Strengthening Educators' Practices for Engaging and Empowering Students with Disabilities and Difficulties as Mathematics Learners

Welcome!

- Phone lines and microphones are muted.
- Please use the chat to introduce yourself, comment or ask questions!
- We are recording this webinar. Slides and a recording of the webinar will be posted on cadrek12.org

Community for Advancing Discovery Research in Education

Strengthening Educators' Practices for Engaging and Empowering Students with Disabilities and Difficulties as Mathematics Learners

June 4, 2020

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This work was supported by a grant from the National Science Foundation, DR-K12, grant numbers 1708327, 1621151, and 1621294. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

A Call to Mathematics Educators

From the National Council of Teachers of Mathematics (NCTM):

- We support the use of mathematics as an analytic tool to challenge power, privilege, and oppression.
- We encourage all educators to challenge systems of oppression that privilege some while disadvantaging others.
- We encourage all educators to create socially and emotionally safe spaces for themselves, their students, and colleagues.

NCTM, *A Statement on George Floyd, Breonna Taylor, and Ahmaud Arbery*, June 1, 2020

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Central Question:

What are ways to support educators in providing high-quality, inclusive instruction that empowers students with disabilities and difficulties as mathematics thinkers and doers?

Essential Shifts

Deficit Models of Students

Strengths-Based Approaches

What are ways to help educators shift to strengths-based instruction?
Add one or two ideas in the CHAT.

Agenda

1. Judy Storeygard, *Doing the Math with Paraeducators Project*
2. Jessica Hunt, *Fraction Activities and Assessment for Conceptual Learning Project*
3. Amy Brodesky, *Strengthening Mathematics Intervention Project*
4. Questions moderated by Karen Mutch-Jones

Common Themes Across the Projects

- Focusing on student thinking
- Listening to and observing students
- Doing mathematics
- Changing beliefs about mathematics and students

As you learn about the three projects, think about:
What do you notice and wonder about these common themes?

Type your ideas and questions in the **chat**!

Doing the Math with Paraeducators: A Research and Development Project

June 4, 2020

Judy Storeygard & Karen Mutch-Jones, PIs

Project Team: Jan Rook, Myriam Steinback, Audrey Martinez-Gudapakkam

Sara Gardner, Denise Treacy, Santiago Gasca

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Grant No. 1621151

What is a Paraeducator?

Paraeducators work alongside and/or under the direction of a licensed or certificated educator to support and assist in providing instructional and non-instructional services to children, youth, and their families. Also known as paraprofessionals, teacher aides, teaching assistants and other titles, paraeducators are integral members of the instructional team.

(National Education Association)

Addressing Equity on Two Levels: Paras

- Paras in our project come from underserved populations.
- They are often from the communities of the students they teach and form close relationships with them/their families.

However:

- They are not well paid and only are paid for instructional time;
- They receive little or no support to help them develop expertise.

Addressing Equity on Two Levels: Students

Underprepared paraeducators are often assigned to help those with learning challenges. They cannot offer the appropriate level and/or type of support.

The Deployment and Impact of Support Staff (DISS) Project showed that paras were often engaged in task completion and correcting students, whereas teachers were more often able to encourage conversation and reasoning.

Blatchford, P., Russell, A. and Webster, R. (2012) Reassessing the impact of teaching assistants: How research challenges practice and policy. Oxon: Routledge

Focus of our PD designed to support para understanding of student strengths and needs

Features of the Project

- Boston Public Schools Kindergarten – Grade 3
- 30 hours of professional development
- Classroom observations
- Interviews with paraeducators, teachers, and principals
- Monthly reflections
- Collaborative planning protocol
- Support for classroom teachers

Building Trust

- Affirm the importance of the paraeducator role
- Acknowledge the challenges
- Create a safe environment where mistakes and confusions are valued
- Encourage support of each other – sharing strategies, looking at student work together

Core Professional Development Focus

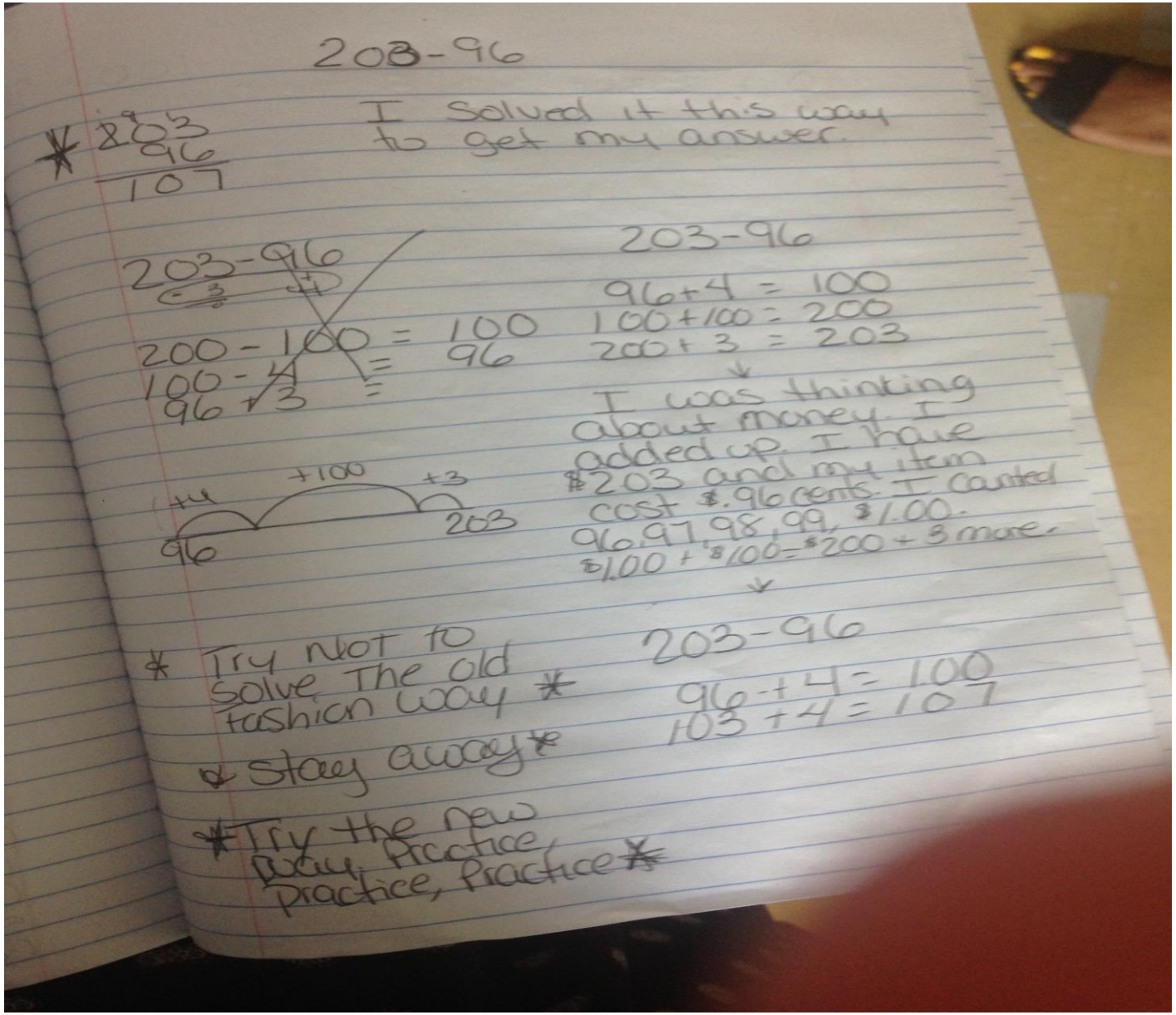
Increase paras':

- comfort and enjoyment when doing the math activities, and ultimately, their confidence in their math abilities;
- opportunities to solve math problems together.

Core Professional Development Focus

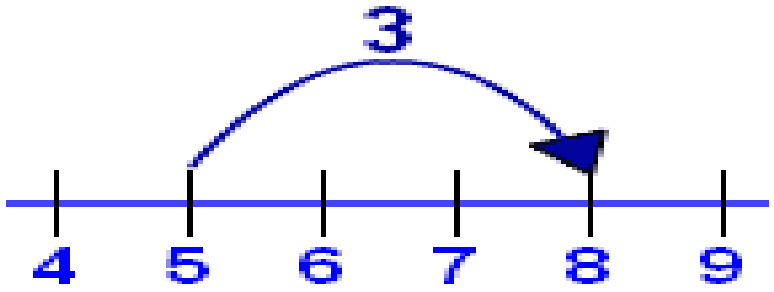
Increase paras':

- understanding of the number system and place value;
- awareness that there are multiple ways to think about and solve a problem.



Practice-Based PD

- Familiarizing paraeducators with district curriculum and resources:



- Developing understanding of grade level expectations

- Understanding the content of math activities.

Analyzing Student Work

- Paras brought samples of student work to PD to discuss in grade K-3 groups;

- Later, we added a formal, school-based *Looking at Student Work* component, facilitated by Para Mentors.

Describe → **Interpret** → **Evaluate** → **Think about next steps**

Para Findings: Professional Development

Paras:

- appreciated the complexity of learning mathematics, and the need for differentiated instruction;
- listened for student thinking, not just the answer;
- offered students available tools and resources;
- drew on a range of strategies that might students use;
- made connections between behavior and learning;
- engaged with teachers about student needs.

Researcher Observations of Paras:

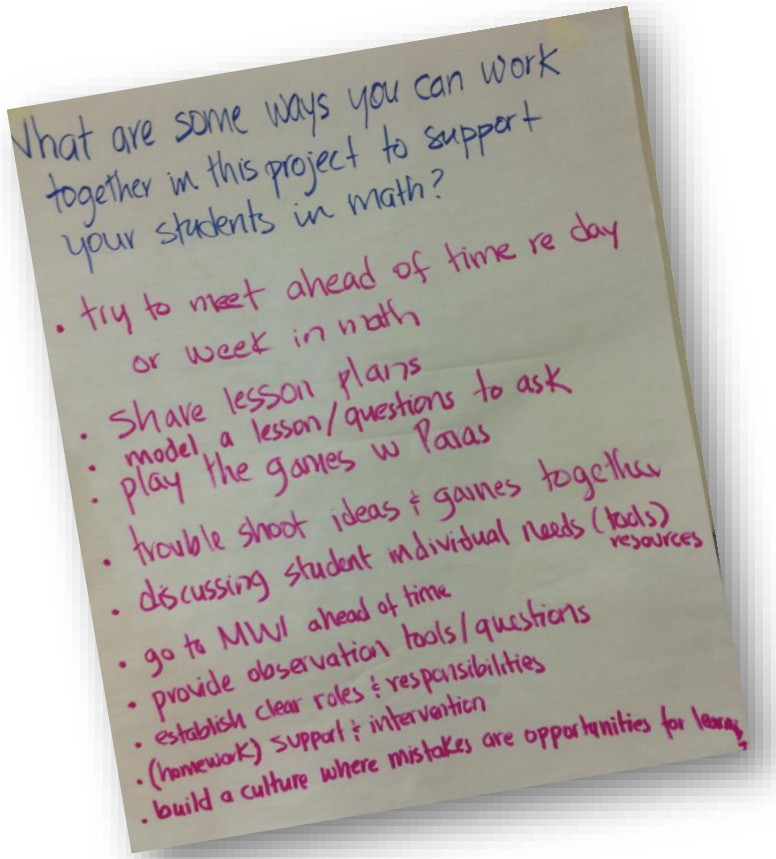
- Asking questions to promote mathematical thinking: *How can you find the answer? How do you know it is 18? How do you know which number is bigger?*

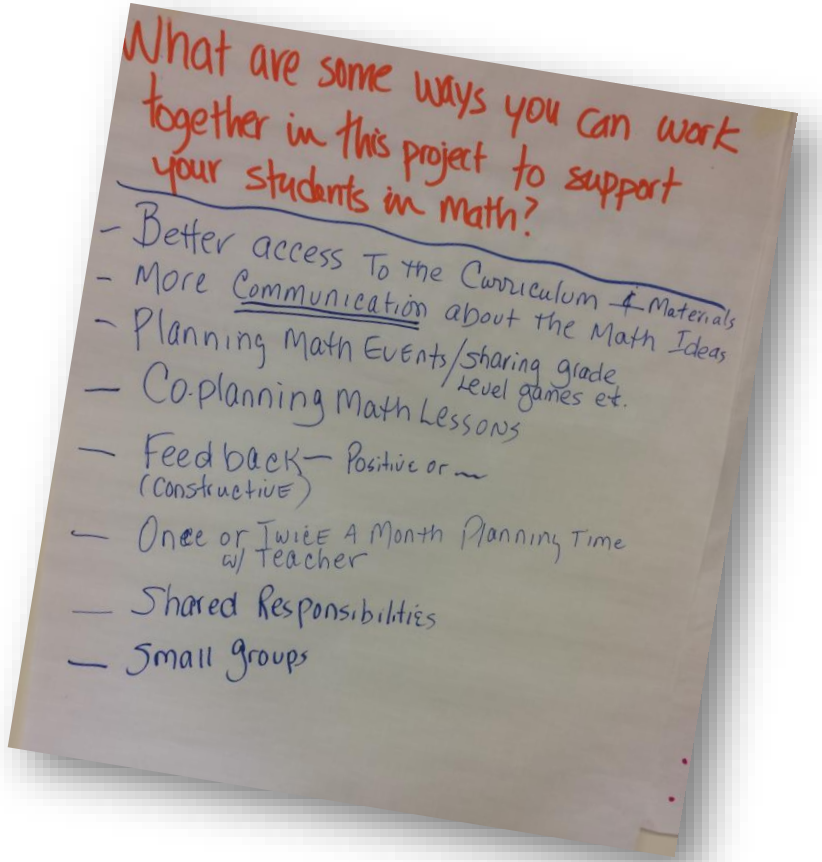
- Encouraging students to show their thinking through drawing or demonstration: using number line and counting cubes or drawing objects;

- Using Mistakes as learning opportunities and teaching students how to check accuracy with math resources and through collaborative group work.

Support for Classroom Teachers

- Half-day professional development session
- Monthly planning protocol
- Agendas for PD sessions
- Post-observation emails





Reflections from Paras and Teachers Indicating an Appreciation for Differentiated Instruction

Para

I learned to observe. It helped me understand what students needed. At the same time it helped me understand what I could do for the student. I realized that all children don't learn the same way. Students can express their understanding in different ways.

Teacher

The more confident she became with the curriculum, the more she was able to make recommendations and had wonderings about what was happening with a kid and suggest questions or alternative things to do with them.

Reflections from Paras and Teachers Indicating an Appreciation for Differentiated Instruction

Para

She [student] went from not being able to recognize numbers—now can count with cubes or the number line. She is talking more and getting excited about answering.

Teacher

At first, she [para] would say, ‘they don’t get it’ and now she’s thinking more of helping them to get it. Before, I was giving her ways to help them, now she uses manipulatives and can follow their strategies herself to help students. She is uncovering what students know.

Learning and Behavior

Paras considered the reasons why a student might be exhibiting behaviors such as lack of focus or refusal to complete tasks, for example:

> *Doing this [PD], [I learned that] the student is not just trying to get out of work, he's learning it a different way. That really helped me understand that everything wasn't all black and white. We didn't have the tools to help this child understand it more than this [other] child. [PD] kind of painted a much clearer picture.*

What Works and Next Steps

To support students in inclusive classrooms, paraeducators need:

- Ongoing PD with initial sessions focused on developing para enjoyment and confidence in math;
- Practice-based activities to familiarize paras with curriculum resources and grade level expectations;
- Opportunities to analyze and reflect on to student work through small group sessions on a regular basis;
- Para leadership programs, preparing to mentor peers;
- Support structures for collaborating teachers.

Building on the Doing the Math! PD Model

- Provide more support for teachers working with paras;
- Support paras to enter the teacher pipeline;
- Develop district- and building-level capacity to support paras by:
  - **Offering PD**
  - **Including paras on committees**
  - **Providing planning time and structures**

Thank You for Attending!

Thank you to the BPS paraeducators, Linda Davenport (Director K-12 Math Instruction), and Connie Henry (Asst. Director)

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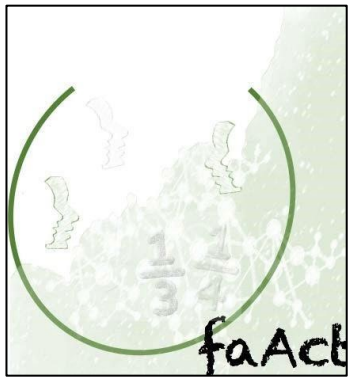

Fraction Activities and Assessment for Conceptual Teaching: Supporting Asset-Based Models of Professional Learning

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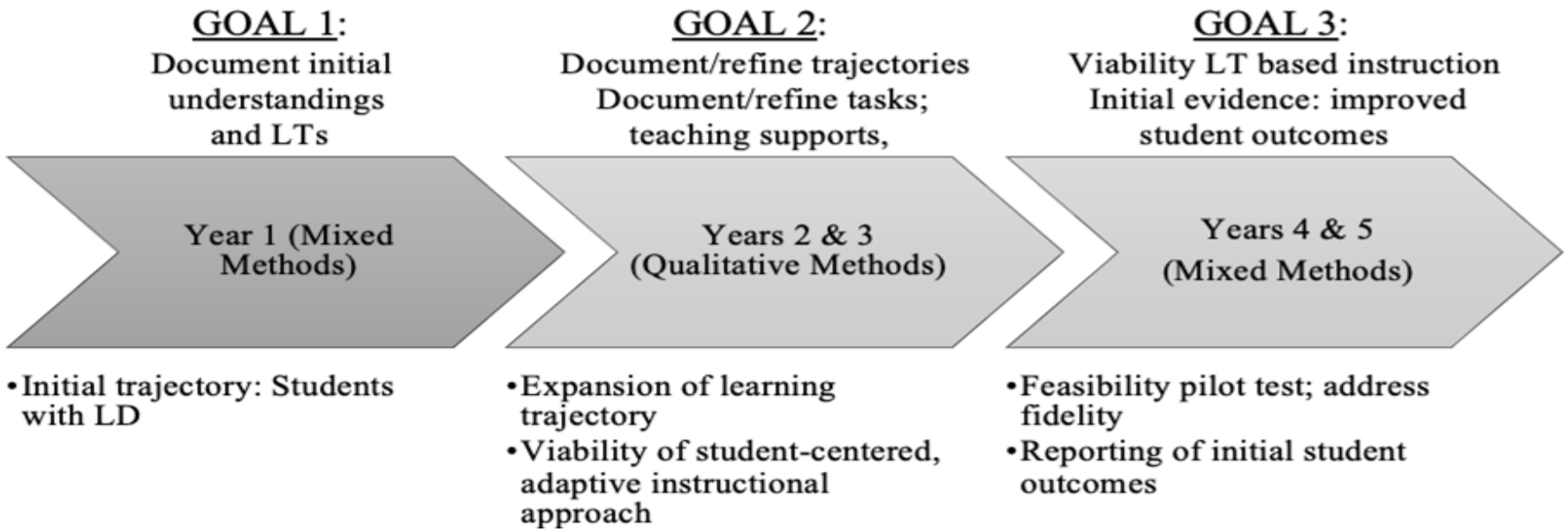
Thank you to my team:

- Juanita Silva, Ph.D.
- Kristi Martin, Ph.D.
- Andy Khounmeuang
- Jasmine Welch-Ptak, Ph.D.
- Blain Patterson, Ph.D.

This work was supported by a grant from the National Science Foundation, DR-K12, grant number 1708327. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

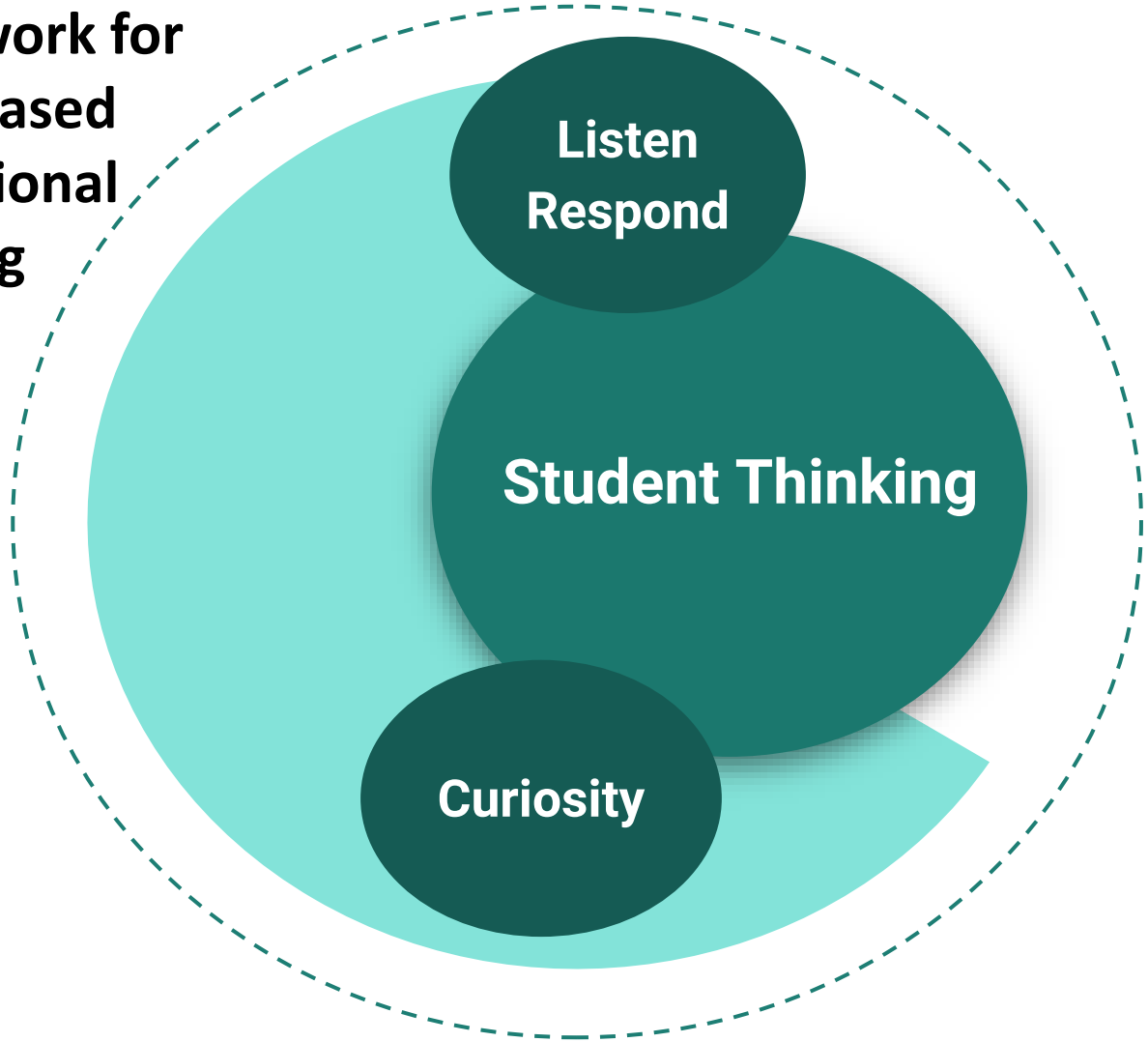
Project Introduction and Goals



Educational Activities:

- Small scale PD related to LTs
- Creation and Refinement of Graduate Course
- Larger scale PD in school settings/ curriculum enactment

Framework for Asset-Based Professional Learning



Roles:
In service elementary school general and special education teachers.

- Often in specialist roles (math specialist, interventionist)

Contexts:
Graduate Course
School-Based PD

Build Knowledge of Students' Fractional Thinking: Curiosity, Listening, and Responding

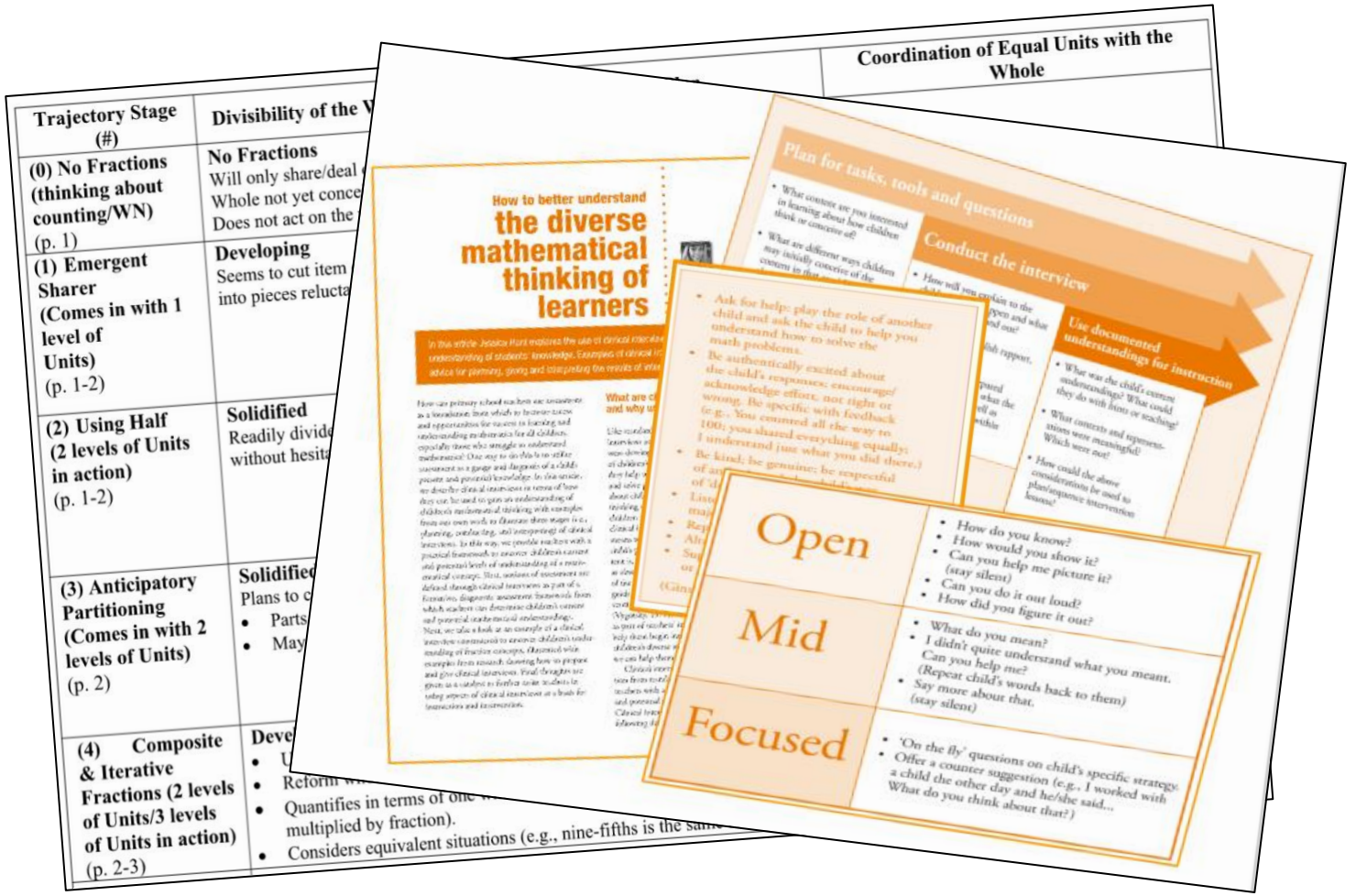
Tools:

- Learning trajectories
- Clinical Interviews

Used to:

- Promoting curiosity

- Listening & Responding



For resources see my website! https://research.ced.ncsu.edu/faact/

Build Knowledge of Students' Fractional Thinking: Curiosity, Listening, and Responding

Promoting curiosity:

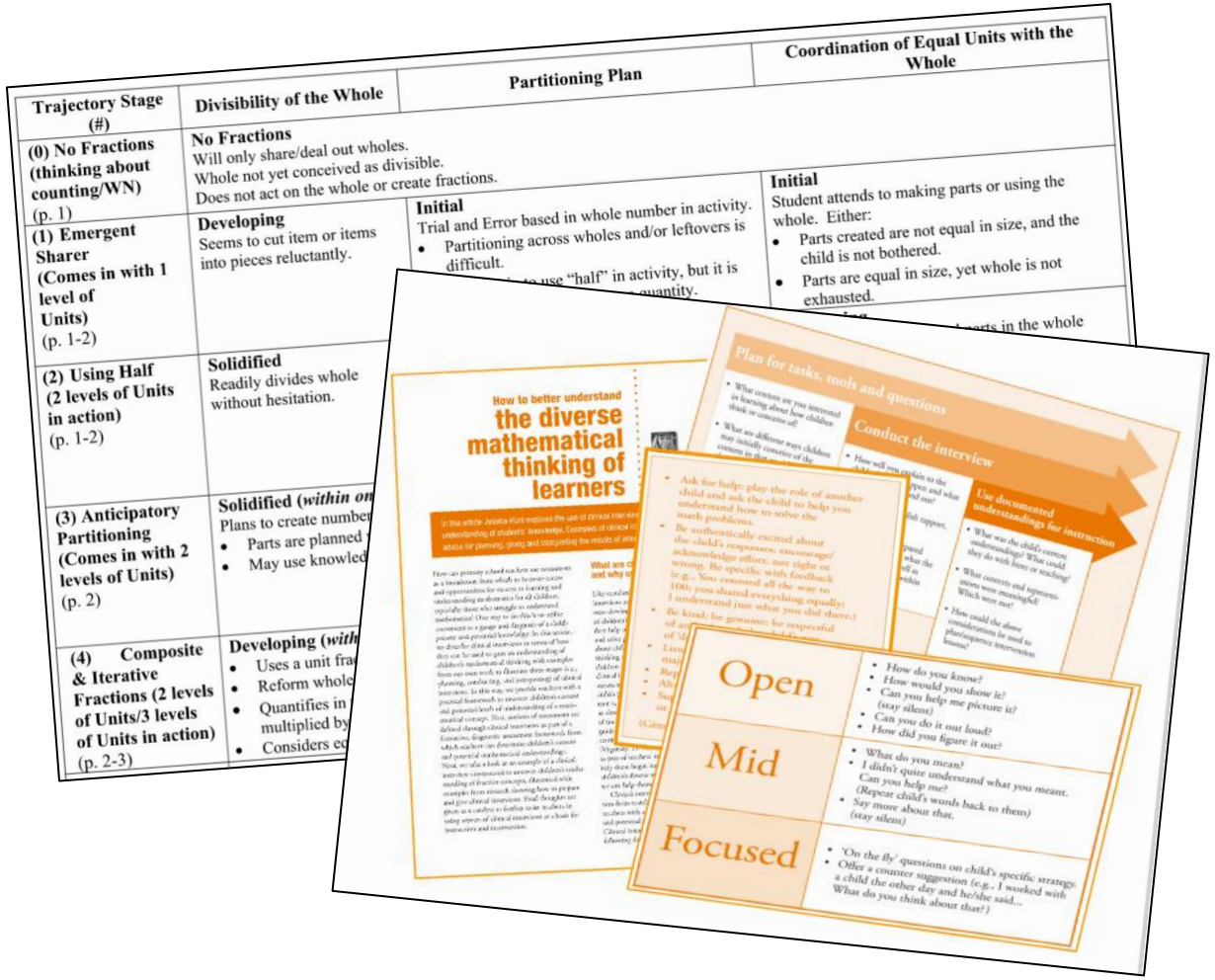
- Noticing thinking & how it might grow
- Surprises in thinking

"I never knew students could engage with problems that way!"

Listening, Responding:

- Child as competent expert
- Connection between teaching and listening

"I appreciated that we had a way to listen to kids!"



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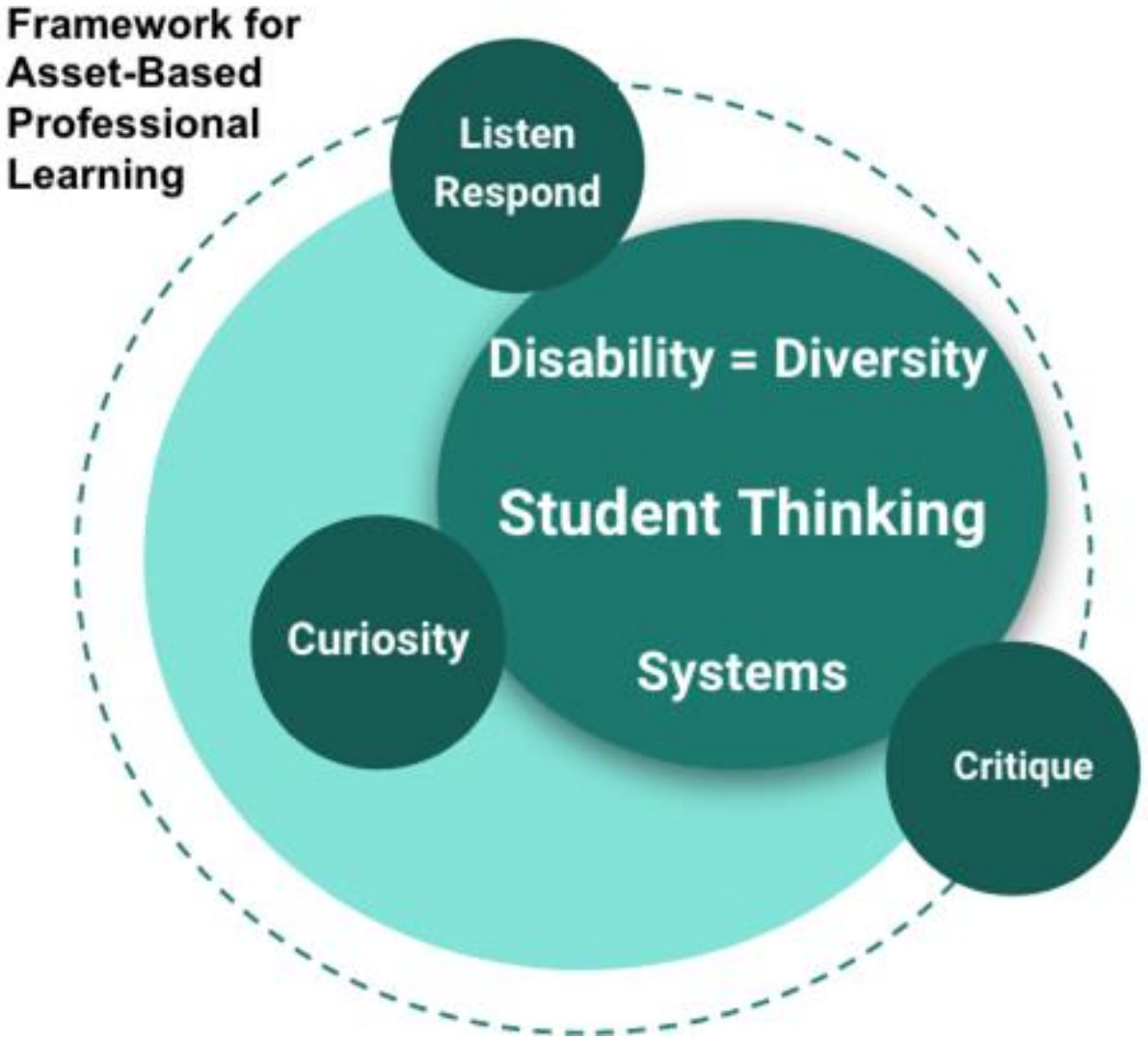
Addressing Beliefs and Applicability: Disability as Diversity



Expanding Our Framework:

- **Added Disability as a form of Diversity within Systems**
- Used critique alongside curiosity, listening and responding

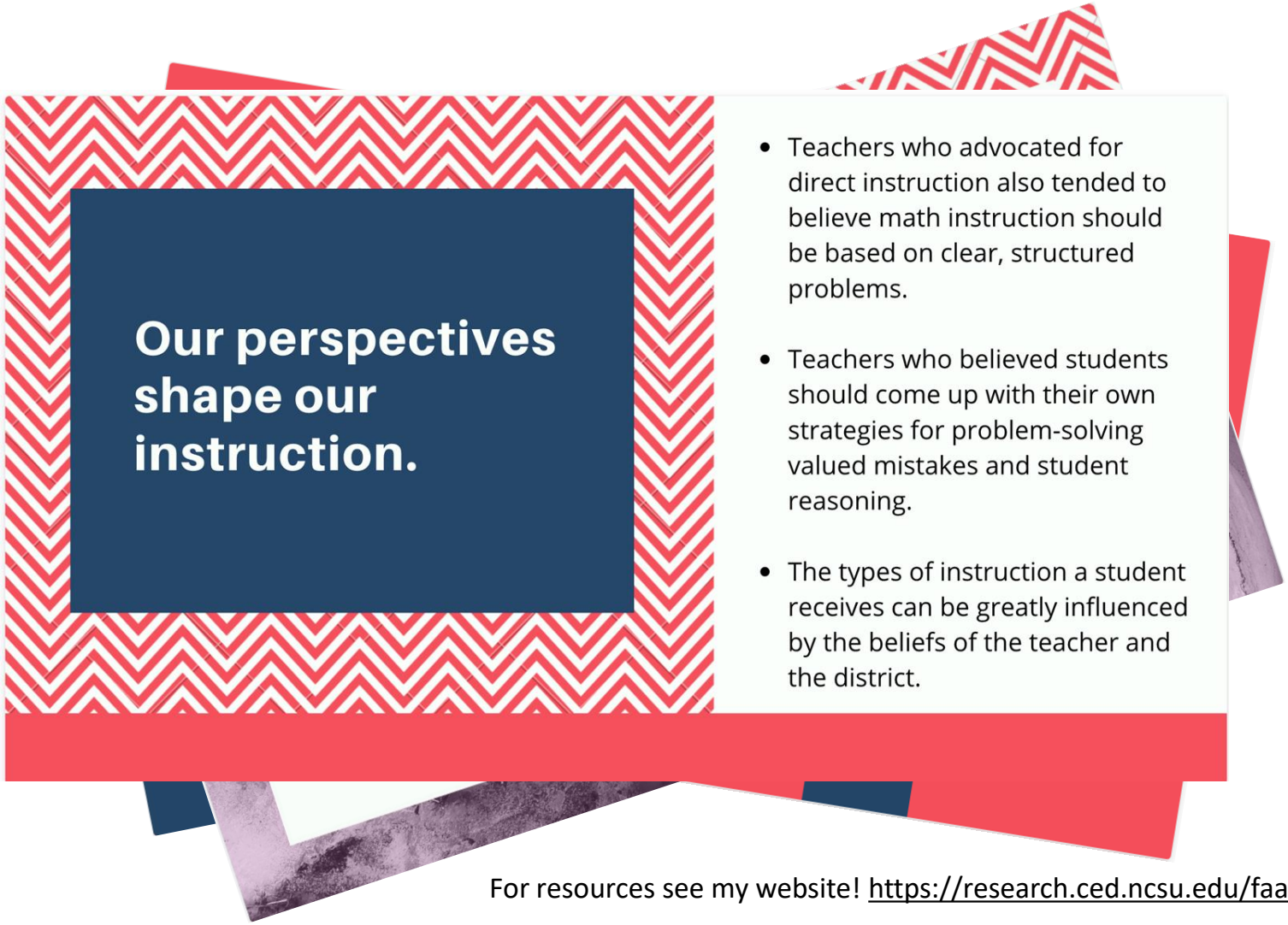
Build Knowledge of Students' Fractional Thinking: Curiosity, Listening, and Responding

Tool:

- **Disability and Math Questionnaire Project**

Used to:

- Promoting curiosity
- Listening, Responding
- **Critiquing**



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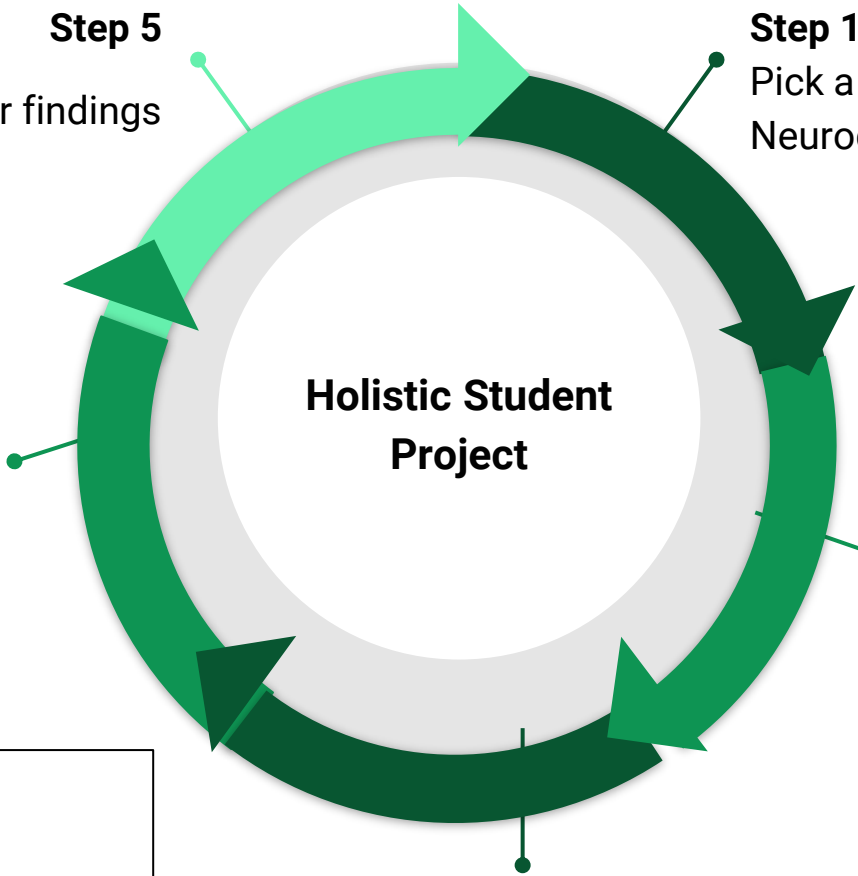
Support Critical View of of Disability & Student Thinking: Curiosity, Listening/Responding, and Critiquing

Tool:

- Holistic Student Project (extension of Clinical Interviews)

Used to:

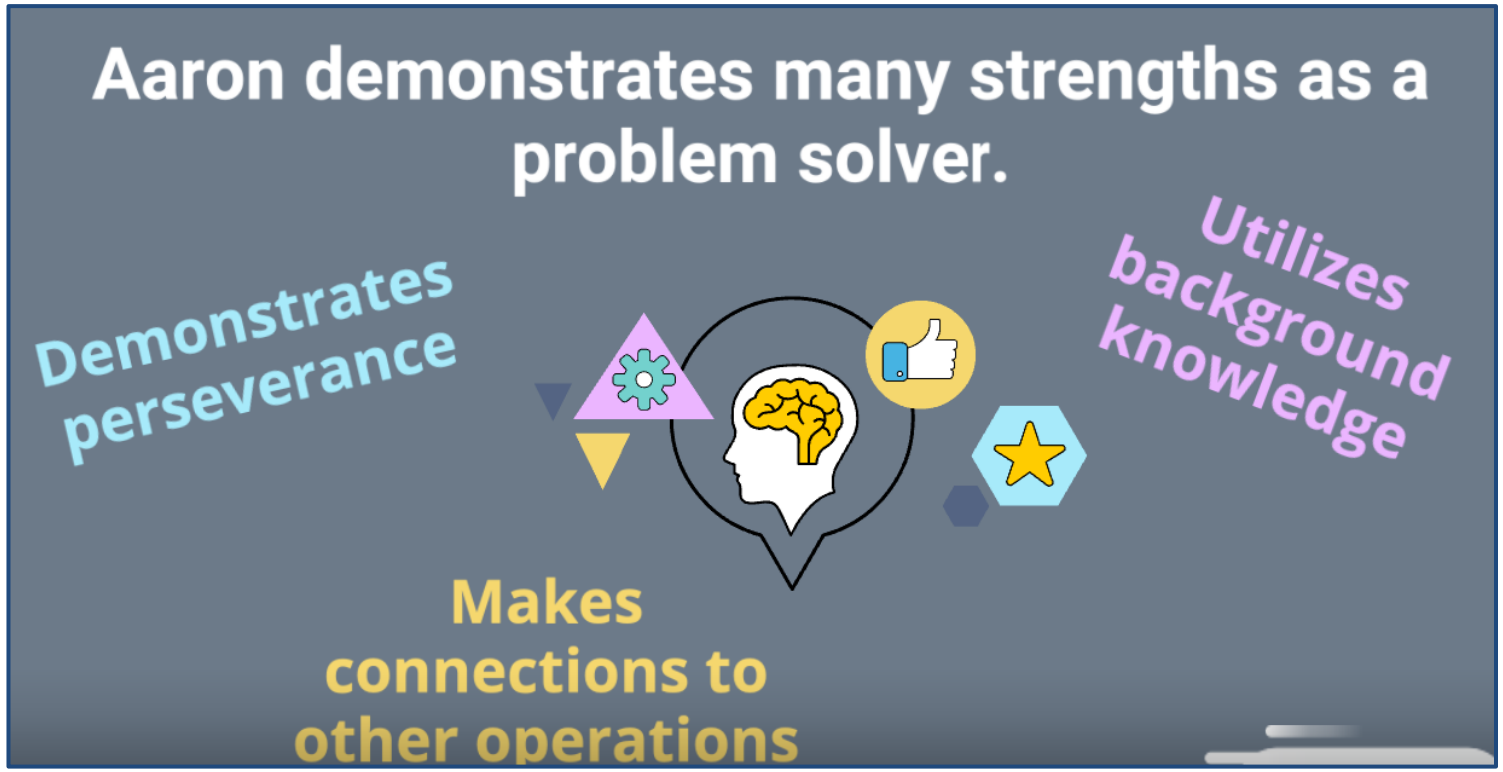
- Promoting curiosity
- Listening, Responding
- Critiquing



Tools:
Initial Interview
Math Strengths Interview
UDL Curriculum Task
Shadow Student*

Support Critical View of of Disability & Student Thinking: Curiosity, Listening/Responding, and Critiquing

Example →



"I've LOVED learning about the alternative perspective to special education, considering neurodiversity and opening up multiple strategies / entry points in my teaching and school environment."

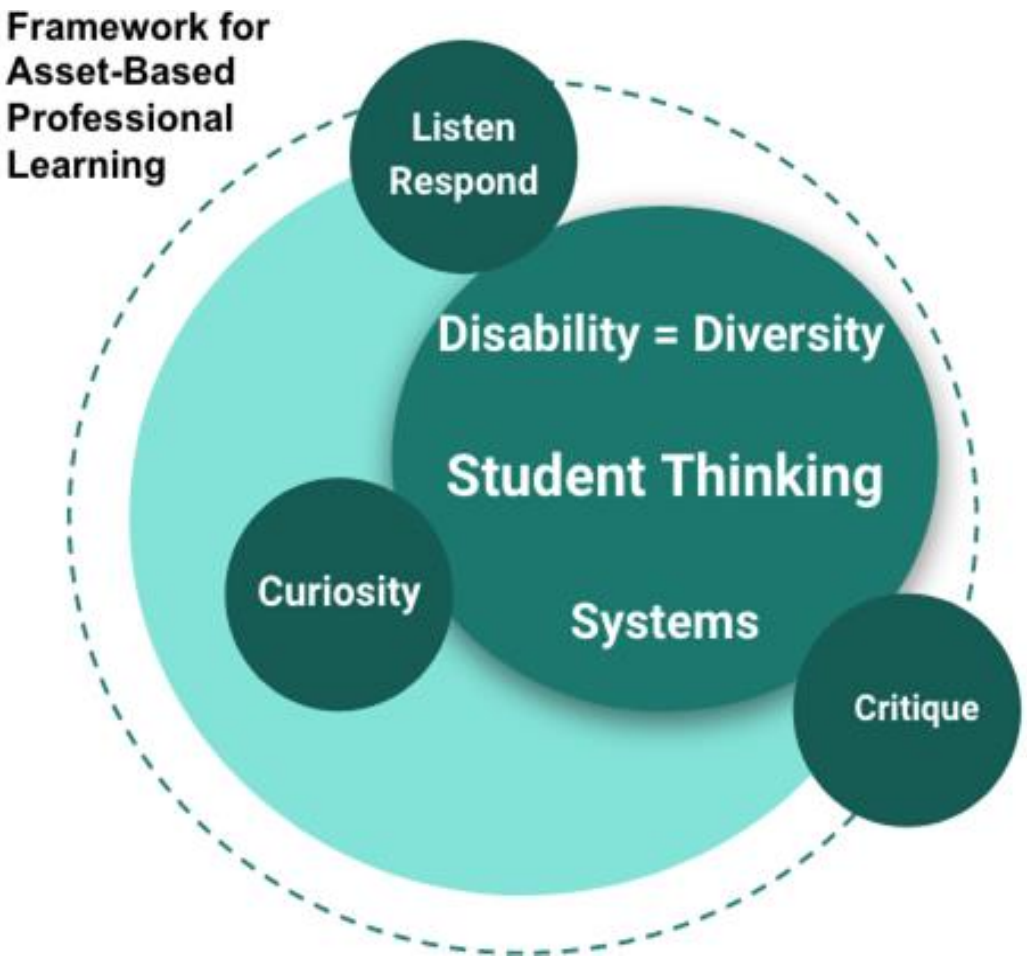
Support Critical View of of Disability & Student Thinking: Curiosity, Listening/Responding, and Critiquing

"[The PD] *Opened my eyes to the potential of children.*"

"[The course] pushed my thinking about labels, equity and supporting all learners through a belief shift."

"I got a lot out of the class, and I really liked the mind shift I have now on Exceptional Children."

"I found the most useful aspect [of the PD] was the reflection of my teaching with all students, especially those who are neurodiverse. I took a look at how my practices might be hindering student growth. The most critical aspect that I took away was the ability to pay attention to my listening and responding and how that might translate to student success."



To support asset based professional learning, teachers require:

Strengths based frameworks that promote curiosity, listening/questioning, and critiquing.

Opportunities to address and challenge beliefs

- Teachers
- Systems

Actionable tools to promote students' strengths in the context of teaching and combat deficit beliefs in the context of systems.

Longitudinal learning opportunities.

Future Connections

- Longitudinal PD with partner schools
- Scalable, learning community based applications that are low or no cost
  - *MOOC creation

Thank you!

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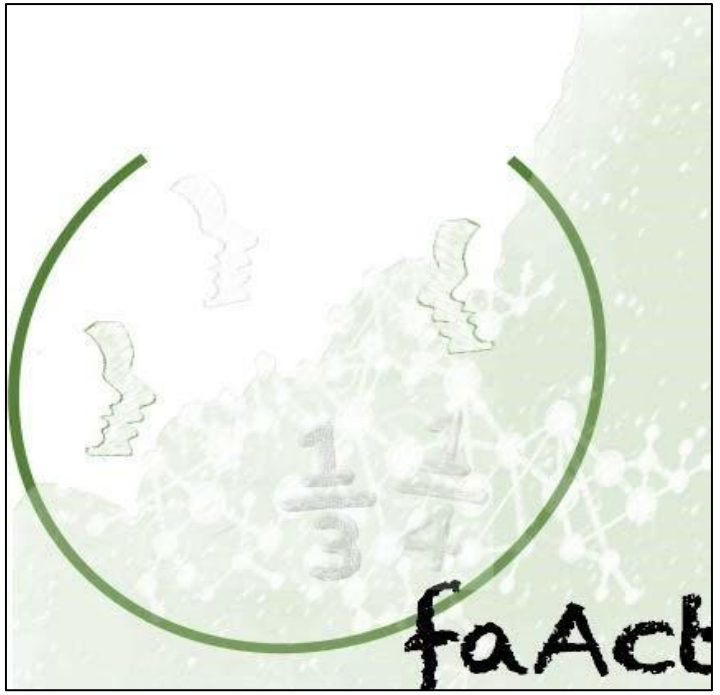


FAACT Project website
ModelME Project website

View my work:
CADRE (NSF) * NCSU website * Research Gate * Google Scholar * Twitter * STELAR

Strengthening Mathematics Intervention (SMI) Project

Project Team:

Amy Brodesky, Emily Fagan, Theresa MacVicar, and Jackie Zweig, EDC

Karen Karp, Senior Advisor, Johns Hopkins University

This presentation is based upon work supported by the National Science Foundation under Grant No. 1621294. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

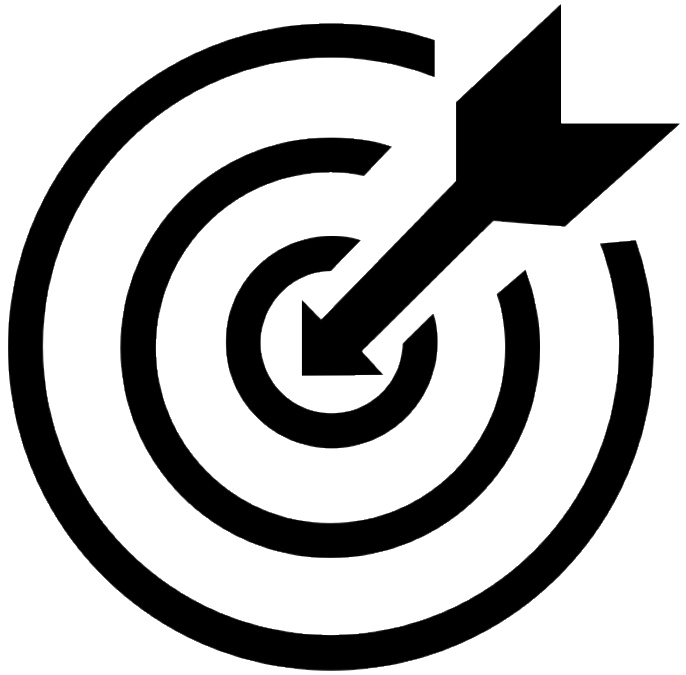
EDC Education Development Center

Mathematics Intervention (MI) Classes

Our Definition: Classes taken by students *in addition to* their general education mathematics classes, during the school day

- Designed for students who are having mathematics difficulties
- Provide additional instruction, support, and time for learning mathematics

If you were observing a math intervention class, what would you hope to see?
Add one or two ideas to the **CHAT**. 



SMI Project Goals

- Study the national landscape of mathematics intervention classes at the middle grades
- Create and pilot professional development for teachers of mathematics intervention classes

Brodesky, A. R., Zweig, J. S., Fagan, E. R., Karp, K. S., & Hirsch, L. (2018). *National Survey: Executive Summary*

SMI Professional Development (PD)

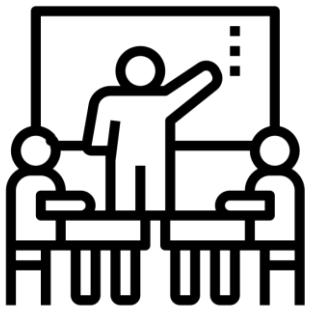
PD Course

- Hybrid: Face-to-face sessions, online sessions, & virtual meetings
- 70 PD hours across one school year
- Piloted with teachers in Massachusetts and Maine

Target Audience

- Teachers of Mathematics Intervention Classes (Grades 5-8)

  What are their professional learning needs?



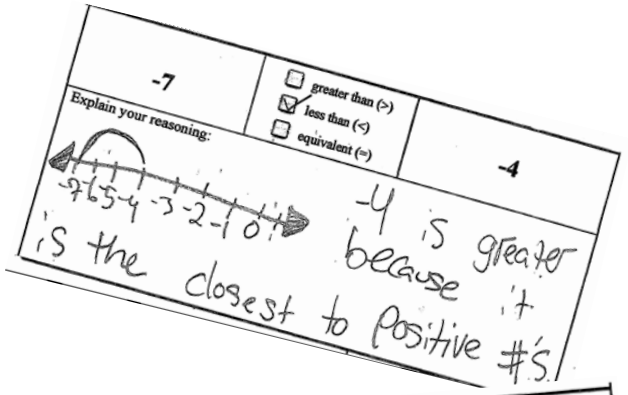
Central Question

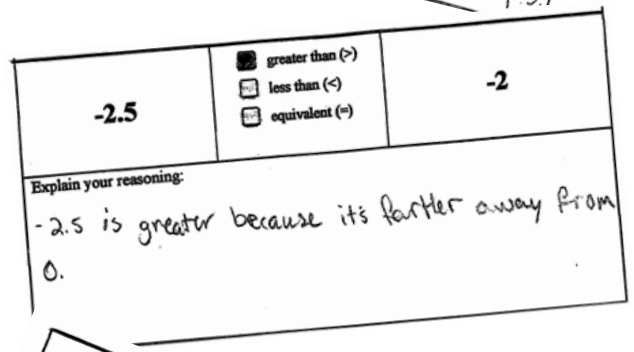
What are ways to support educators in providing high-quality, inclusive instruction that empowers students with disabilities and difficulties as mathematics thinkers and doers?

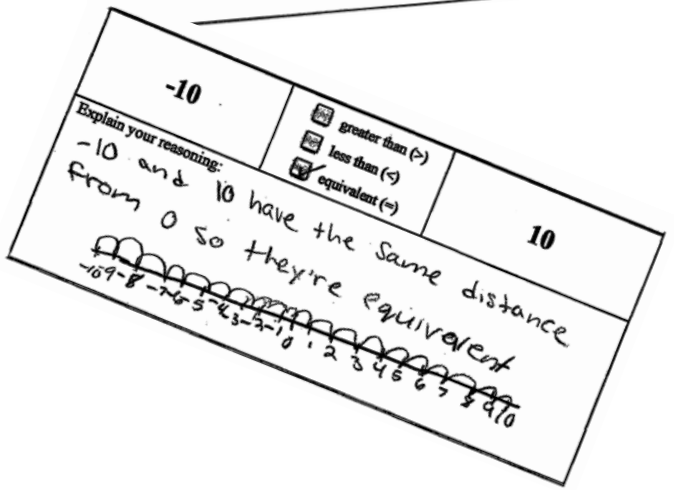
PD Approaches

PD: Understanding Students as Mathematics Learners

- Put students at the center of the PD
- Bring in students' voices and work
- Use a *Focus Student Approach*
  - Select one student to focus on during the course
  - Collect and examine the student's work
  - Find out about their strengths and difficulties
  - Target instruction and reflect on practices



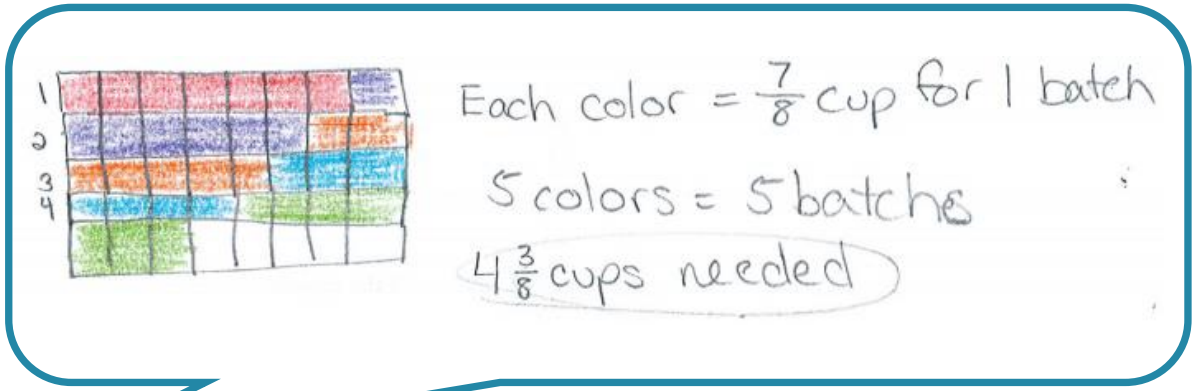


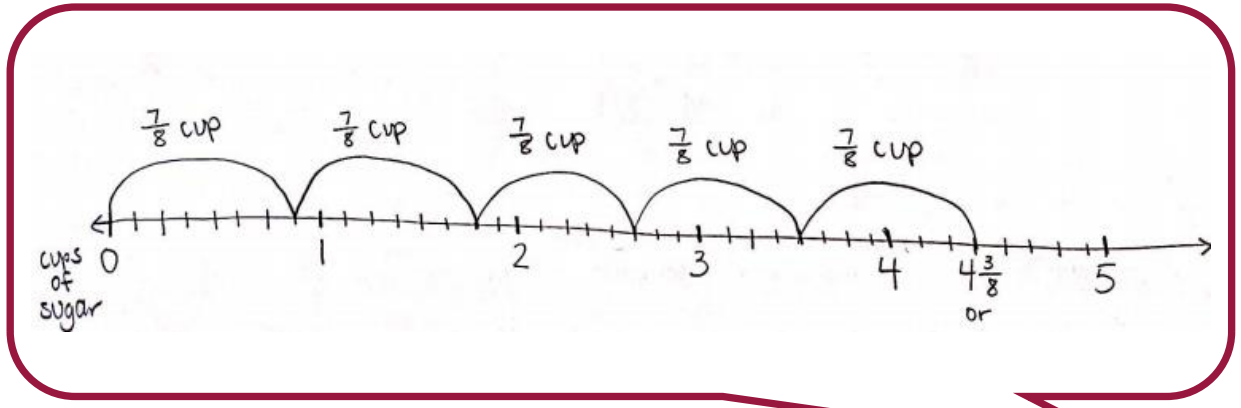


PD: Doing Mathematics

Mathematics Intervention Classes: Engage students in doing meaningful mathematics to build conceptual understanding and sense-making

Professional Development: Engage teachers in doing meaningful mathematics, using multiple representations, and sharing approaches

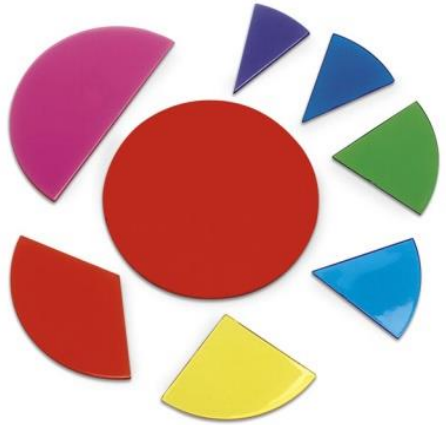




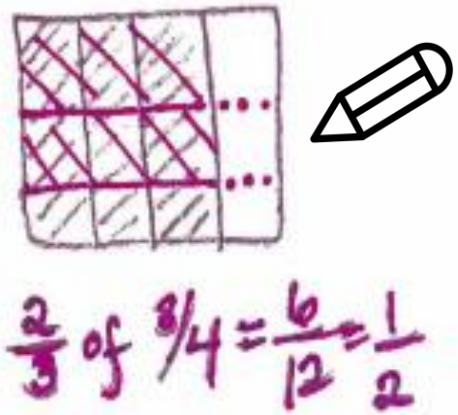
Two Teachers' Approaches for the Same Problem

PD: Using Recommended Instructional Practices

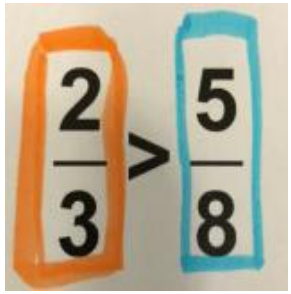
Manipulatives

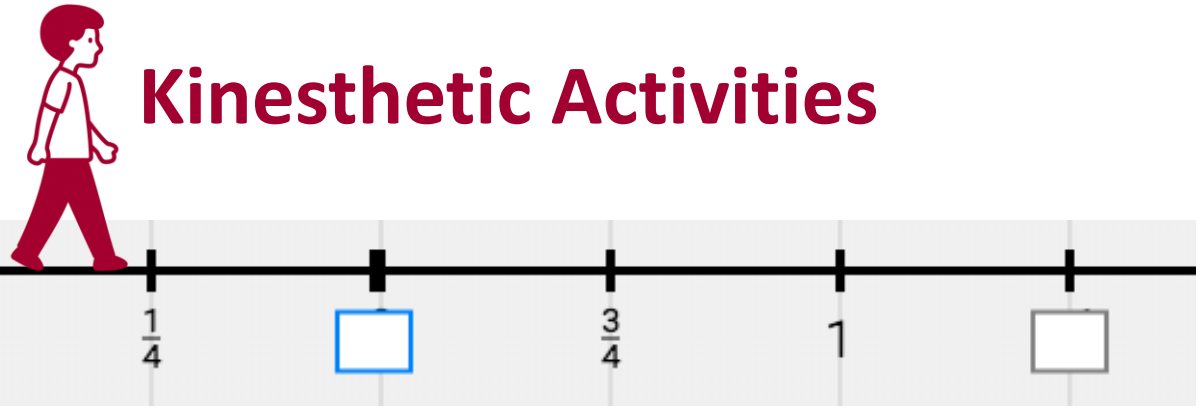


Visual Representations



Concrete—Semi-Concrete — Abstract (CSA)



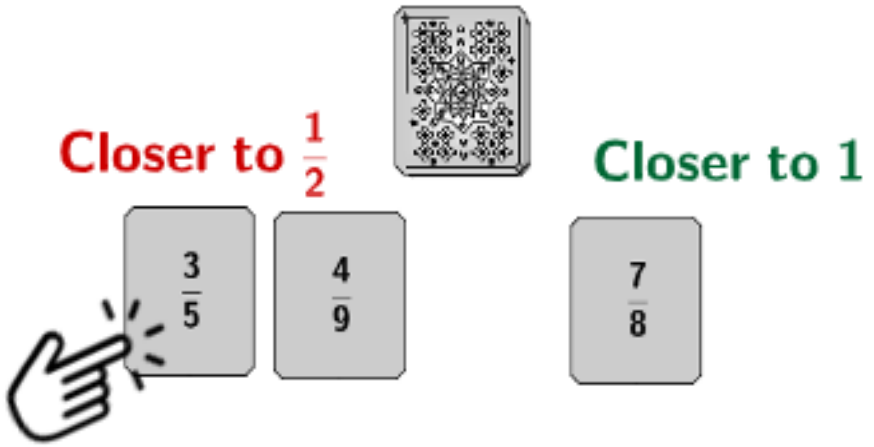


PD: Supporting Student Communication

Challenge: Students are hesitant to share their math ideas

In the PD, teachers use a variety of language strategies to promote discourse

Card Sorts with Discussion Protocols

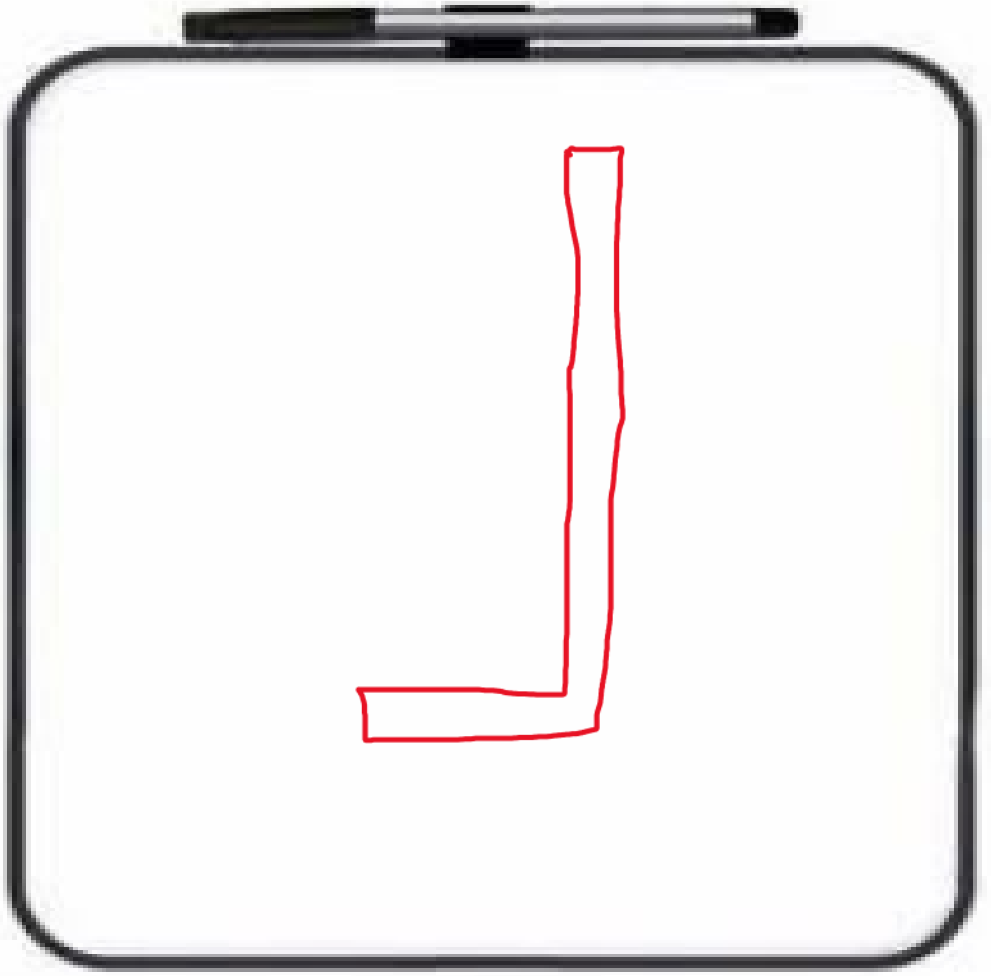


"I put $\frac{3}{5}$ in this category because…"

"I agree/disagree because…"

Using Mini-Whiteboards for Sharing

"Show me an example of…
a shape that has a large perimeter
and a small area"



Benefits:

- Students hold up examples and talk about their ideas
- Easy to erase and change ideas
- Allows for multiple approaches

Swan, Malcolm (2005), *Improving Learning in Mathematics: Challenges and Strategies*

PD Focus: Formative Assessment Probes

Comparing Decimals Probe

Selected Response

Explanation Prompt

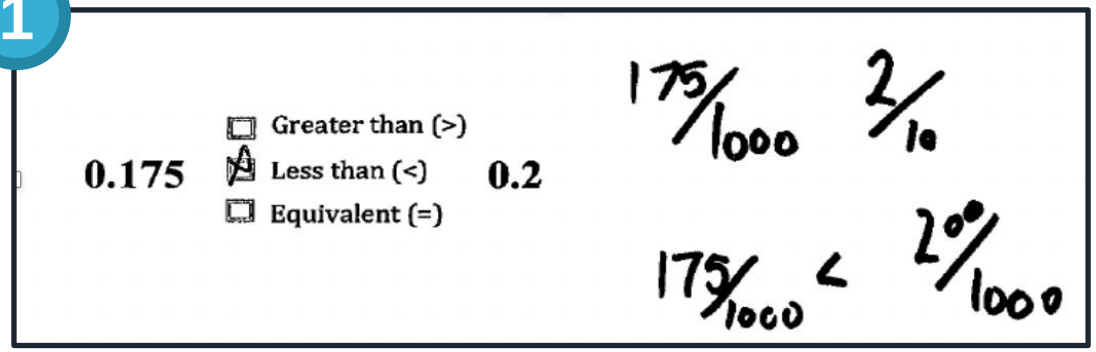
Choose the correct response	Explain your thinking:
A) 0.175 ☐ Greater than (>) ☐ Less than (<) ☐ Equivalent (=) 0.2	
B) 0.31 ☐ Greater than (>) ☐ Less than (<) ☐ Equivalent (=) 0.426	
C) 0.25 ☐ Greater than (>) ☐ Less than (<) ☐ Equivalent (=) 0.0756	

Fagan, Tobey, & Brodesky (2016) *Targeting Instruction with Formative Assessment Probes;* Link to Probes

Probes Elicit Evidence of Understandings

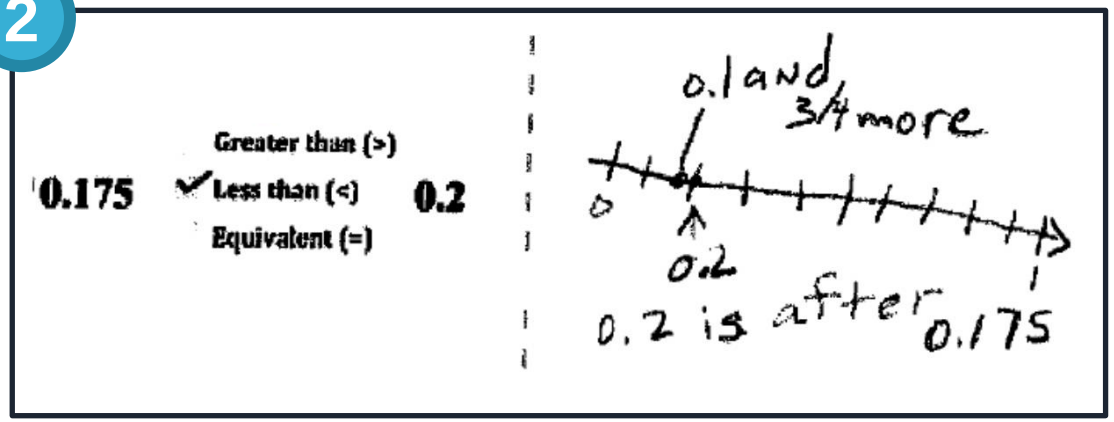
Examples

1



Student 1 represented the decimals as fractions with common denominators.

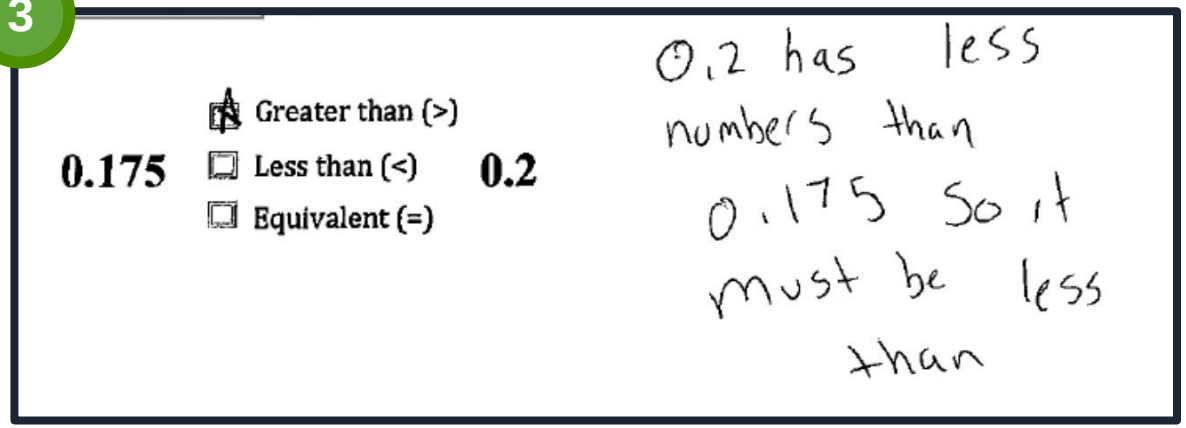
2



Student 2 located the decimals on a number line.

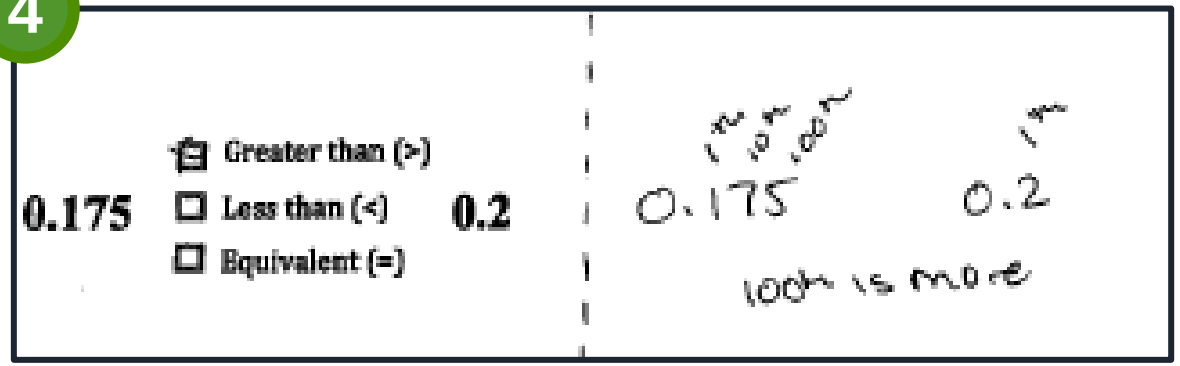
Probes Elicit Evidence of Difficulties & Misconceptions

3



Student 3 seems to assume that more digits means a larger value.

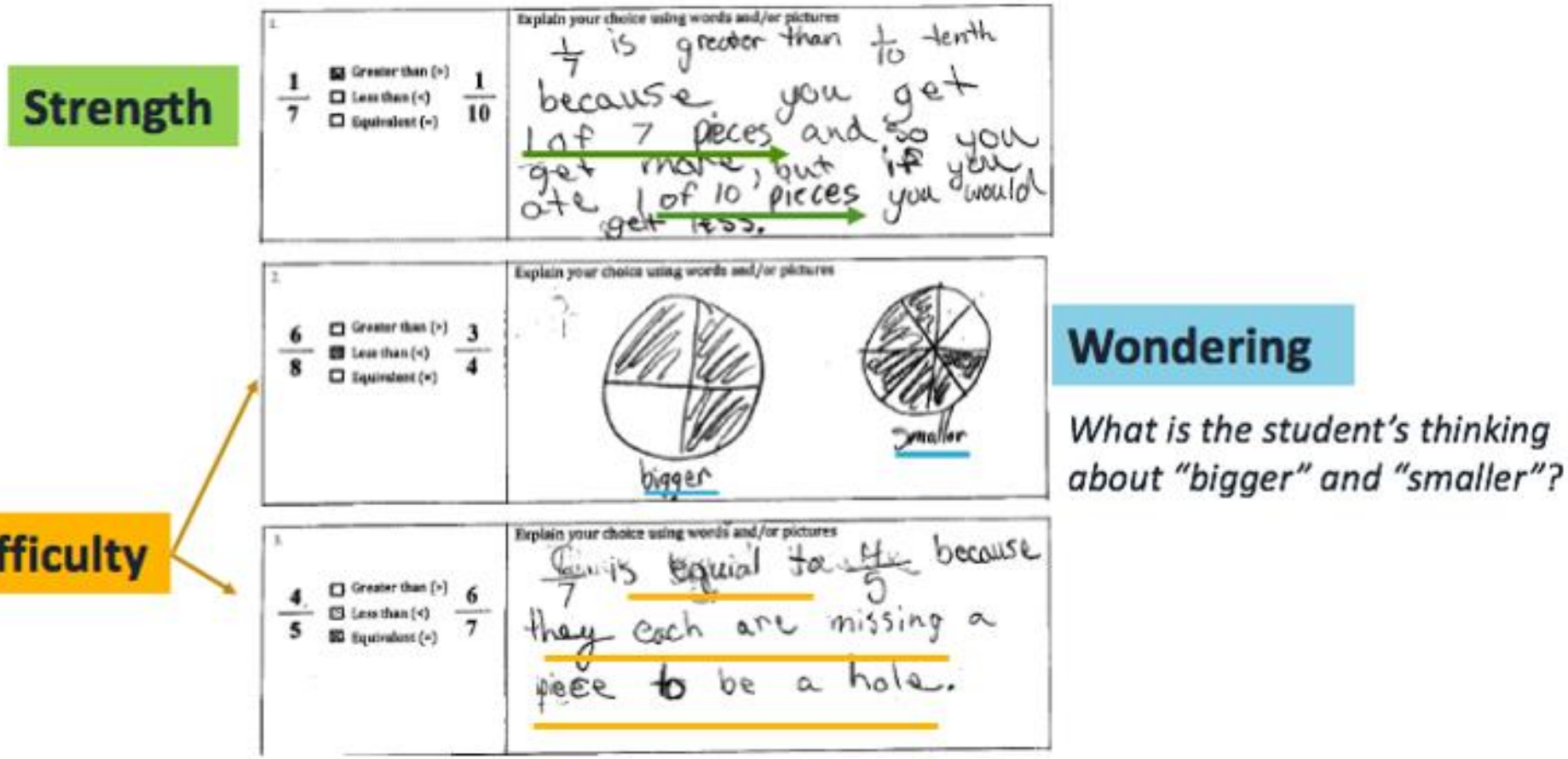
4



Student 4 made errors in labeling and interpreting the place values.

PD: Examining Student Work

- What do you **notice?** Start with evidence of **strengths.**
- What are you **wondering** about the student's understanding?



Annotated Student Work: Comparing Fractions Probe

PD Focus: Conduct Student Interviews Using Probes

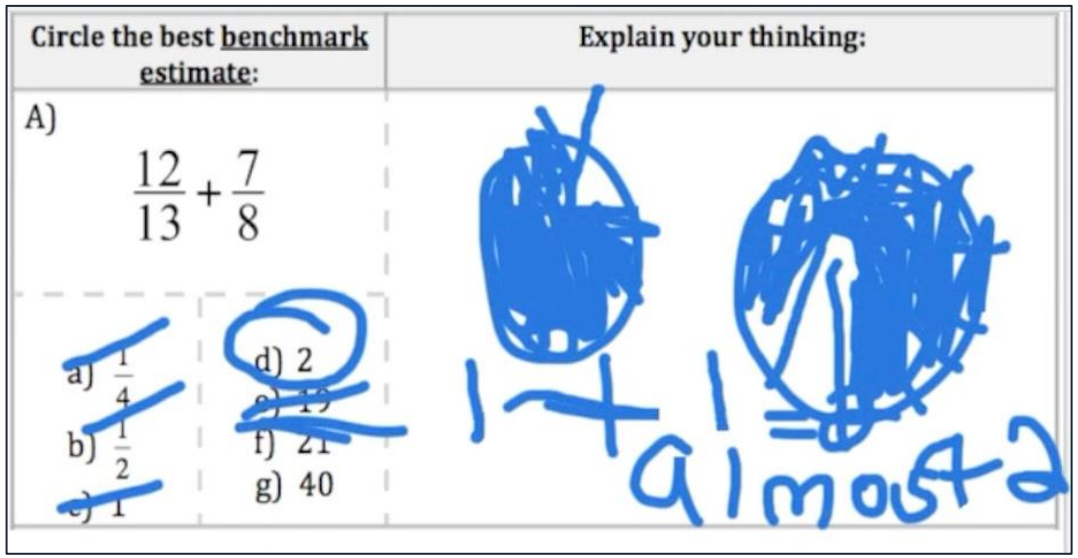
Goal of Interviews: To find out about students' understandings and difficulties by asking them to think aloud as they solve probe items

Teacher's role is to **listen** and **ask questions** as needed to find out more about the student's thinking, but **not to provide instruction**. The information will be used later to target instruction for the students.

Interview Process

Interview Example

Screenshot from Recording



Excerpt from Transcript

S: I'm just going to leave one open. [Drawing 7/8]

T: You are leaving one open because…

S: Like if you did 7 to 8, it's 1. So you could also think about is as you know that 7/8 is almost a whole, so you would have one left in it. [Pause]

S: It would be closest to 2 instead of 1 because you're almost done with it.

T: And it's almost 2 because? Why?

S: Because these two are almost 1. This is 1 and this is 1.

Benefits of Interviews

"I thought this was incredibly helpful and allowed me to **understand** my students' thinking much better than I had before. I was surprised by the amount of **thinking/ knowledge my students shared and their excitement to do so**."

"The interviews really helped me refocus on **slowing down** and really **taking the time to listen** to students as they share their thinking!"

PD: Planning Targeted Instruction

Guiding Questions

1. Based on the findings, what mathematics content will you target?
   - More foundational topic
   - Same topic as the probe
   - Move on
2. What are the mathematical learning goals for students?
3. What activities and approaches will engage and support students' learning?
4. How will you gather evidence of progress towards the learning goals?

Targeted Instruction

"It's about using **students' thinking as stepping stones**."

"I am proud of what I created based on my particular student--really **tailoring my lesson to her strengths and learning needs**. It pushed me to critically analyze her work and get a whole picture of her."

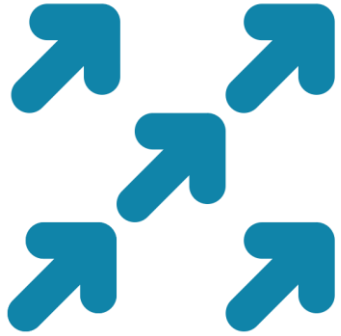
Future Directions

Build on Successes

- Strong focus on students as mathematics learners
- Probes and interviews
- Assignments and support for applying Ideas

Teachers' Suggestions for Future PD

- Integrating interviews into their classes
- Planning targeted lessons for intervention classes
- Supporting students in self-assessment and self-advocacy



THANK YOU!

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Resources

- National Survey Executive Summary
- Article: *Targeting Instruction with Formative Assessment Probes*
- Probes

Please add your questions to the Chat!

Acknowledgements: We greatly appreciate the participation and feedback of the teachers in the SMI PD Courses.
Graphics: Teachers' work examples from participants in the SMI PD course; Icons from thenounproject.com

EDC Education Development Center

Questions?

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Write your questions in the chat!

Thank you!

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