Examining Equitable Teaching Using the Mathematics Teaching Framework

Robert Q. Berry, III, Ph.D.
President, National Council of Teachers of Mathematics
@robertqberry
#CGIequity
robertberry@virginia.edu

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Four Rights of the Learner in the Mathematics Classroom

1. The right to be confused;
2. The right to claim a mistake;
3. The right to speak, listen and be heard; and
4. The right to write, do, and represent only what makes sense.

Kalinec-Craig, C. A. (2017). . The Rights of the Learner: A Framework for Promoting Equity through Formative Assessment in Mathematics Education. *Democracy and Education*, 25 (2), Article 5.

Math, Men, & Mission

Teachers are identity builders who position learners as being mathematically and socially competent by creating time and space for learners demonstrate their agency.

Summer 2016

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Math, Men, & Mission

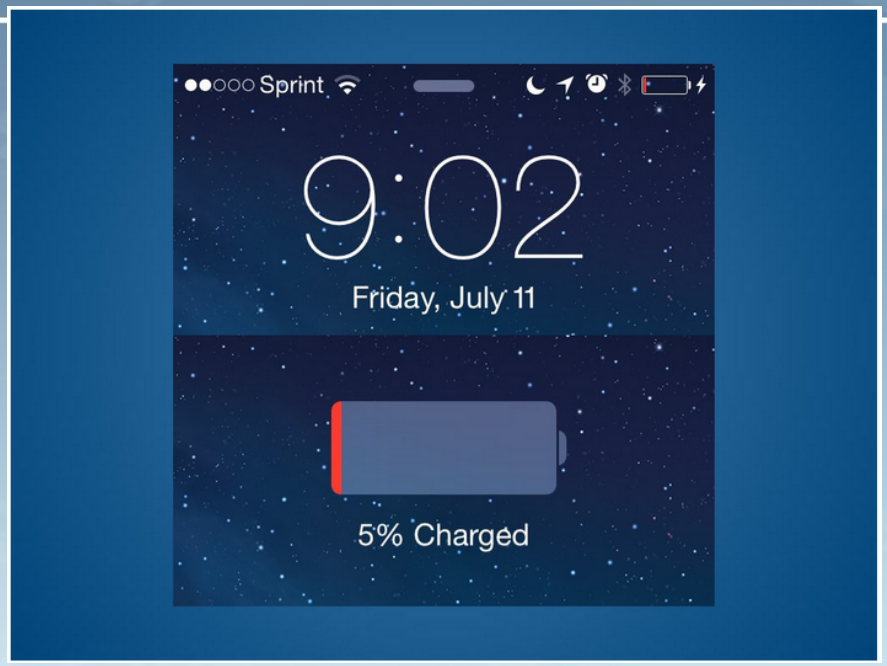
- Creating tasks ground in social interactions
- Connecting students to one another
- Connect students to the mathematics

Summer 2017

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

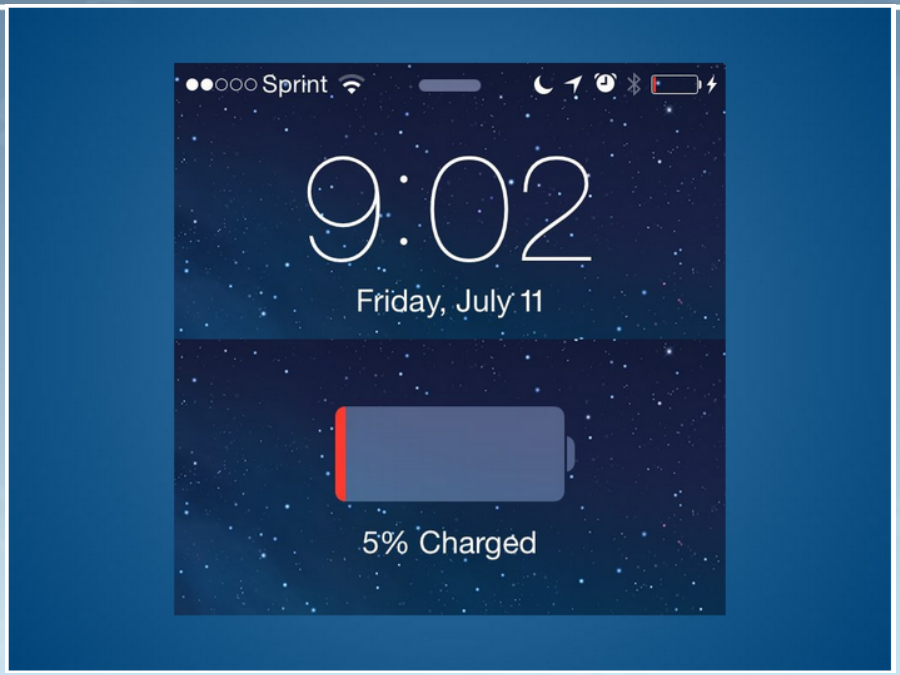
NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

What do you notice?



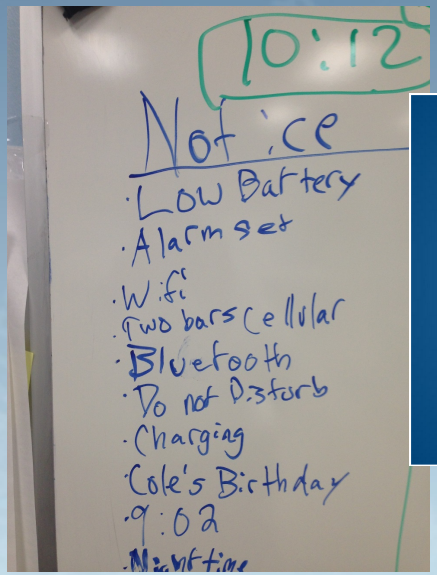
Source: Michael Fenton's Reason and Wonder Web Site: http://reasonandwonder.com/charge/

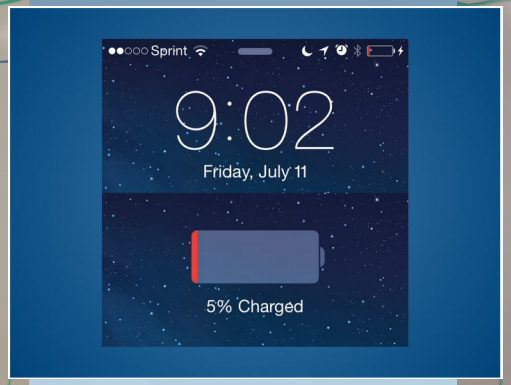
What do you wonder?

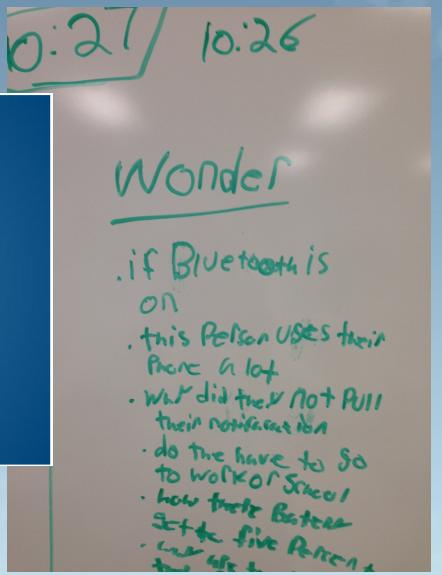


Source: Michael Fenton's Reason and Wonder Web Site: http://reasonandwonder.com/charge/

Taking Risks





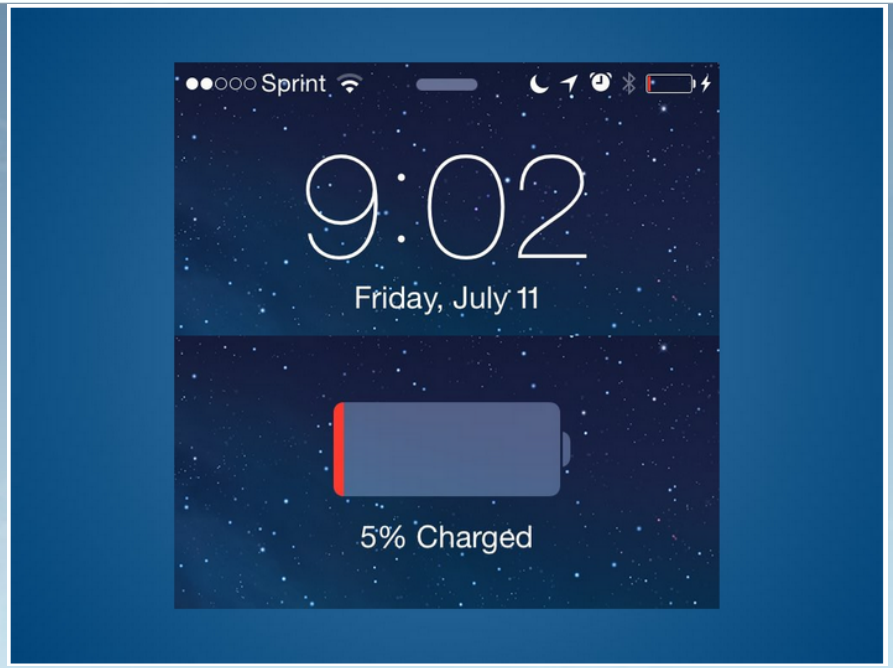


NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Notice & Wonder

- Participation
- Risk-taking
- Identity
- Positionality
- Competence
- Agency

Wonder: At what time will the phone be fully charged?

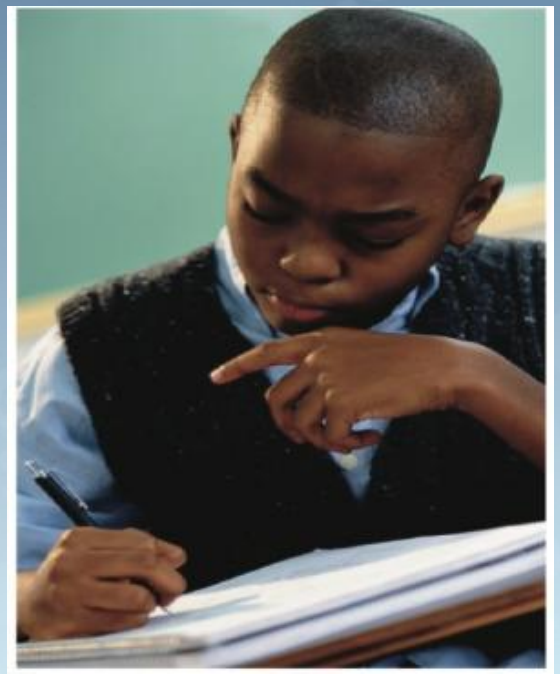


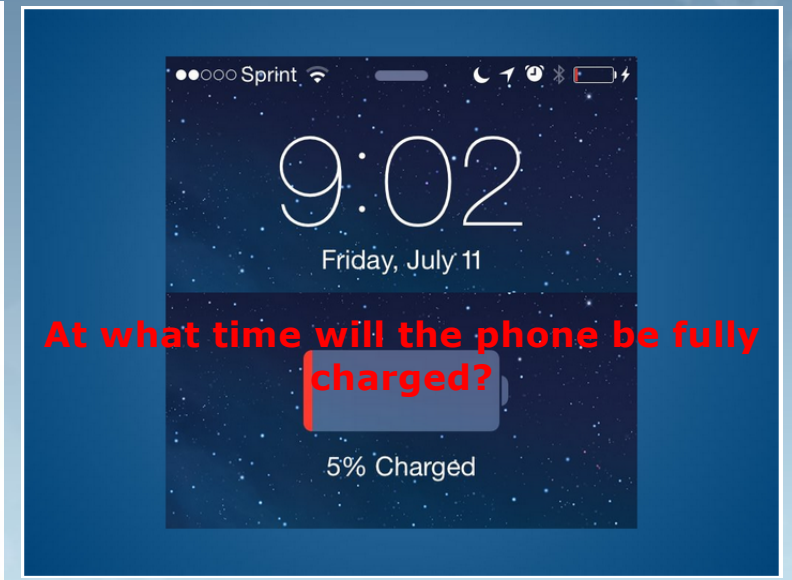
Source: Michael Fenton's Reason and Wonder Web Site: http://reasonandwonder.com/charge/

What Is Your Guess?

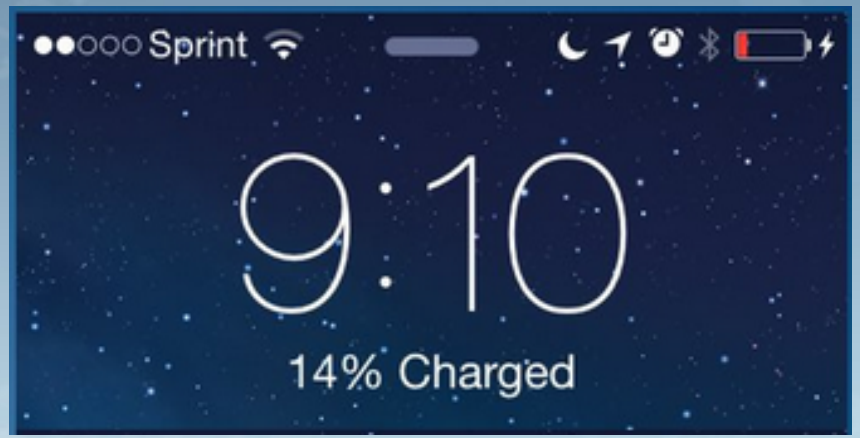
Upper limit – _____
Low limit – _____
Just Right - _____

What Information Do We Need?





Some Data

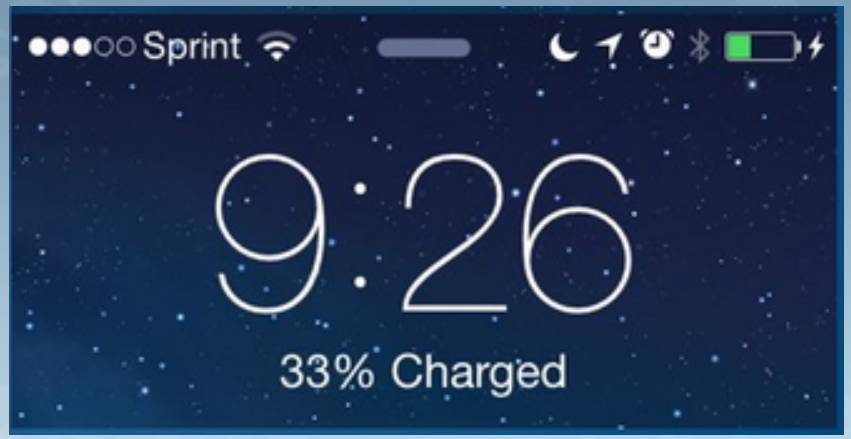


Source: Michael Fenton's Reason and Wonder Web Site http://reasonandwonder.com/charge/

Some More Data

Source: Michael Fenton's Reason and Wonder Web Site http://reasonandwonder.com/charge/

Some More Data

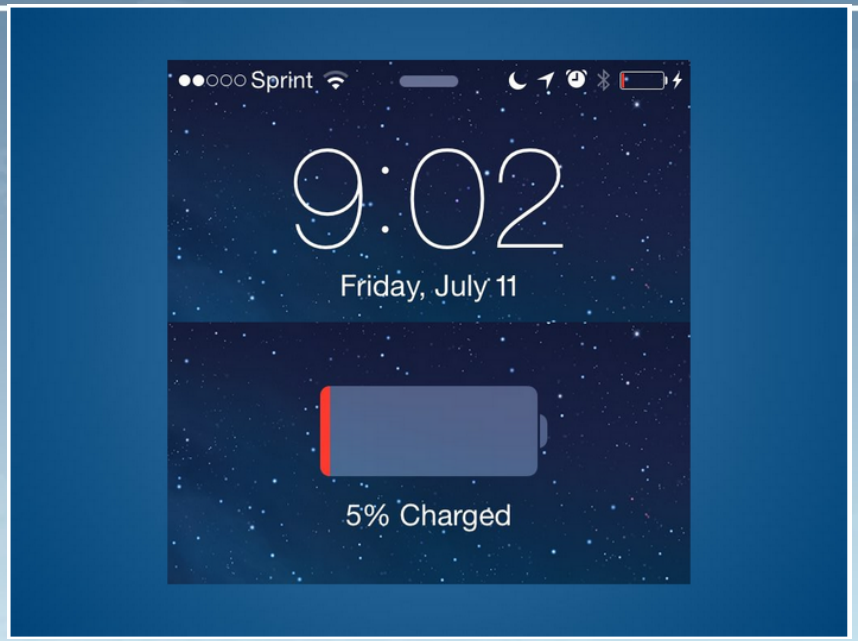


Source: Michael Fenton's Reason and Wonder Web Site http://reasonandwonder.com/charge/

Data

Time	Percent Charged
9:02	5%
9:10	14%
9:14	19%
9:26	33%

At what time will the phone be fully charged? (Individually 3 mins)



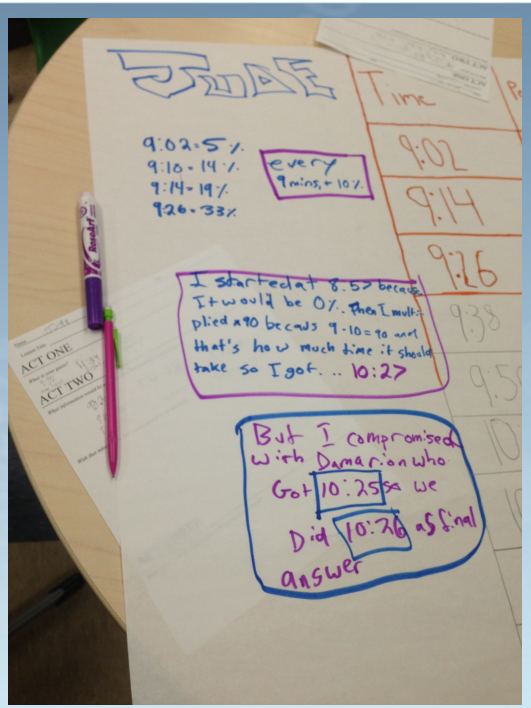
Source: Michael Fenton's Reason and Wonder Web Site http://reasonandwonder.com/charge/

Rough Draft Talk

Amanda Jansen, Brandy Cooper, Stefanie Vascellaro, & Philip Wandless. (2017). Rough-Draft Talk in Mathematics Classrooms. *Mathematics Teaching in the Middle School, 22*(5), 304-307.

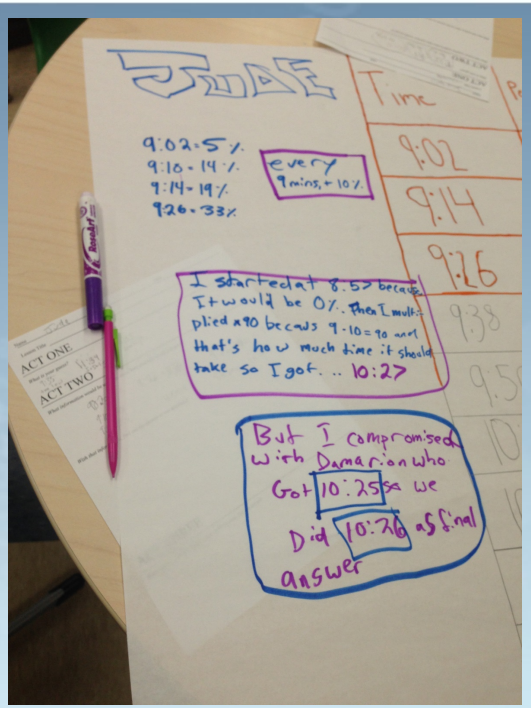
NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Two Drafts-One Sheet



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

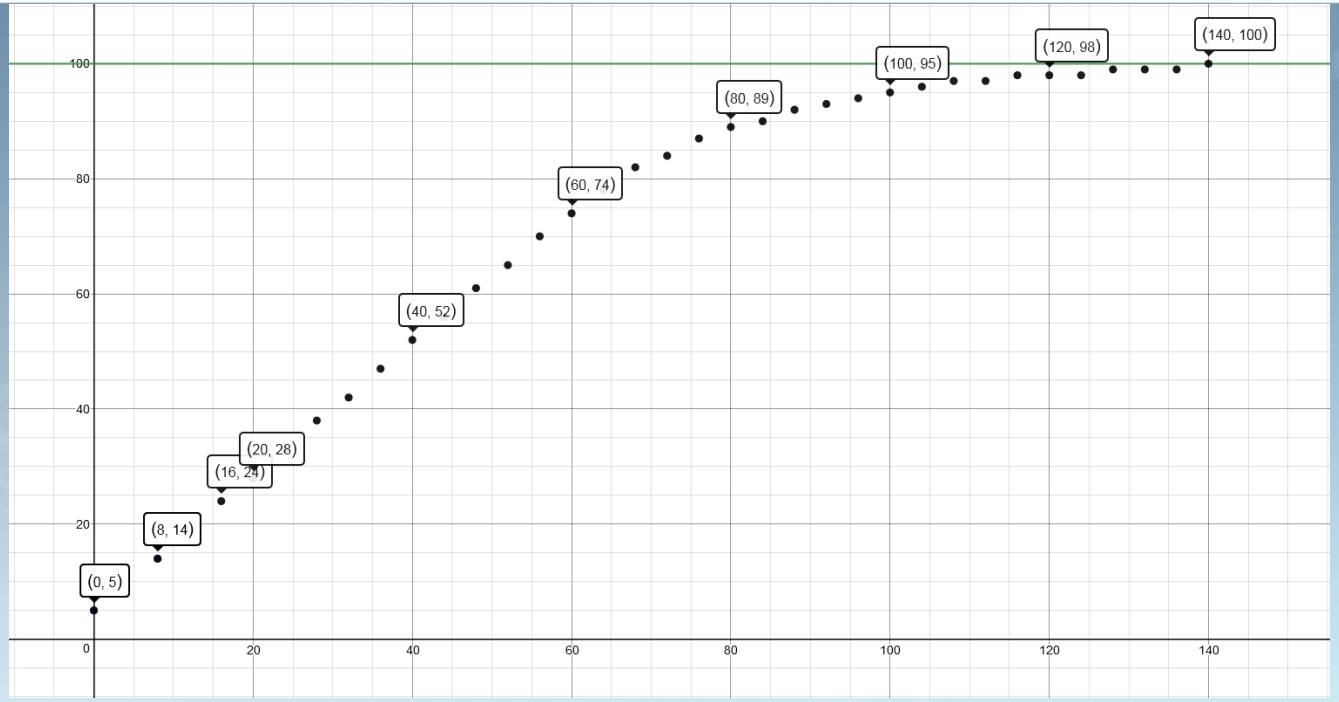
Taking Risks



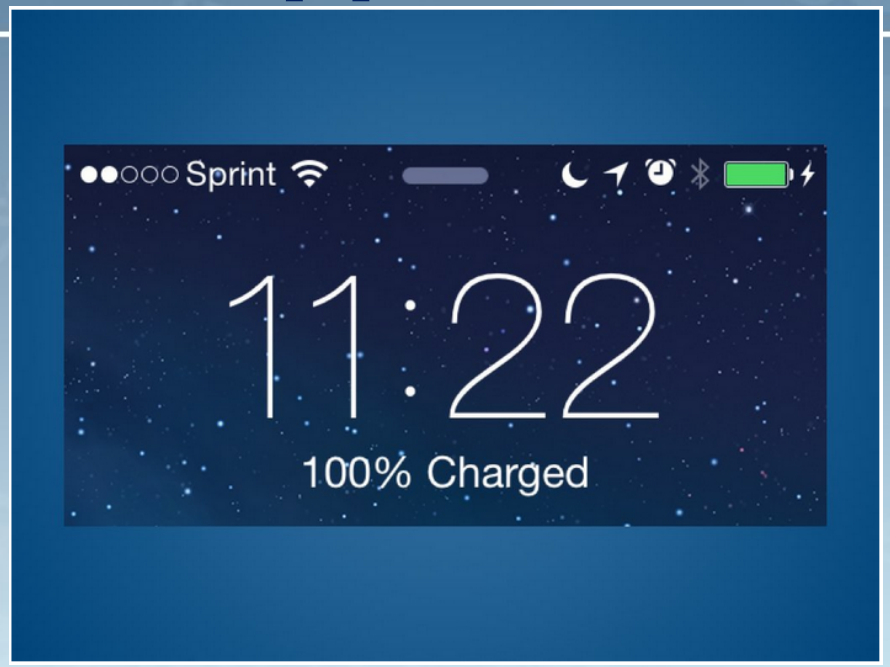
Every 9 mins + 10%

I started at 8:57 because it would be 0%. Then I multiplied x 90 because 9 x 10 = 90 and that's how much time it should take so I got …10:27
But I compromised with Damarion who got 10:25 so we did 10:26 as our final answer

Act 3


(0, 5)
(8, 14)
(16, 24)
(20, 28)
(40, 52)
(60, 74)
(80, 89)
(100, 95)
(120, 98)
(140, 100)
0
20
40
60
80
100
120
140
20
40
60
80
100

What happened ? Why?



Source: Michael Fenton's Reason and Wonder Web Site
http://reasonandwonder.com/charge/

Instructional Routines

- Notice & Wonder
- Rough Draft Talk/Thinking
- Two Drafts, One Sheet
- Connecting Math to Students and Students to Each Other

Mathematics Teaching Practices

NCTM identified a core set of eight research-informed effective teaching practices in *Principles to Actions: Ensuring Mathematical Success for All* (NCTM 2014).

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

While the list provides a common professional language for discussing important elements of teaching, it is the interconnections among the teaching practices that support equitable teaching.

Mathematics Teaching Framework

The authors of the Taking Action Series developed the Mathematics Teaching Framework diagram to illustrate how the eight teaching practices form a coherent framework for equitable and ambitious teaching of mathematics (Boston, Dillon, Smith, and Miller 2017, p. 215; Huinker and Bill 2017, p. 245; and Smith, Steele, and Raith 2017, p. 194)

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

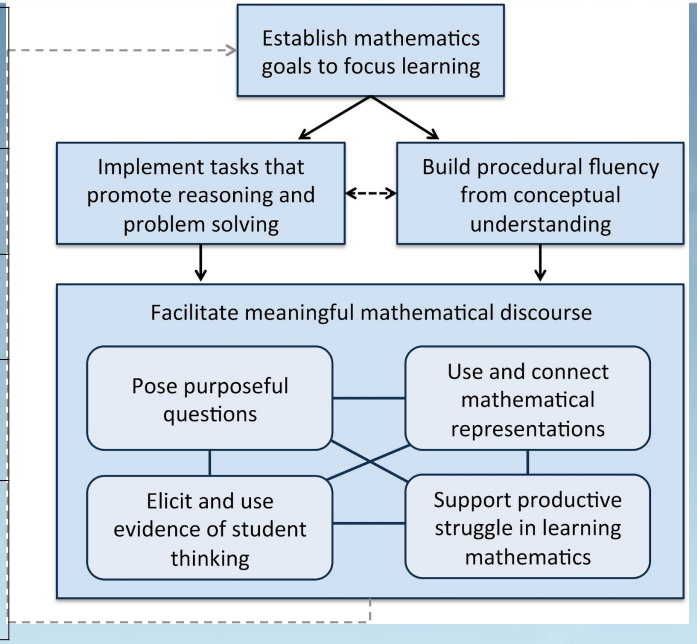
Go deep with mathematics. Develop students' conceptual understanding, procedural fluency, and problem solving and reasoning.

Leverage multiple mathematical competencies. Use students' different mathematical strengths as a resource for learning.

Affirm mathematics learners' identities. Promote student participation and value different ways of contributing.

Challenge spaces of marginality. Embrace student competencies, diminish status, value multiple mathematical contributions.

Draw on multiple resources of knowledge (math, language, culture, family). Tap students' knowledge and experiences as resources for mathematics learning (Aguirre, Mayfield-Ingram, and Martin 2013) .



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Equitable Mathematics Teaching

Equitable mathematics teaching provide every student with access to meaningful mathematics by:

- leveraging students' strengths,
- situating students as mathematical competent,
- drawing on students as resources of knowledge, and
- challenging spaces of marginality.

Equitable Mathematics Teaching

Classroom communities of collaboration and coherent discourse position each and every student to make sense of mathematics and develop positive mathematics identities.

Situated-Mediated Identity Theory

The situated-mediated identity framework describes three types of identity growth:

1. Situated Identity
2. Positionality
3. Agency (Murrell, 2007, 2009).

Our identities are situated within the context of learning environments and are mediated by the environments in which they act.

Situated Identity

Situated identity implies that a person's identity is multi-factored, fluid, and situationally determined.

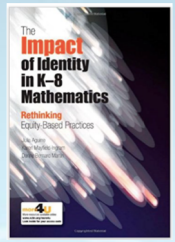
- Students identities are mediated from classroom to classroom
  - Different situations elicit different modes of interactions and behaviors.
  - People and structures matters for situated identity.

Mathematical Identity

Aguirre, Mayfield-Ingram, and Martin (2013) defined mathematical identity "as the dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the contexts of their lives" (p. 14).

Aguirre, J., Mayfield-Ingram, K., & Martin, D. (2013). *The impact of identity in K-8 mathematics: Rethinking equity-based practices*. The National Council of Teachers of Mathematics.

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS



Positionality

How individuals are positioned within a context depends on both the manner in which they wish to be represented and their perceptions of how others view them.

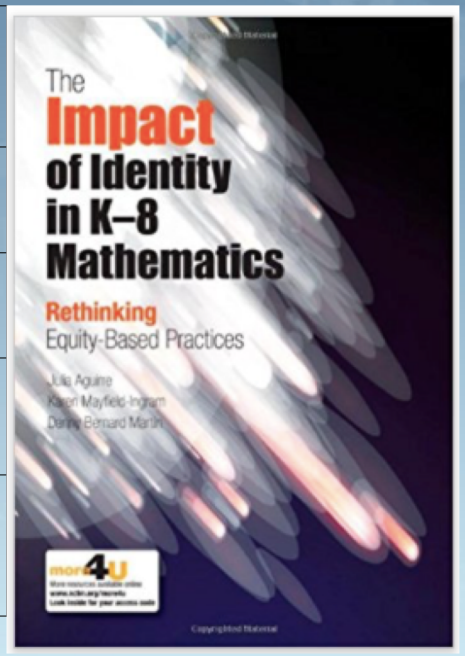
Assumption: All learners wish to be represented as competent.

Mathematical Agency

- Agency refers to the expression of one's identity (Murrell 2007).
  - Agency is one's identity in action.
- In mathematics classrooms, agency is expressed in the ways that students make their mathematical thinking visible and leveraging an approach that represents their mathematical ideas.
- Mathematical agency is about participating in mathematics in ways that are meaningful, both personally and socially (Berry 2016).

Equitable Mathematics Teaching

Go deep with mathematics. Develop students' conceptual understanding, procedural fluency, and problem solving and reasoning.
Leverage multiple mathematical competencies. Use students' different mathematical strengths as a resource for learning.
Affirm mathematics learners' identities. Promote student participation and value different ways of contributing.
Challenge spaces of marginality. Embrace student competencies, diminish status, value multiple mathematical contributions.
Draw on multiple resources of knowledge (math, language, culture, family). Tap students' knowledge and experiences as resources for mathematics learning (Aguirre, Mayfield-Ingram, and Martin 2013) .



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Five Equity Based Teaching Practices

1. Go Deep with Mathematics

   Cognitive demand and developing mathematical proficiencies

Notice	Reflection Questions
Explanation & Justification	How does my lesson promote explanation and justification of thinking and solution paths?
Discourse	How do I promote engagement through discourse?
Using task that promote conceptual understanding to build procedural fluency	Does task selection promote conceptual understanding leading to procedural fluency?

Five Equity Based Teaching Practices

2. Leveraging multiple competencies

Recognizing and positioning students various mathematics backgrounds as strengths and resources that can be used in teaching and learning.

Notice	Reflection Question
Structure collaboration to use varying math knowledge and skills	How do I create spaces for mathematical contributions from different students with different strengths and levels of confidence?
Task allow for multiple entry points	What are the different ways students can enter a task?

Five Equity Based Teaching Practices

3. Affirm mathematics identity

   Teaching that values multiple contributions, provides, multiple entry points, and promote participation in various ways aid the development of math identity

Notice	Reflection Question
Promote persistence and reasoning	How do I promote persistence and reasoning?
Encourage students to see themselves as confident learners	In what ways do I promote confidence?
Use mistakes as resources for learning	How do I use errors as opportunities?
Recognize identities a multifaceted	How do I discourage speed as "smartness" while encouraging reasoning as a form of smartness?

Five Equity Based Teaching Practices

4. Challenge spaces of marginality

Practices that embraces student competencies, diminishes status, and value multiple contributions challenges marginality.

Notice	Reflection Question
Students experiences and knowledge as spaces for investigating ideas	How do I connect students' knowledge to the math concepts in lessons?
Position students as sources of expertise	How do I structure tasks to maximize student inputs (notice and wonder)?
Distribute authority and interconnect students ideas to text, each other and other sources	How do I make sure that all students have had opportunities to demonstrate their math knowledge?
Encourage student-to-student interactions	How do I create space for student-to-student interactions?

Five Equity Based Teaching Practices

5. Draw on multiple resources of knowledge

Intentionally tapping into students knowledge and experiences

Notice	Reflection Question
Taps knowledge and experiences related to students' culture, community, and histories.	How do I get to know my students' histories to support learning in my classroom?
Use previous knowledge as a bridge to promote new learning	How do I connect to students previous knowledge?
Recognize and strengthen multiple language forms (academic language, informal language, and everyday language)	How can I effectively communicate with students to promote learning?
Affirm and support multilingualism	How do I affirm my students multilingual abilities to help them learn math?

Jennifer Kick's Class

- Teacher: Jennifer Kick
- First Grade
- Whole Number Story Problem
  - Mrs. Kick bought 4 seed packets. Each packet contains 11 seeds. How many seeds did she buy in all?

Jennifer Kick's Class

Go deep with mathematics. Develop students' conceptual understanding, procedural fluency, and problem solving and reasoning.
Leverage multiple mathematical competencies. Use students' different mathematical strengths as a resource for learning.
Affirm mathematics learners' identities. Promote student participation and value different ways of contributing.
Challenge spaces of marginality. Embrace student competencies, diminish status, value multiple mathematical contributions.
Draw on multiple resources of knowledge (math, language, culture, family). Tap students' knowledge and experiences as resources for mathematics learning.

Jennifer Kick's Class

- Write the ways you notice students (individually and collectively) are participating (3 to 5 notices).
- How do the forms of participation move the students forward in their thinking about the mathematics?
- In what ways does the teacher use the forms of participation in her teaching practices?

Jennifer Kick's Class

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Reflect & Discuss

Positioning students as participatory is a way of positioning them as competent.

- What does the statement mean in the context of Jenn's class?

Identity & Positioning

Jennifer Kick positioned her students as capable contributors to mathematical discussions.

- Questions or compliments
- Status
- Participatory

Identity & Positioning

Imagine this same task unfolding in a different classroom in which the discussion is not orchestrated in such way that students can come to understand the connections among their reasoning.

Authority

Too often, authority in mathematics classrooms lies primarily with the teacher or curriculum in which students are compelled to accept without question the mathematical ideas and understandings of these resources.

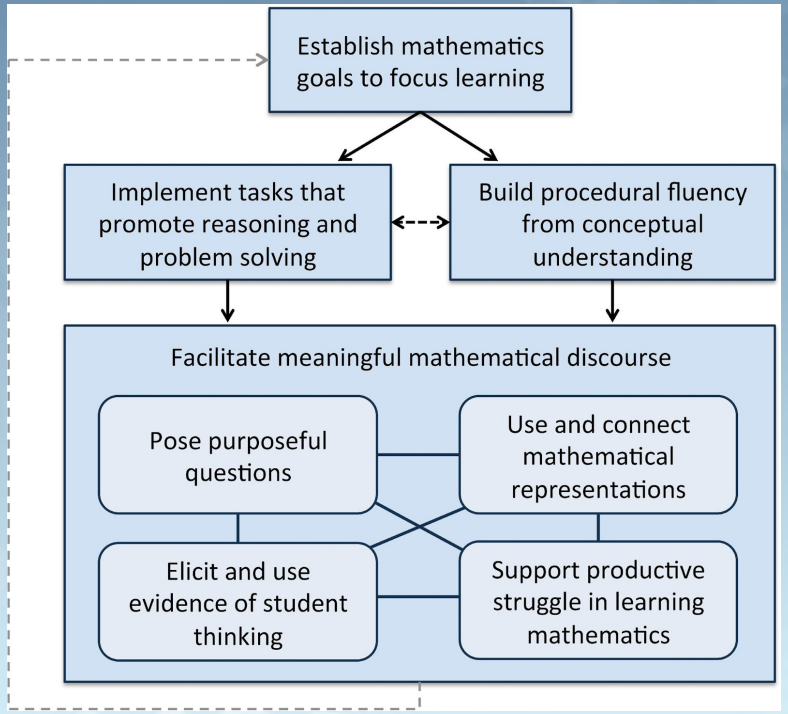
- Students rarely develop their own ideas, engage in discourse in which ideas are exchanged, or question the reasoning of the ideas presented to them.

Authority

In classrooms where authority is shared, we find that teachers create opportunities for students to take ownership of their ideas and question the reasoning of concepts presented, resulting in students with a shared understanding of the mathematical ideas and a positive identification with mathematics.

Mathematics Teaching Framework

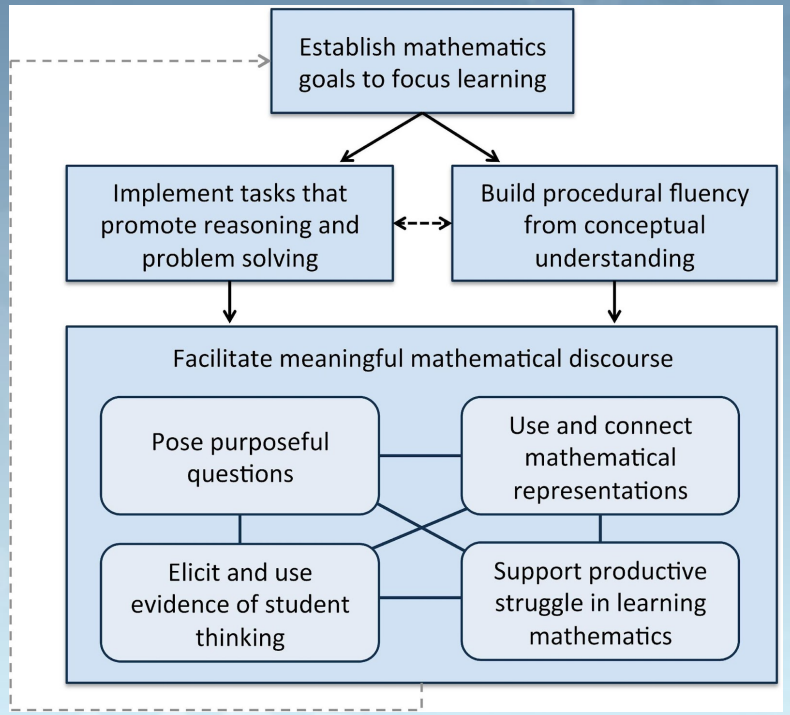
- **Establish mathematics goals to focus learning**
  - Establishing norms for participation involves creating structures to position each and every student as a full participant in mathematics and recognizing that participation builds agency.



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

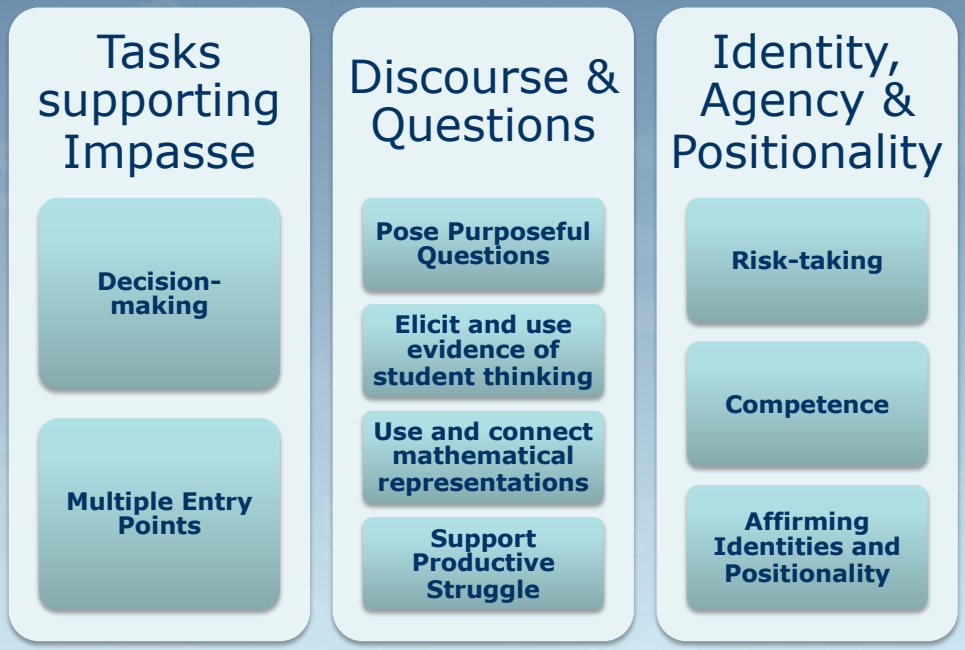
Mathematics Teaching Framework

- **Implement tasks that promote reasoning and problem solving.**
  - Tasks that require reasoning, problem solving, and modeling result in a positive orientation toward mathematics and oneself as a doer of mathematics.



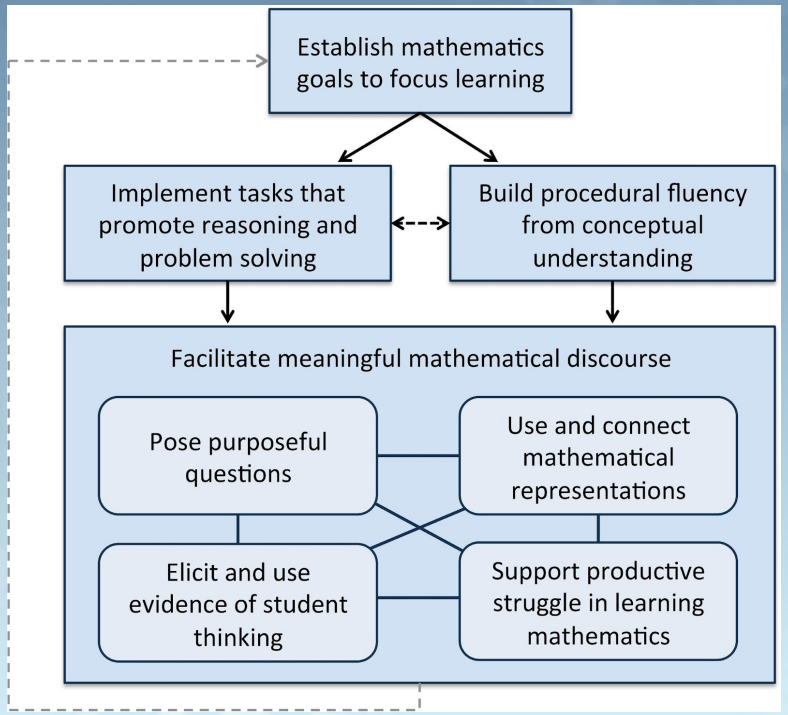
NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Framing Identity, Agency, and Positionality



Mathematics Teaching Framework

- **Build procedural fluency from conceptual understanding.**
  - Mathematics instruction that focuses solely on memorization convey the message that mathematics is not about knowing and doing but about memorizing.

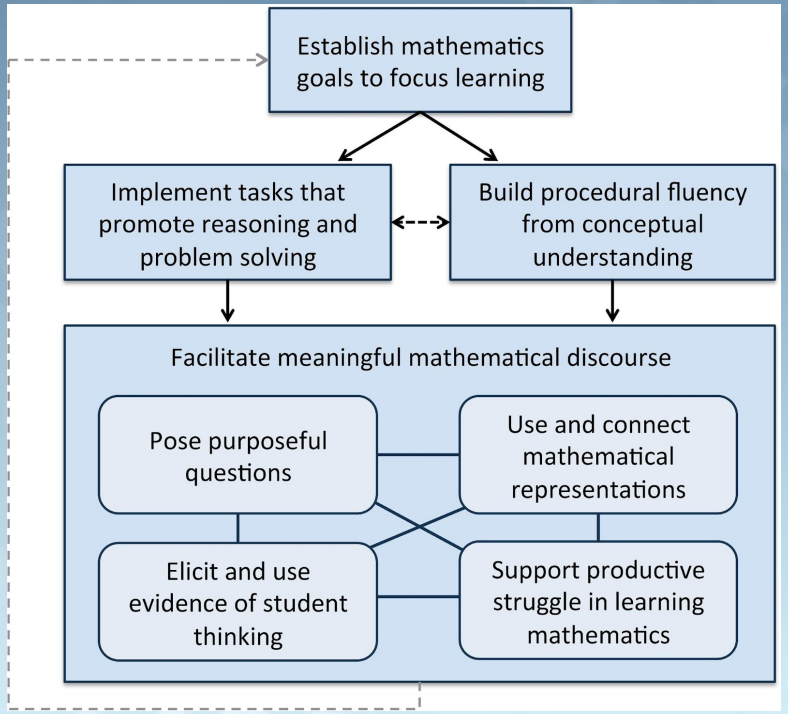


NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

Facilitate meaningful mathematical discourse.

- Through discourse, students realize that their work and thinking serve an important role in mathematics, thus positioning themselves and others as mathematically competent and reducing hierarchical status in mathematics classrooms.



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Orchestrating Productive Mathematics Discussions

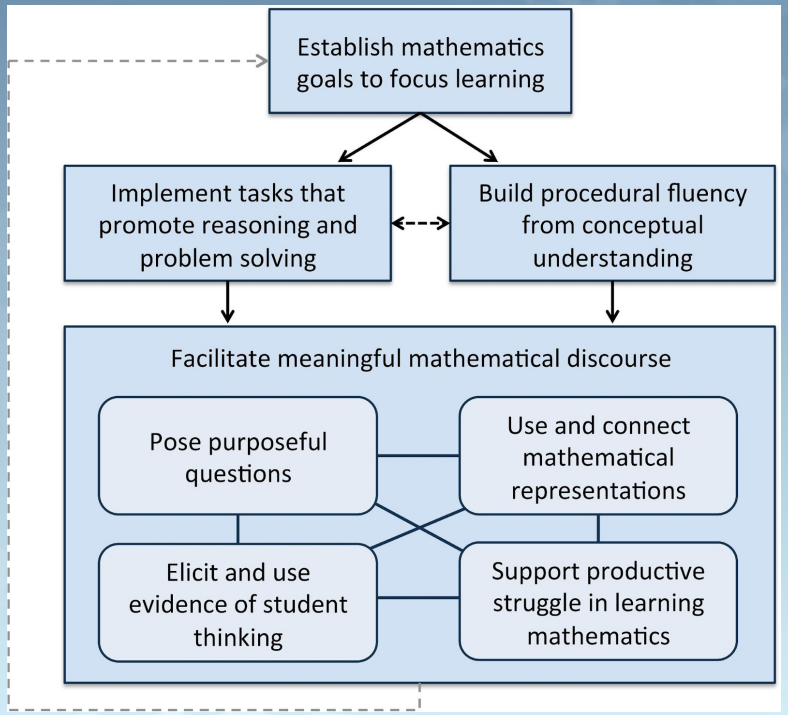
1. Anticipating likely student responses to challenging math task
2. Monitoring students' actual responses to the task (while students work on the task)
3. Selecting particular students to present their mathematical work during whole group discussion
4. Sequencing student responses that will be displayed in a specific order
5. Connecting different students' responses and connecting to key mathematical ideas.

Stein, M. K., & Smith, M. (2018). 5 Practices for Orchestrating Productive Mathematics Discussions. *National Council of Teachers of Mathematics*

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

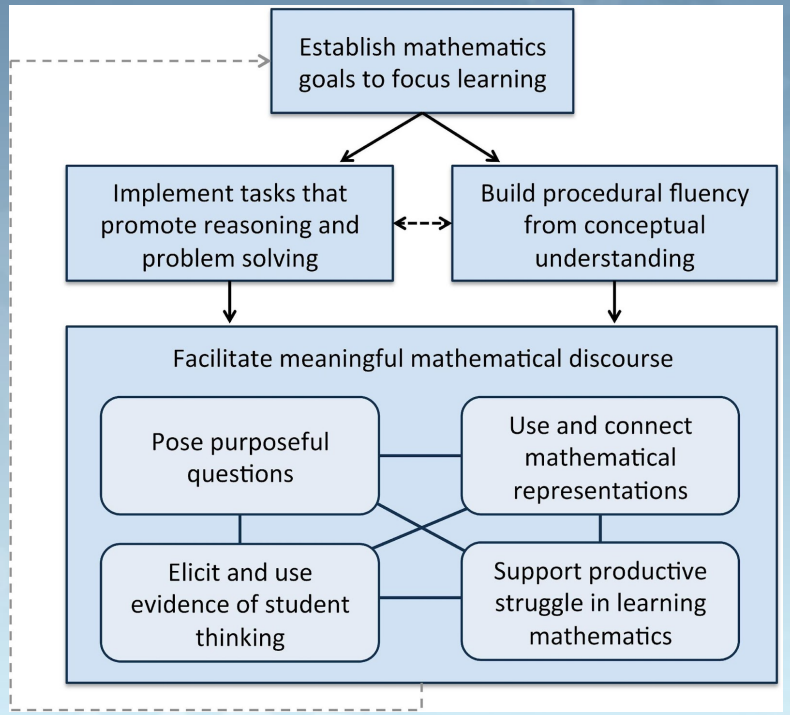
- **Pose purposeful questions.**
  - Students who are consistently asked questions requiring them to explain their reasoning are positioned differently from students who are consistently asked questions not requiring explanation.



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

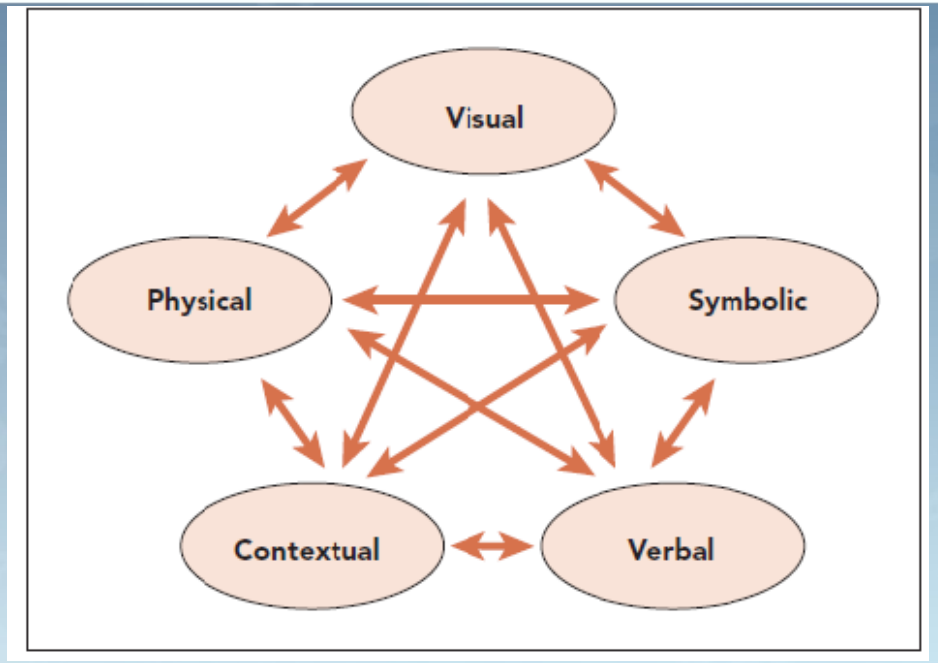
Mathematics Teaching Framework

- **Use and connect mathematical representations.**
  - The use of multiple representations allows students to draw on multiple sources of knowledge.
  - Drawing on multiple sources of knowledge acknowledges the mathematical, social, and cultural resources that students bring to mathematics.



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Representations

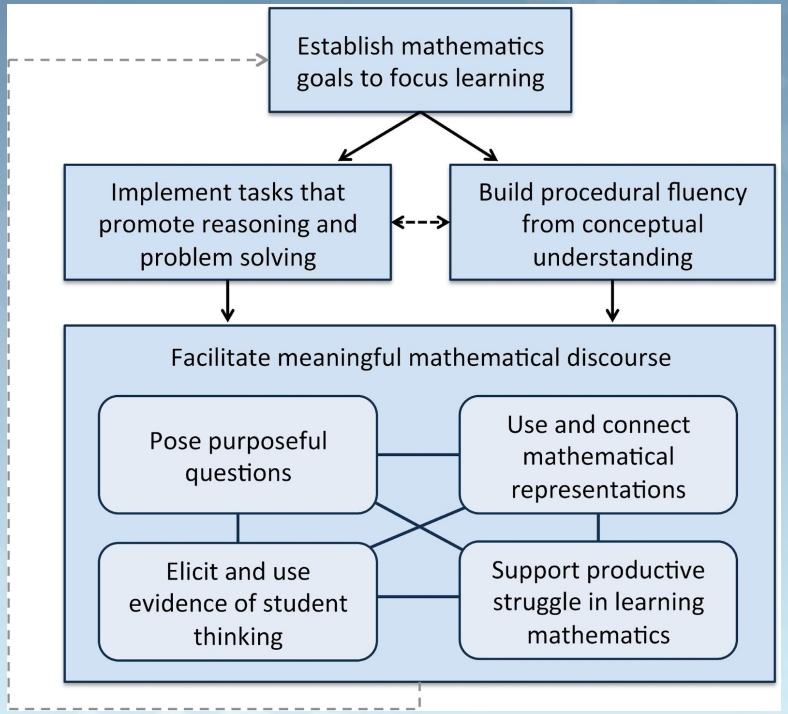


NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

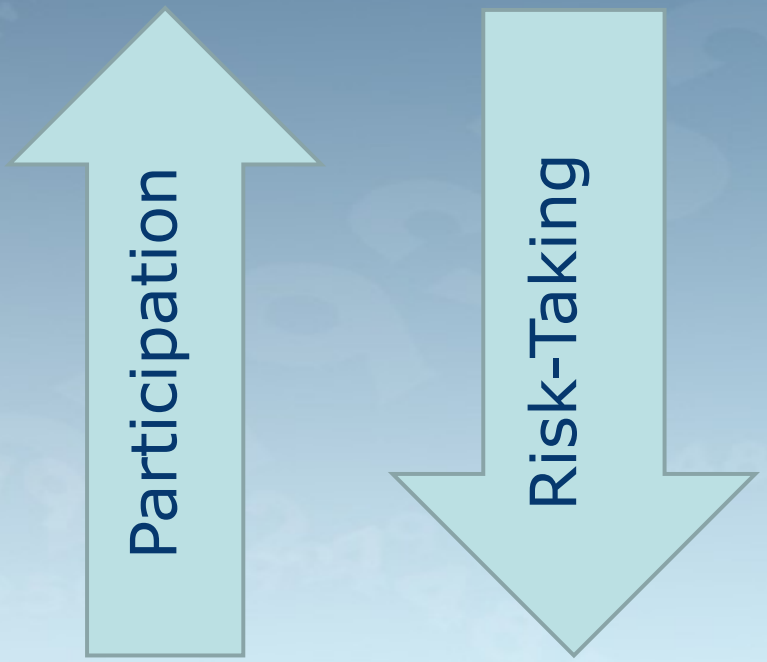
Elicit and use evidence of student thinking.

- Eliciting mathematical ideas from students who are perceived as always giving the right answer positions correctness as more valuable than mathematical thinking.
- Teachers who make a practice of eliciting and using evidence of students' mathematical thinking position each and every student as mathematically competent.



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Participation & Risk-Taking

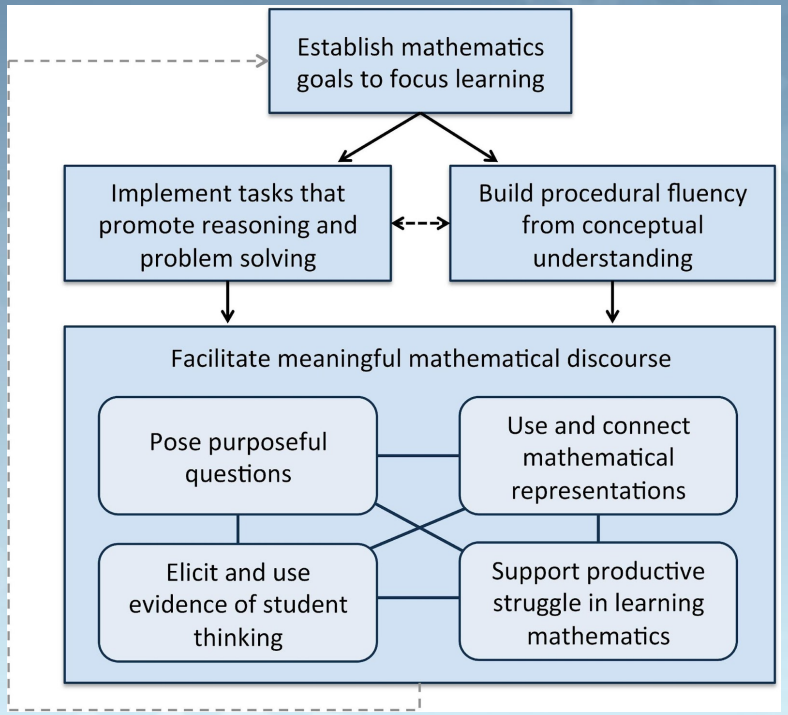


NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

Support productive struggle in learning mathematics.

- Grappling with ideas provides opportunities for students to develop a sense of agency by taking ownership of their mathematical thinking.
- Teachers allow time for students to engage with mathematical ideas and provide purposeful questioning to support perseverance and identity development.



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Mathematics Teaching Framework

The teaching practices within the Mathematics Teaching Framework are a coherent and connected set of practices that when implemented together, create a classroom learning environment supportive of equitable mathematics teaching practices

- What are the norms for participation in my mathematics classroom? How are these norms played out in my classroom?
- How do the tasks implemented in my classroom help students see themselves as doers and sense makers of mathematics?
- In what ways do students in my classroom use each other as mathematical resources?
- How do I facilitate discourse in my classroom that communicates to each and every student that their ideas matter?

The Important Book

- The important thing about rain is that it is wet.

  It falls out of the sky,

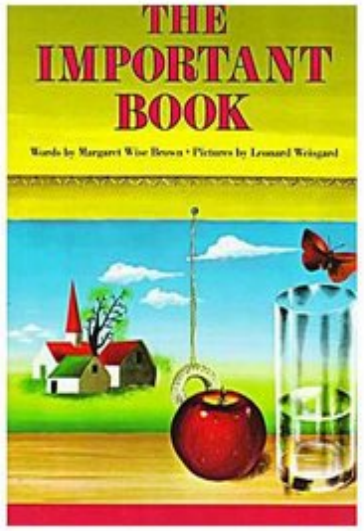
  and it sounds like rain,
  and makes things shiny,

  and it does not taste like anything,

  and is the color of air.

- But the important thing about rain is that it is wet.

Margaret Wise Brown, *The Important Book*



The Important Book

The important thing about identity, agency & positionality is _____.

- –Really great detail #1
- –Really great detail #2
- –Really great detail #3

But the most important thing about identity, agency & positionality is _____.