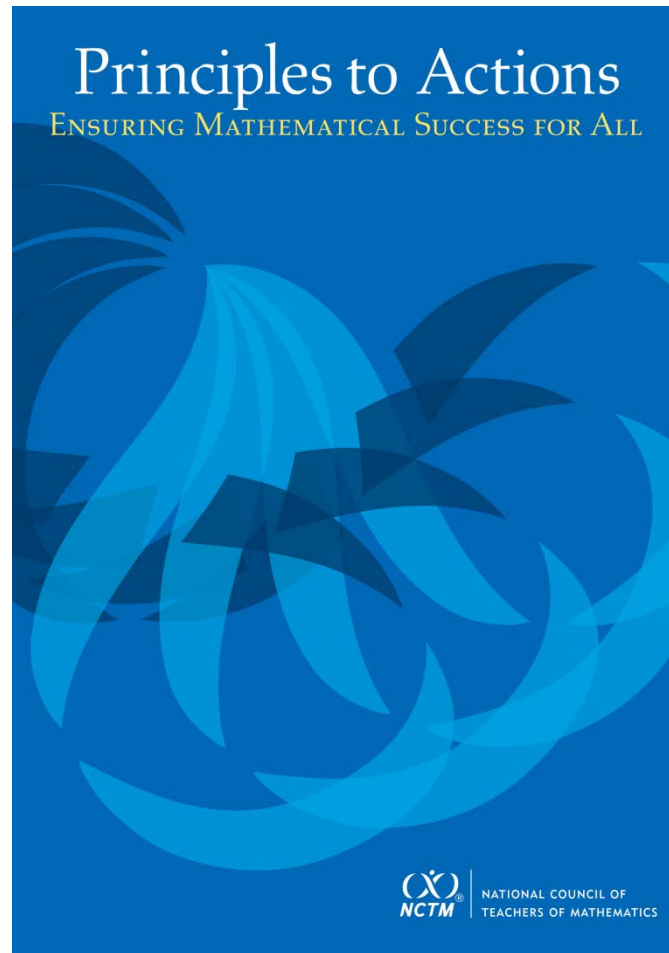


Using Identity and Agency to Frame Equitable Teaching Practices

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Essential Elements of School Mathematics Program

- **Access and Equity**
- **Curriculum**
- **Tools and Technology**
- **Assessment**
- **Professionalism**

Access and Equity Principle

An excellent mathematics program requires that all students have **access** to a high-quality mathematics curriculum, **effective** teaching and learning, **high expectations**, and the **support and resources** needed to maximize their learning potential.

Calvin's Story

Dyad:

One person is the talker and the others are listeners. The talker will talk continuously and the listeners listen but may respond non-verbally with gestures (but not words).

Interwoven Identities

- Am I not being recommended for placement in pre-algebra course because I am no longer a good student who is good at mathematics?
- Am I not being recommended because I am perceived as a behavioral problem?
- Am I not being recommended because middle school is different from elementary?
- Am I not being recommended for placement in pre-algebra course because I am a Black boy?

Interwoven Identities

“I want to go to the Air Force Academy and become a pilot. You have to be good at math to get into the Academy.” Andre

Identities are not mutually exclusive.

Identities serve as motivation to persevere.

Mathematics Identity

Mathematics identity includes:

- beliefs about one's self as a mathematics learner;
 - one's perceptions of how others perceive them as a mathematics learner;
 - beliefs about the nature of mathematics,
 - engagement in mathematics, and
 - perception of self as a potential participant in mathematics (Solomon, 2009).
- ▶ Think about you as a student in your classroom

Identity & Motivation

- Understanding the strengths and motivations that serve to develop students' identities should be embedded in the daily work of teachers.
- Mathematics teaching involves not only helping students develop mathematical skills but also empowering students to seeing themselves as being doers of mathematics.

Supporting Teaching

Mathematics teaching should leverage students' culture, contexts, and identities to support and enhance mathematics learning (NCTM, 2014).

Orange Problem

A grocer was asked how many oranges he had sold that day. He replied:

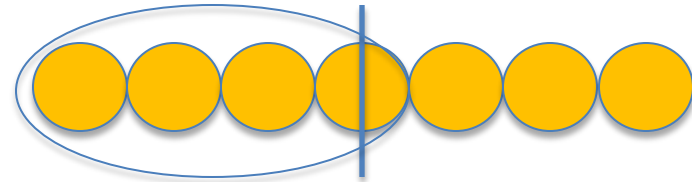
- “My first customer said I'll buy half your oranges and half an orange more.”**
- He then said, “My second customer said the same thing... I'll buy half your oranges and half an orange more.”**
- Then he stated, “My third customers said the same thing... I'll buy half your oranges and half an orange more.”**

When all three orders were filled he was sold out and did not have to cut a single orange all day.”

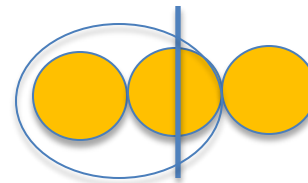
How many oranges had the grocer sold in all?

Orange Problem

“There has to be an odd number of oranges.”



“The last customer will get one orange.”

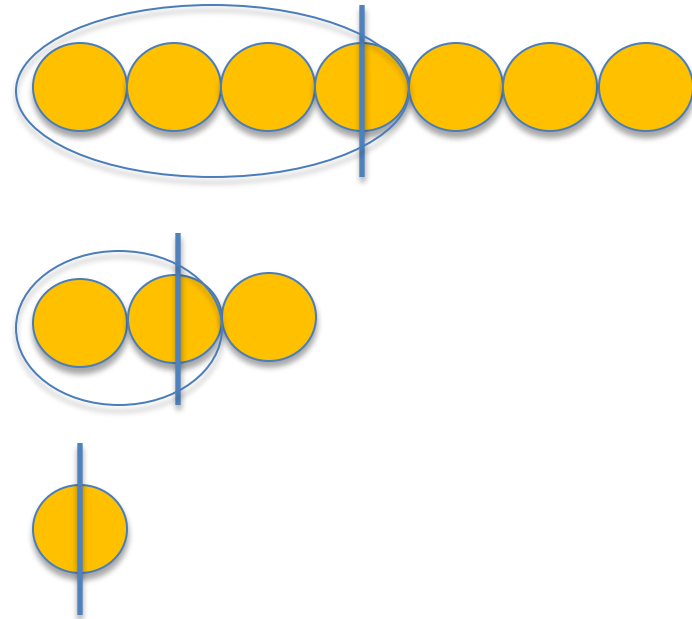


“If the last person gets one orange, then it is times two plus one.”



Orange Problem

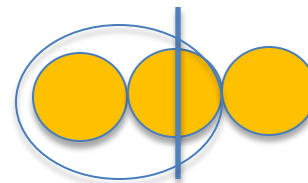
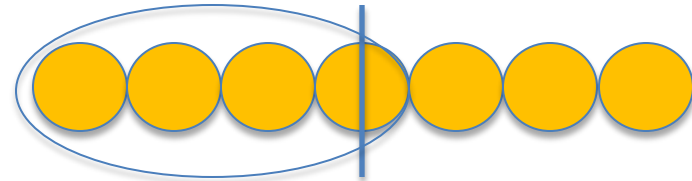
Number of Customers	Number of Oranges Sold
1	1
2	3
3	7
5	
10	
n	



Suppose there were 5 customers, 10 customers, or n customers?

Orange Problem

Number of Customers	Number of Oranges Sold	?
1	1	1
2	3	$1 + 2$
3	7	$1 + 2 + 4$
5		
10		
n		



Agency

- Agency is our identity in action and the presentation of our identity to the world (Aguirre, Ingram & Martin, 2013).
- Social and behavioral expectations are associated with agency.

Agency

If one identifies themselves as being good at mathematics, then they present themselves and adopt behaviors and actions of being good at mathematics.

- ▶ Once this presentation of good at mathematics is affirmed, then students see themselves active participants and doers of mathematics (Berry, 2014).

High Sense of Agency

Students with a high sense of agency make decisions about their participation in mathematics.

- ▶ “Good math students are focused, do their work, and want to make A’s all the time...I am a good math student.”
(Andre)

Identity Affirming & Agency

Identity-affirming behaviors influence the ways in which students participate in mathematics and how they see themselves as doers of mathematics.

- We see identity-affirming criteria emerging as participation: public praising, who is called on, and perceptions of doers of mathematics.
- We see identity-affirming criteria emerging as learners are labeled as “smart,” “gifted,” “proficient,” “at-risk,” or “on grade-level”

Identity Affirming & Agency

We affirm mathematics identities by providing opportunities for students to

- make sense of and persevere in challenging mathematics;
- facilitate meaningful mathematical discourse;
- support productive struggle in learning mathematics;
- elicit and use evidence of student thinking;
 - ▶ This kind of teaching cultivates and affirms mathematical participation and behaviors (NCTM, 2014)

Multiplication Strings Task (Teacher Version)

1. Solve this set of multiplication equations. Each time you solve a new equation, try to use the previous equation to help you solve it.

$$8 \times 4 = \underline{\quad}$$

$$8 \times 8 = \underline{\quad}$$

$$8 \times 16 = \underline{\quad}$$

$$8 \times 32 = \underline{\quad}$$

$$8 \times 64 = \underline{\quad}$$

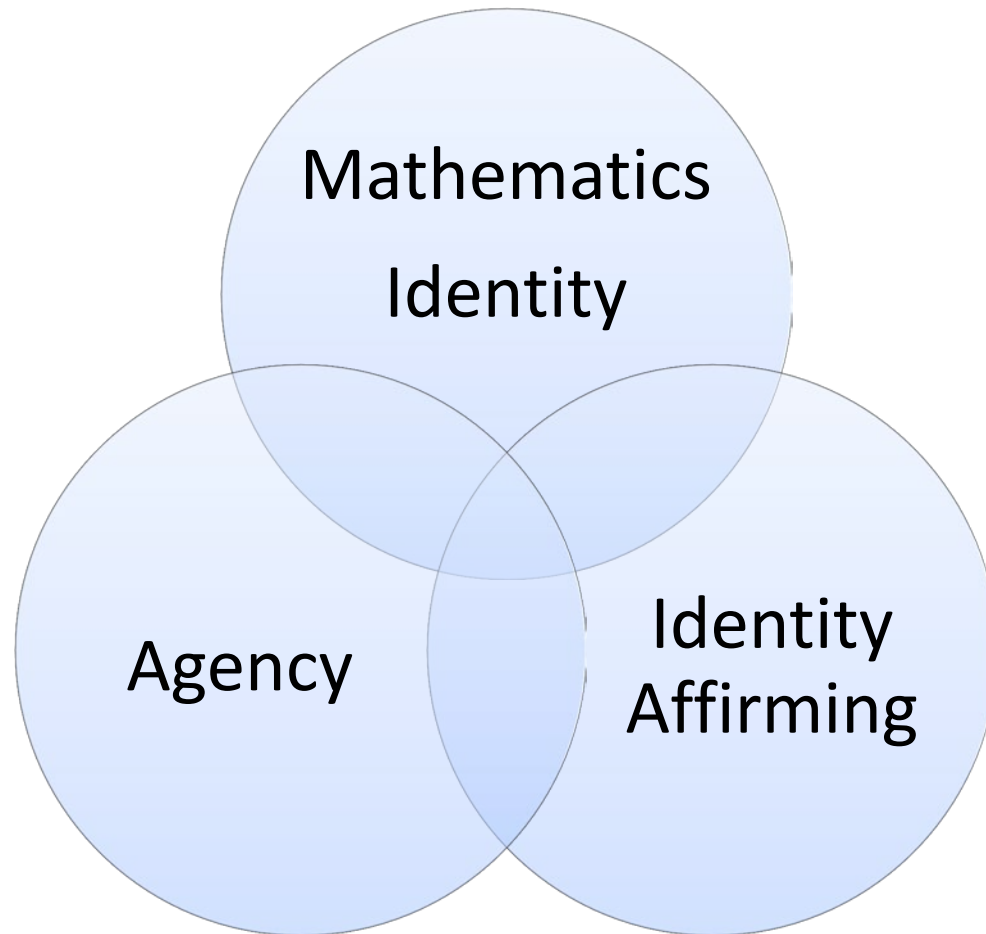
2. Reflect on the string of multiplication equations. What patterns do you notice? Why do these patterns occur?
3. To solve 8×8 , Nicholas, a third grade student, explained that he knew that 8 times 4 would be 32 so he just added 32 and 32 to get the answer. Show how you, as the teacher, might represent his reasoning with an area model. How does his strategy utilize properties of the operations?

Identity Affirming & Agency

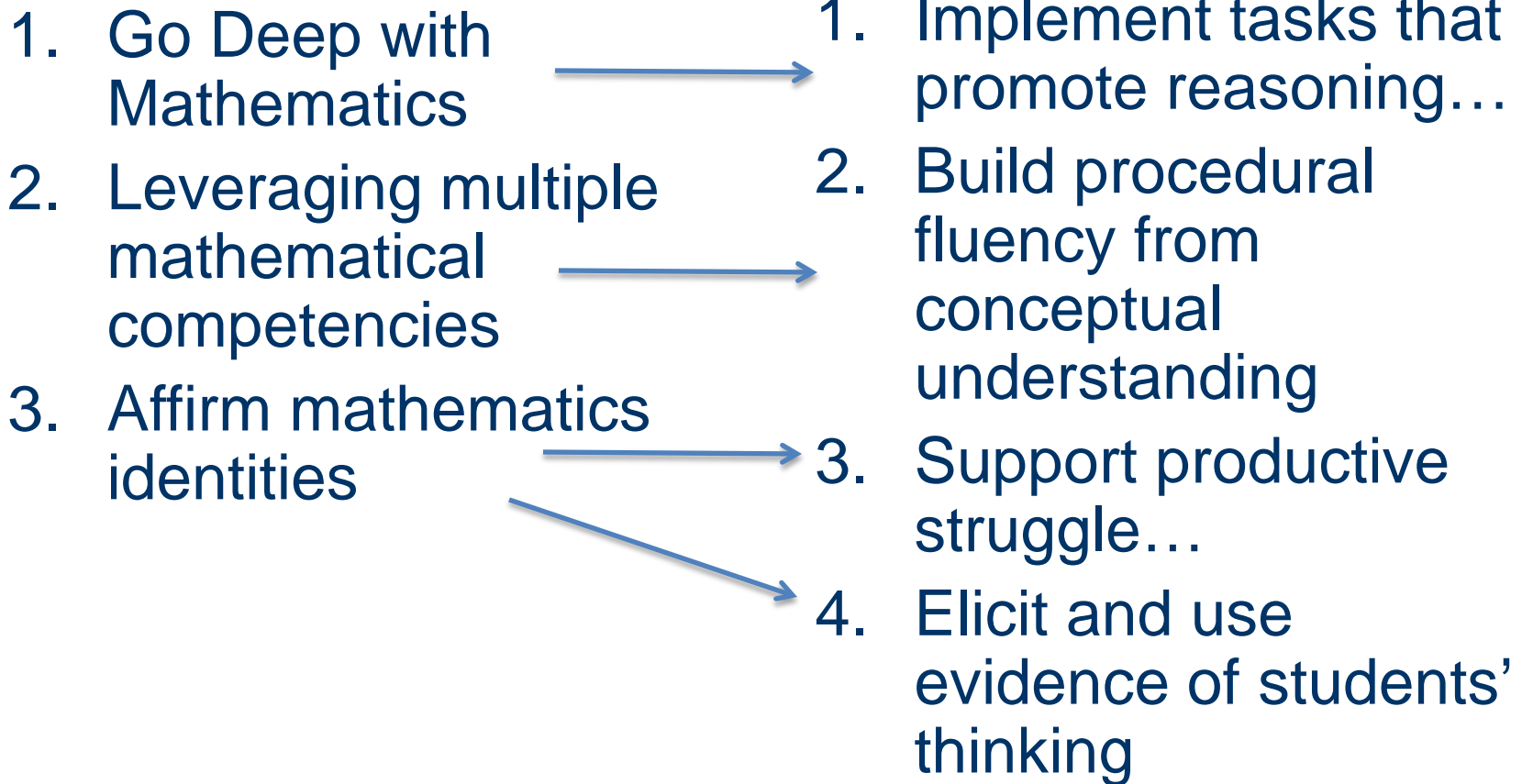
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Interwoven

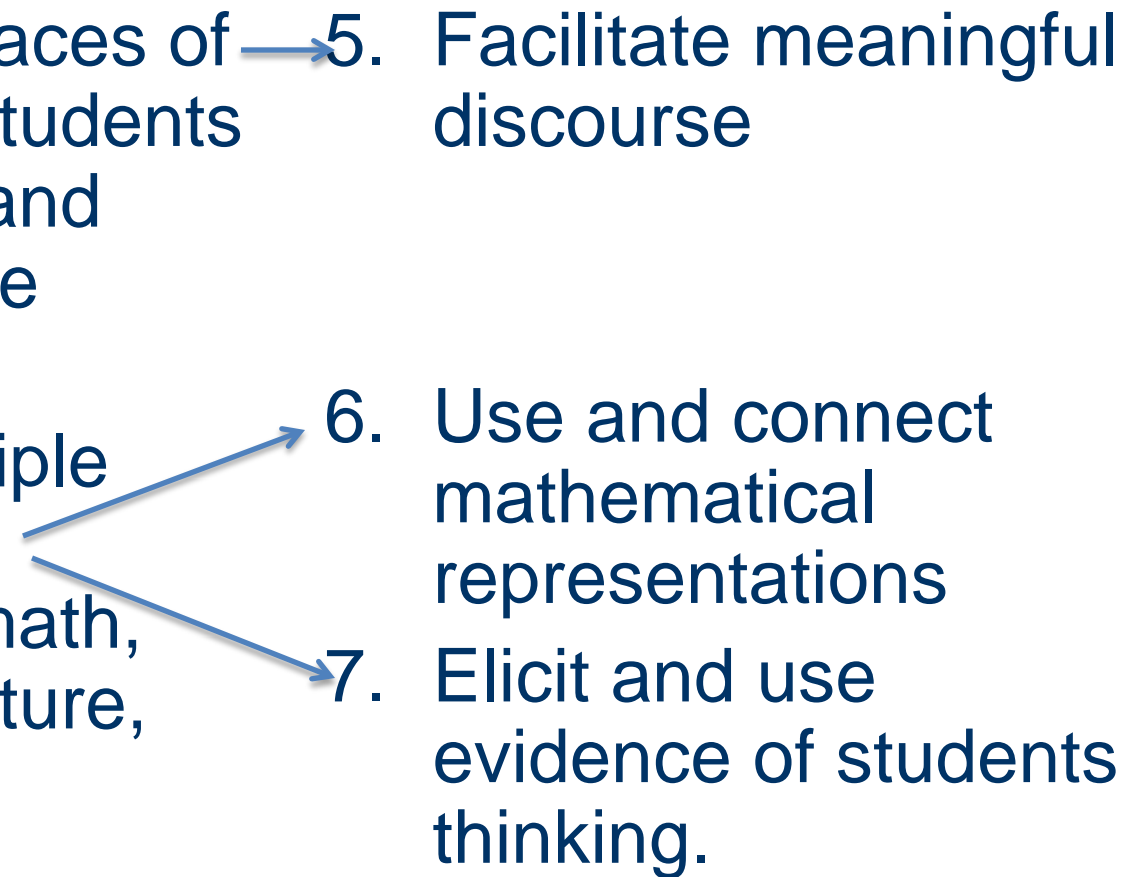


Five Equity Based Teaching Practices

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1. Go Deep with Mathematics → 1. Implement tasks that promote reasoning...
2. Leveraging multiple mathematical competencies → 2. Build procedural fluency from conceptual understanding
3. Affirm mathematics identities → 3. Support productive struggle...
- 4. Elicit and use evidence of students' thinking

(Aguirre, Ingram & Martin, 2013)

Five Equity Based Teaching Practices

4. Challenge spaces of marginality (students experiences and knowledge are legitimate) →
 5. Draw on multiple resources of knowledge (math, language, culture, family...) →
 5. Facilitate meaningful discourse
 6. Use and connect mathematical representations
 7. Elicit and use evidence of students thinking.
- 

(Aguirre, Ingram & Martin, 2013)

Identity Affirming

Students need opportunities to learn using their strengths and opportunities to learn by compensating for their the challenges (Sternberg, 2007)

- ▶ We must provide opportunities that play to the strengths and challenges of students.

Beliefs about Access and Equity

Unproductive Beliefs	Productive Beliefs
<p>Mathematics learning is independent of students' culture, conditions, and language, and teachers do not need to consider any of these factors to be effective.</p>	<p>Effective mathematics instruction leverages students' culture, conditions, and language to support and enhance mathematics learning.</p>
<p>Students living in poverty lack the cognitive, emotional, and behavioral characteristics to participate and achieve in mathematics.</p>	<p>Effective teaching practices have the potential to open up greater opportunities for higher-order thinking and for raising the mathematics achievement of all students</p>

Beliefs about Access and Equity

Unproductive Beliefs	Productive Beliefs
<p>Equity is the same as equality. All students need the same learning opportunities so that they can achieve the same academic outcomes</p>	<p>Equity is attained when students receive the differentiated supports (e.g., time, instruction, curricular materials, programs) necessary to ensure that all students are mathematically successful.</p>
<p>Students possess different innate levels of ability in mathematics, and these cannot be changed by instruction.</p>	<p>Mathematics ability is a function of opportunity, experience, and effort.</p>

- Allocate resources to ensure that all students are provided with an appropriate amount of instructional time to maximize their learning potential.
- Ensure that teachers at all levels are emphasizing the mathematical practices as a key element of their instruction for all students.

- ...structure interventions that provide high-quality instruction and other classroom support, such as math coaches and specialists.
- Provide support structures, co-curricular activities, and resources to increase the numbers of students from all racial, ethnic, gender, and socioeconomic groups who attain the highest levels of mathematics achievement.

- Maintain a school-wide culture with high expectations and a growth mindset.
- Develop and implement high-quality interventions.
- Ensure that curricular and extracurricular resources are available to support and challenge all students.

Actions: Teachers

- Develop socially, emotionally, and academically safe environments for mathematics teaching and learning...
- Understand and use the social contexts, cultural backgrounds, and identities of students as resources to foster access, motivate students to learn more mathematics, and engage student interest.
- Model high expectations for each student's success in problem solving, reasoning, and understanding.
- Promote the development of a growth mindset among students.

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Rocking presentations of their analysis of
slope and y-intercept to peers
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