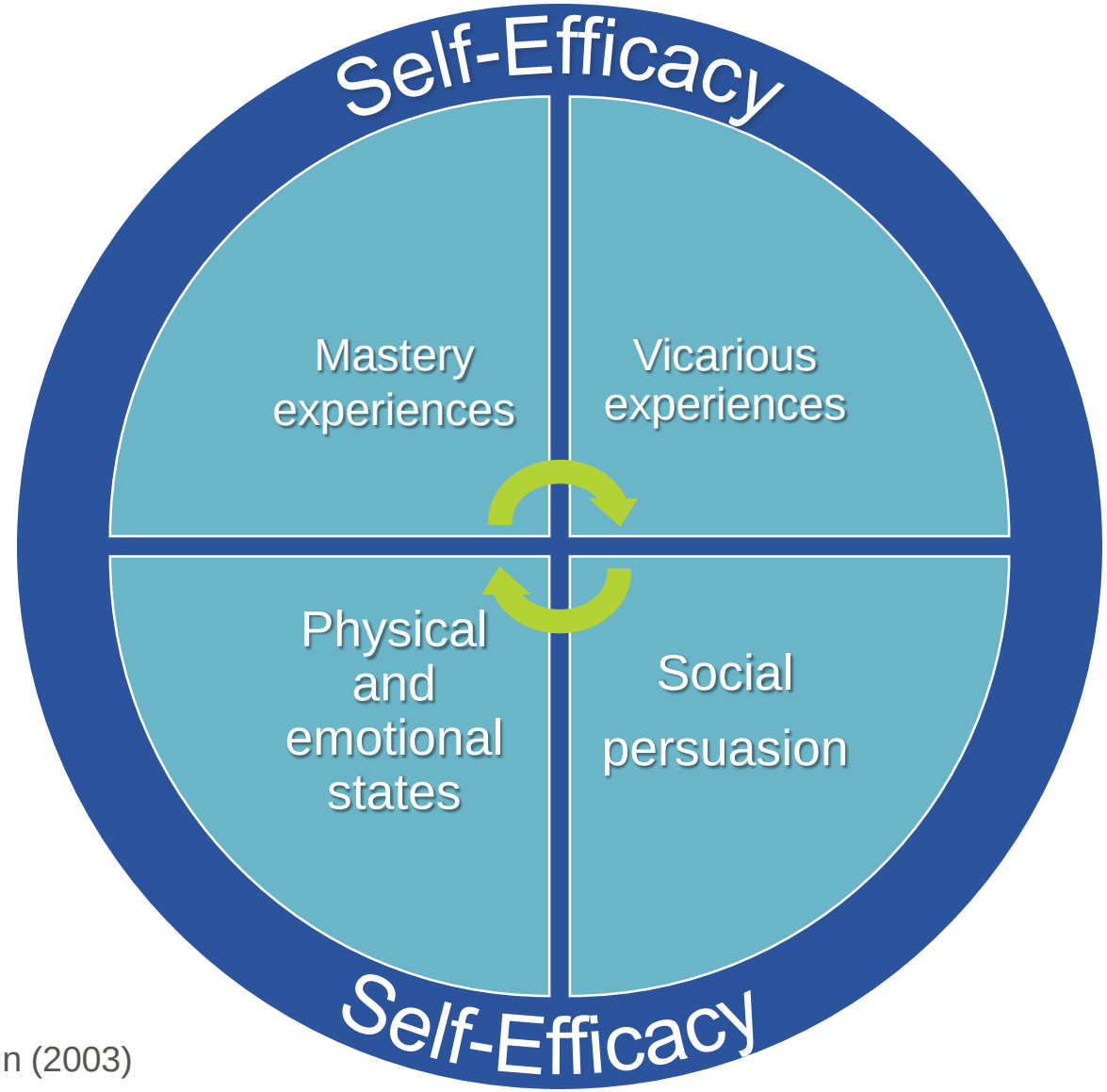
Sources of Self-Efficacy



Bandura (1977); Maddux & Gosselin (2003)

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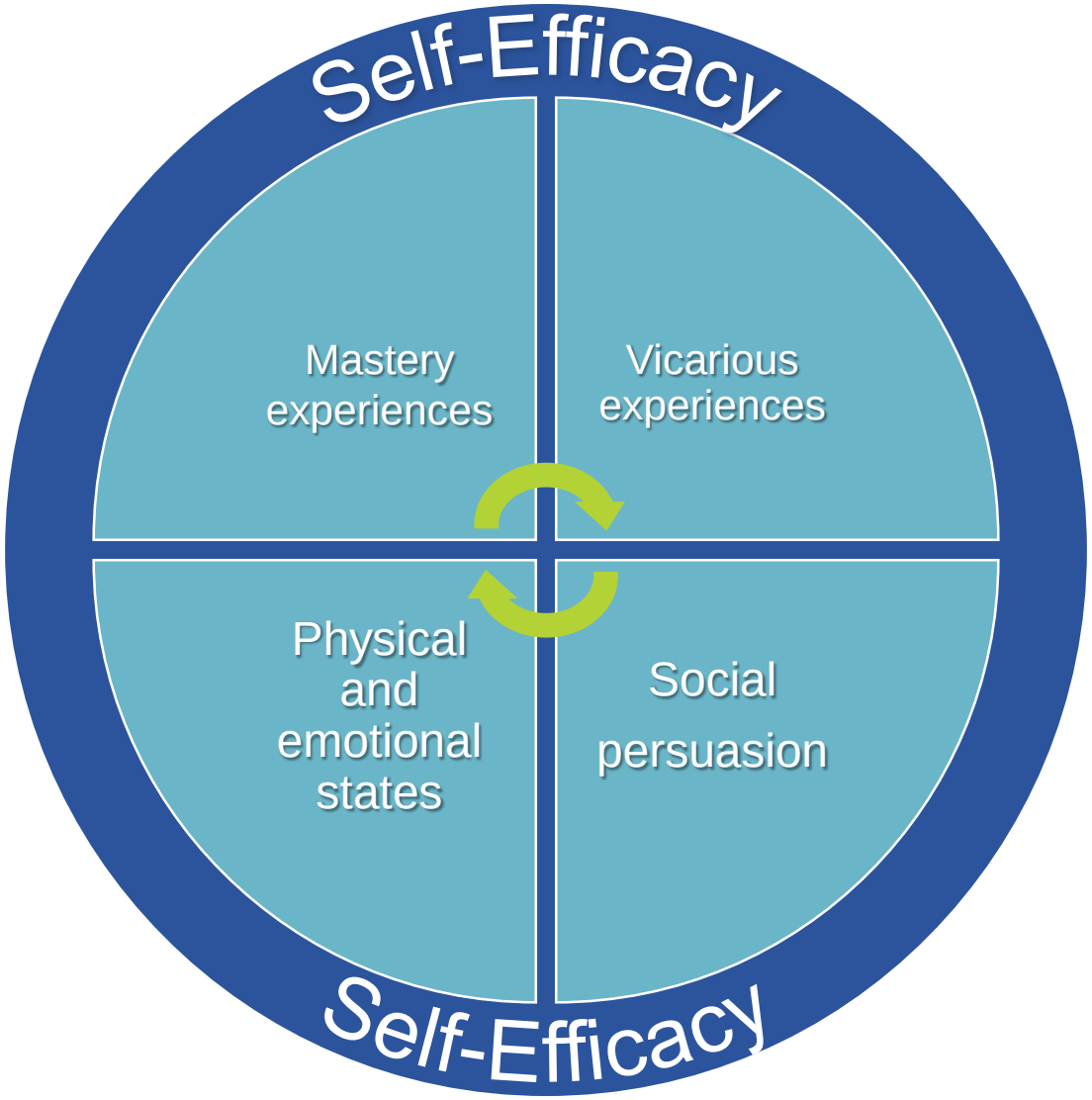
Sources of Self-Efficacy



- **Mastery Experiences:** I have had positive or negative experiences with this activity in the past or in other similar experiences.
- **Vicarious Experiences:** I have seen others whom I consider similar to me experience success or failure with this activity.
- **Social Persuasion:** People have told me I can or can't do this activity.
- **Physical and Emotional States:** I experience positive or negative physical and emotional sensations when engaged in this activity.

Bandura (1977); Maddux & Gosselin (2003)

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Self-Efficacy: What Do You Think?

"People's level of motivation, affective states, and actions are based more on what they **believe** than on what is objectively the case."

– Albert Bandura

? Do you agree that beliefs are a powerful determinant of academic behavior?

? Are there certain groups of students who seem to enter the classroom with more positive beliefs about their competence and ability than others? Why do you think that's the case?

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Gendered Perceptions of Math

"Boys do not pursue mathematical activities at a higher rate than girls do because they are better at math. They do so, at least partially, because they **think** they are better."

– Shelley Correll

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Self-Efficacy and Math Stereotypes

Sociocultural stereotypes associating science, technology, engineering, and math (STEM) with males act as barriers that prevent girls from developing interests in STEM—and this starts at a young age.

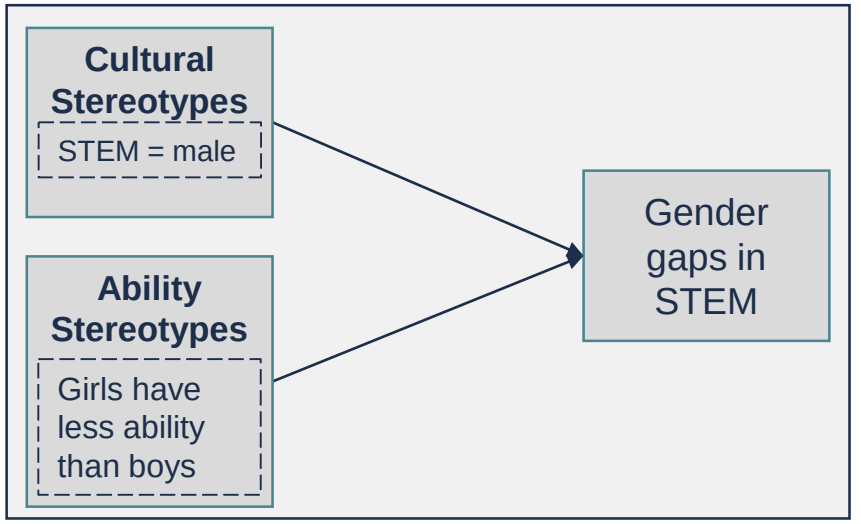

Figure adapted from Cheryan, Master, & Meltzoff (2015)

Counteracting stereotypes can increase interest in STEM among girls and students of color by increasing their confidence and making them feel as if they belong in math.

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Classroom Strategies to Build Self-Efficacy

Key Strategies

- Increase likelihood of success to build mastery
- Cultivate successful vicarious experiences
- Provide positive verbal persuasion
- Attend to physical and emotional states (see Math Anxiety session)

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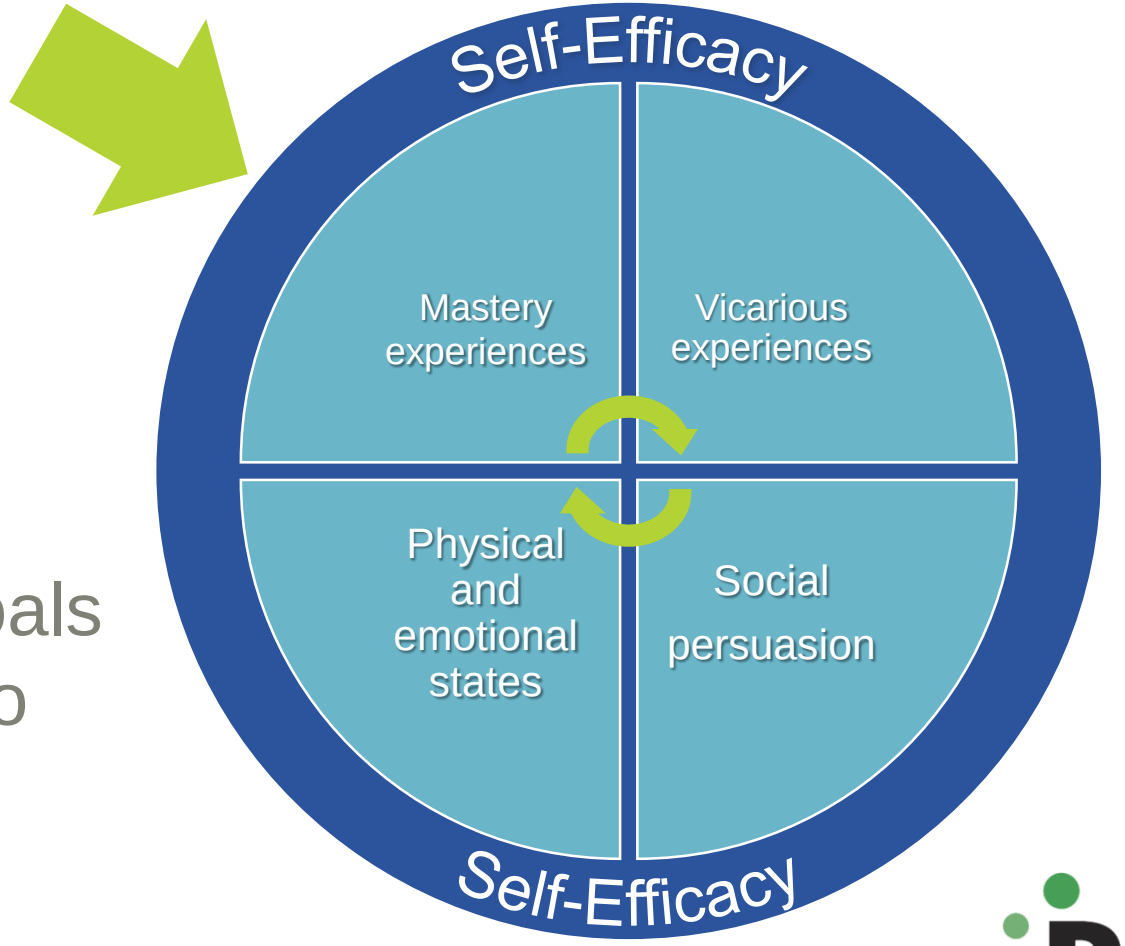
Increase Likelihood of Success to Build Mastery

- Use scaffolding to promote success on appropriately challenging tasks
- Help students set goals and track progress to see growth



Schunk (1990)

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Use Scaffolding to Promote Success

Scaffolding means building support features into lessons to help students independently transition from tasks at which they are successful to tasks that are more difficult.

Scaffolding strategies:

- Bridges
- Ladders

Anghileri (2006)

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Use Scaffolding to Promote Success

Build a **bridge**

- Horizontal method
- Evaluate whether your modeled exercises are sufficient to set students up to work independently and succeed at a problem
- If not, create additional practice tasks and fade your direction more gradually

Anghileri (2006)

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Use Scaffolding to Promote Success

Build a **ladder**

- Vertical method
- Compare students' starting point with end-of-lesson expectations
- Evaluate whether examples and exercises are sufficient to help students progress
- If not, add "rungs" to help students progress from their starting point to the end goal

Anghileri (2006)

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Use Scaffolding to Promote Success

- Consider how steps toward task comprehension need to be tailored for a range of learners
- Support students to identify their learning zone ("comfortable," "good challenge," or "too hard") in relation to where they are on the task road map
- Use *low-floor, high-ceiling* tasks to accommodate a range of abilities

Check out youcubed.org for resources

Anghileri (2006)

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Help Students Set Goals and Track Progress

- Identify the larger goal or lesson objective and then help students break it into small, attainable goals
- Goals should challenge students but still be achievable
- Give students the opportunity to track their progress toward these goals so they can see their successes and growth
- Celebrate successes!

Schunk (1990)

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Cultivate Successful Vicarious Experiences

Siegle & McCoach (2007)

Help students observe the successes of others who are similar to them

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Help Students See Successes of Others Like Them

- Use class demonstrations, such as a fishbowl activity, and invite students to model skills during lessons
- Create collaborative learning environments in which students develop skills while observing peers who can model effective strategies
- Use guided questioning to help peer models attribute their successes **AND** roadblocks to factors they can control (practice, trying a new approach, etc.)

Siegle & McCoach (2007)

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Provide Positive Verbal Persuasion

Give students substantive, process-related feedback to emphasize specific approaches and the connection of the approach to the end result

Siegle & McCoach (2007)

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YOU GOT THIS

Siegle & McCoach (2007)

Use Process-Related Feedback

- Use process praise to emphasize effort and strategy
- Be specific
- Be honest and realistic
- Challenge negative self-talk

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Positive Social Persuasion Scenario

Hey, Tyron, I noticed you're stuck on problem 2. Is now a good time to sit down and look at it together? OK, well, first I see that you found that the least common denominator between 1/3 and 1/6 is 6. Nice work—that's an important first step to adding these two fractions. And it looks like you listed multiples of 3 and 6 and found the smallest number that's the same, which is a helpful approach to finding the least common denominator.

It looks like you got stuck here and weren't sure how to make 1/3 into a fraction with a denominator of 6. How many times does 3 fit into 6? Two times—that's right! So if we multiply 1/3 by 2, what do we get? Yes, that's it! You multiply 2 x 1 to get the numerator (2) and 2 x 3 to get the denominator (6).

$$\frac{2}{6} + \frac{1}{6} = \frac{3}{6}$$

So now we have two fractions with the same denominator. How do you feel about adding these two fractions together now? Wonderful! I knew you could do it. Thank you for showing me the steps you used and giving it another try after you got stuck. Do you want to try showing Josie how to do it now?

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Bringing It All Together

In which of these areas are you most interested in practicing specific classroom strategies to build student self-efficacy in math:

- Mastery experiences?
- Vicarious experiences?
- Social persuasion?

How can you build these practices into everyday math instruction?

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Reflection

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

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

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