USING TEACHING SIMULATIONS TO ASSESS AND DEVELOP SKILL WITH INTERPRETING STUDENT THINKING

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ASSESSMENT MATTERS

Teaching that is grounded in, and guided by, ongoing formative assessment has a strong impact on learning (Black & Wiliam, 1998)

"Assessment is the act of gathering evidence about student knowledge or ability to use mathematics and make inferences from that evidence for a variety of purposes/audiences" (NCTM, 1995)

Interpreting student thinking is a teaching practice that is essential to assessing

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INTERPRETING STUDENT THINKING

Characterizing what a student thinks based on evidence from the student's words, actions, or writing involves:

- Making qualified claims about valued outcomes that can be used as the basis for future action
- Using evidence to generate and test claims
- Matching the scope and nature of the claim to the amount and type of information available
- Actively working to prevent bias or distortion
- Developing or using appropriate criteria to focus or inform judgments

(Developed drawing on Stiggins, 2001)

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WHY FOCUS ON INTERPRETING STUDENT THINKING?

Attention to **interpreting student thinking** in professional development is crucial, because:

- errors in focus, scope and/or evidence are consequential for students' learning and life opportunities
- it is a rich territory in which to notice, and work to address/counteract, the impacts of bias
- like many practices, it routinely happens within isolated classrooms using routines/habits that could benefit from professional interaction with colleagues

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SESSION OVERVIEW

- Unpack interpretation in the context of classroom assessment
- Examine an activity structure in which teachers can develop their skills with making evidence-based interpretations
- Discuss affordances and constraints of the activity structure

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UNPACKING INTERPRETATION IN CLASSROOM ASSESSMENT

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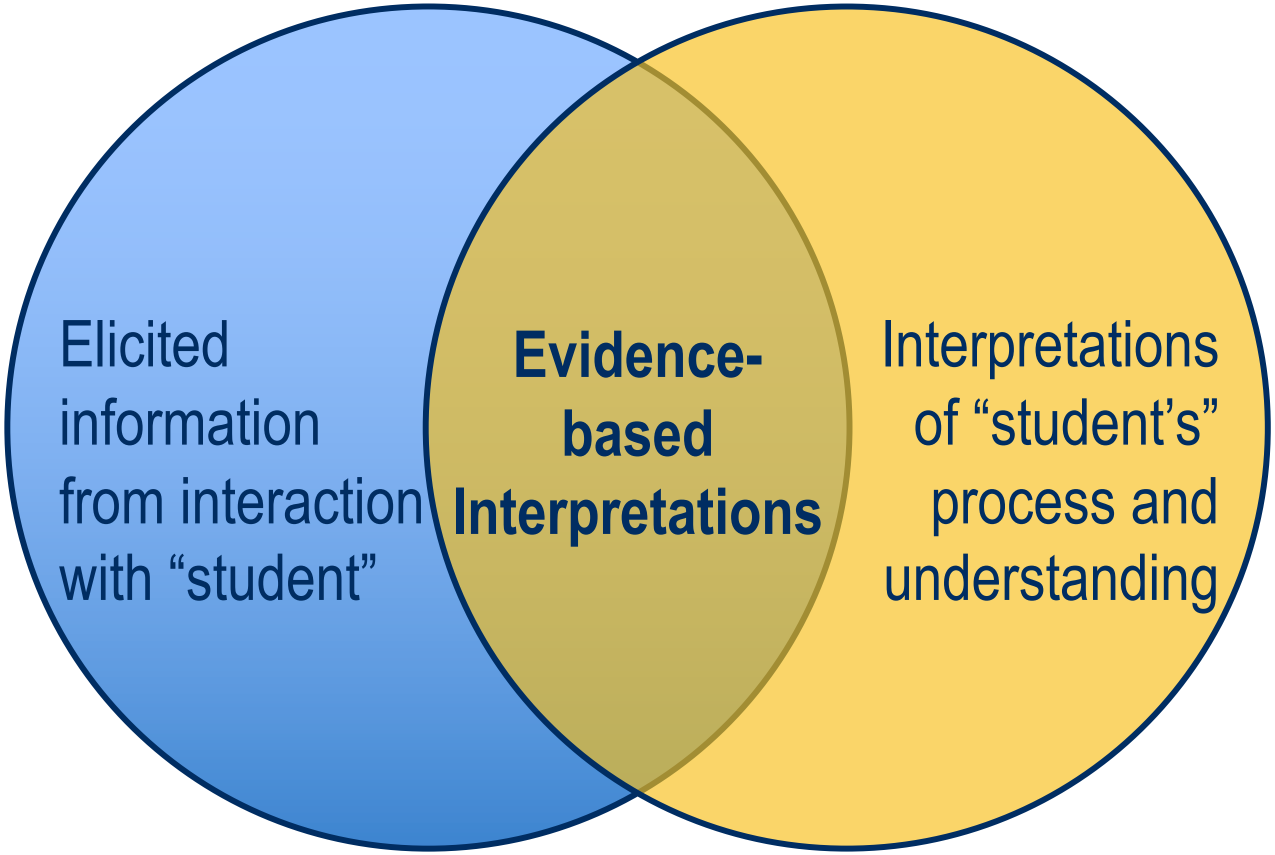
EVIDENCE-BASED INTERPRETATIONS



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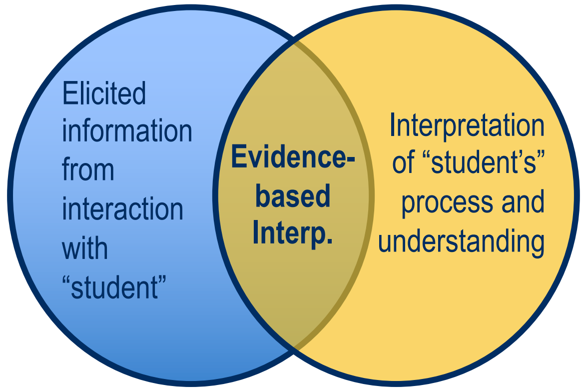
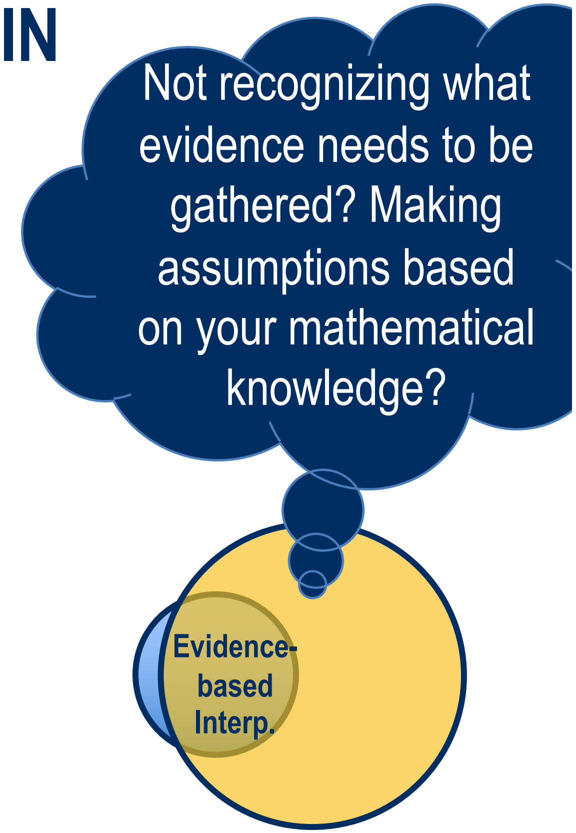
DIFFERENT WAYS THAT EVIDENCE-BASED INTERPRETATIONS MIGHT ARISE IN PRACTICE





Small percentage of interpretations are evidence-based

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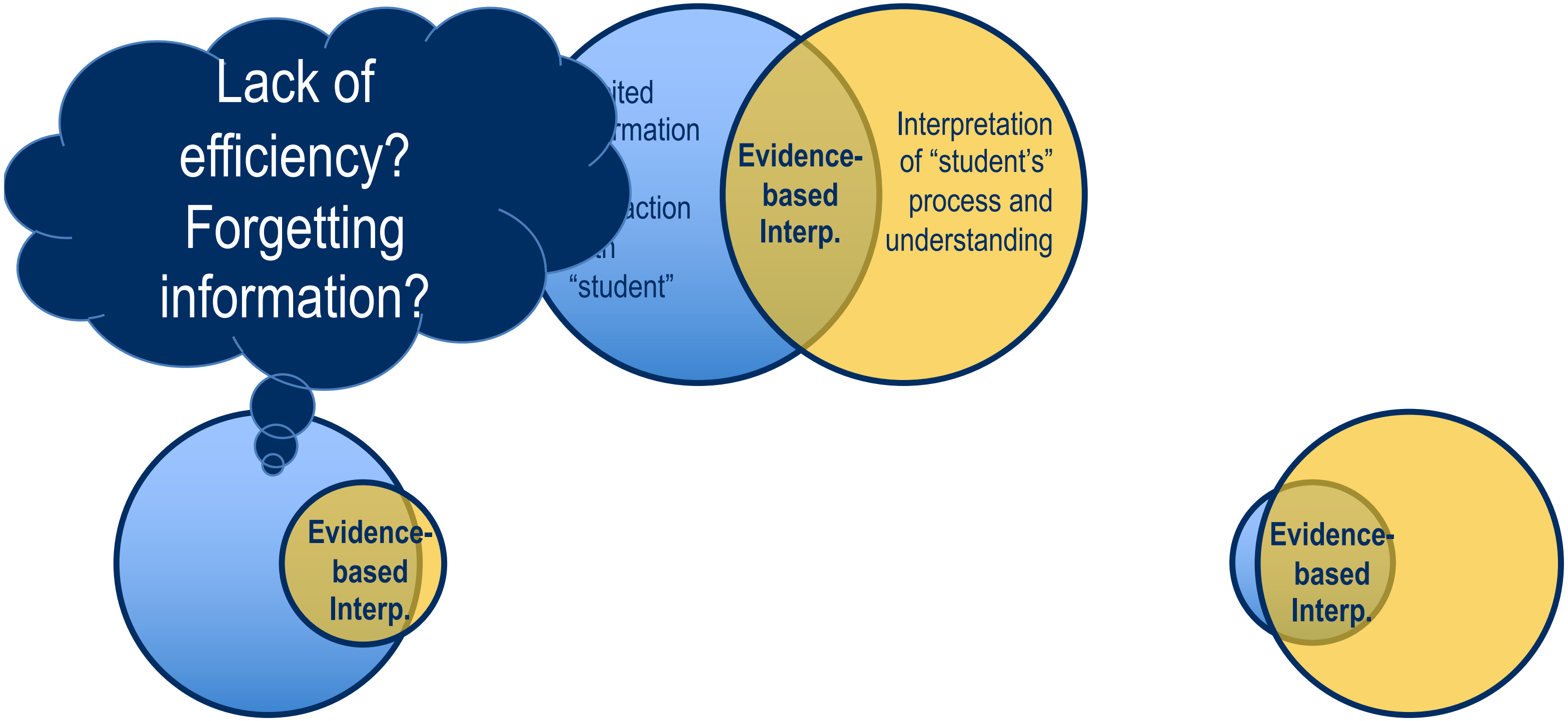

Small percentage of data that is gathered is used for interpreting

Small percentage of interpretations are evidence-based

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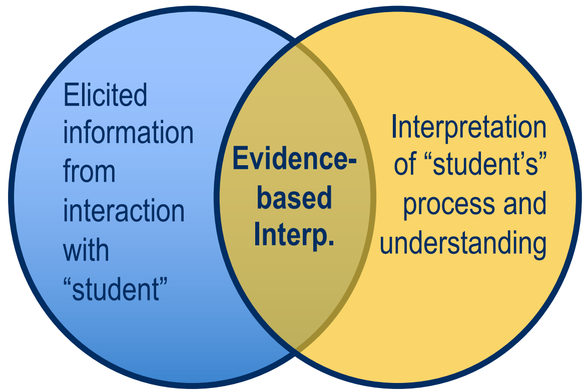
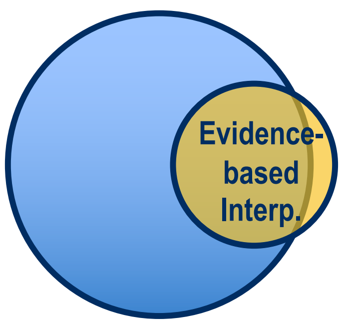
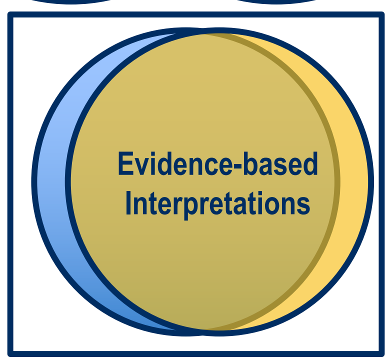
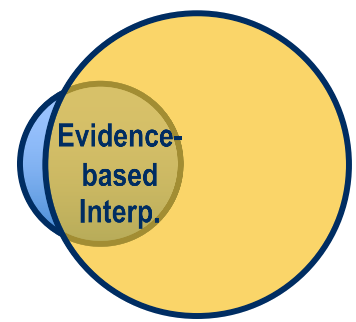




Small percentage of data that is gathered is used for interpreting



Interpretations are almost exclusively evidence-based AND most of the data gathered is used in interpretations



Small percentage of interpretations are evidence-based

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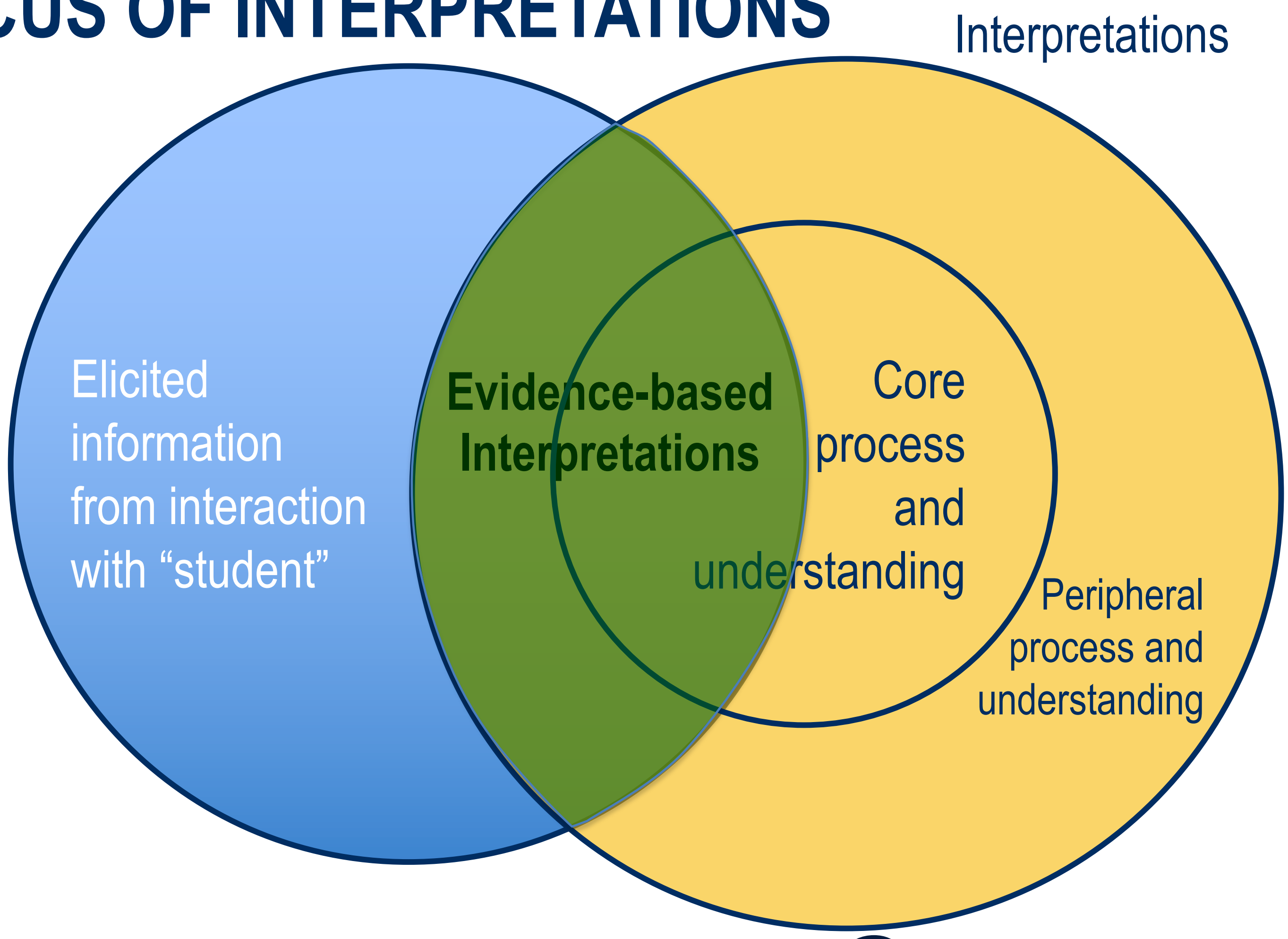
FOCUS OF INTERPRETATIONS



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WHAT DO WE KNOW ABOUT TEACHERS' SKILLS IN MAKING EVIDENCE-BASED INTERPRETATIONS?

Our prior work with preservice teachers suggests that:

- Preservice teachers typically have skills in:
  - Asking about and remembering the student's process
  - Applying the process to a similar case
- Preservice teachers may experience more challenges in interpreting a "student's" understanding, such as
  - Identifying core components of understanding in need of attention
  - Using evidence to support claims about understanding
  - Remembering information that could be used as evidence for claims about core components of understanding

(Shaughnessy, Boerst, & DeFino, 2018)

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ENHANCING EVIDENCE-BASED INTERPRETATIONS

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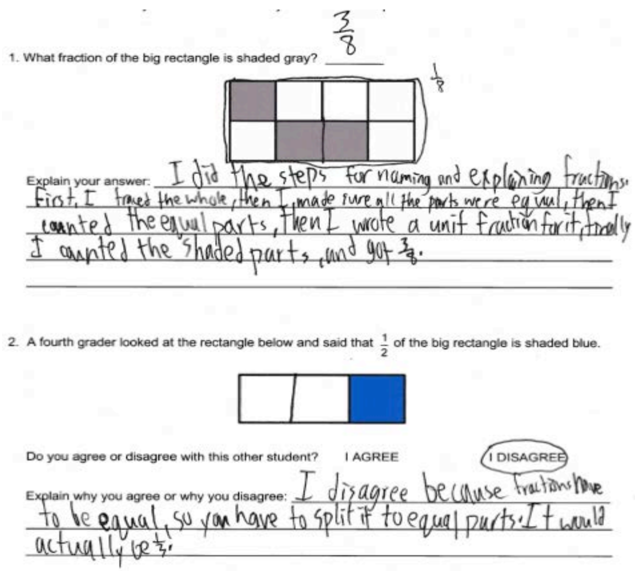
ONE PROFESSIONAL DEVELOPMENT ACTIVITY: ANALYZING STUDENT WORK



1. What fraction of the big rectangle is shaded gray? $\frac{3}{8}$

Explain your answer: I did the steps for naming and explaining fractions. First, I traced the whole, then I made sure all the parts were equal, then I counted the equal parts, Then I wrote a unit fraction for it, finally I counted the shaded parts, and got $\frac{3}{8}$.

2. A fourth grader looked at the rectangle below and said that $\frac{1}{2}$ of the big rectangle is shaded blue.

Do you agree or disagree with this other student? I AGREE I DISAGREE

Explain why you agree or why you disagree: I disagree because fractions have to be equal, so you have to split it to equal parts. It would actually be $\frac{1}{3}$.

Teachers could consider:

- For the first problem, what process does this student appear to be using to name the shaded part of area as a fraction?
- Across the two problem, what does the student appear to understand about fractions and naming fractions?

There is also a need to help teachers get better at in the moment interpreting that occurs as students share their ideas in class

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DEVELOPING/ENHANCING PROFESSIONAL INTERPRETATIONS OF THE INTERACTIVE PARTS OF TEACHING

An activity structure for working with colleagues to enhance teachers' abilities to gather information through interaction that would support later interpretation would need:

- the potential for mathematically focused talk and action that could serve as evidence for interpretations about a student's process and understanding
- the need to generate and pose questions to gather evidence of student thinking through interaction
- the occasion to making evidence-based interpretations based on the information gathered
- the opportunity to work iteratively with colleagues in a shared context geared to professional learning (and at times or in some ways not hindered by the realities of classrooms or other professional development contexts)

These features led us to consider the use of simulations for professional learning.

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A COMPLEMENTARY APPROACH: USING SIMULATIONS TO SUPPORT LEARNING

Simulations:

- are "approximations of practice" (Grossman et al., 2009)
- are commonly used in many professional fields
- place authentic, practice-based demands on a participant
- purposefully suspend some elements of the practice-based situation
- ensures that particular situations arise
- can provide teachers with insights that are not possible or practical to generate in real-life professional contexts

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OUR PAST WORK USING SIMULATIONS

- Designed and used simulations with preservice teachers to assess their developing skills with eliciting and interpreting student thinking
  - The preservice teacher interacts with a teacher educator who is taking on the role of student
  - The preservice teacher has 5 minutes to talk with a student about their work on a mathematics problem with a goal of learning about their process for solving the problem and their understanding of the mathematical ideas behind the process
  - After talking with the student, the preservice teachers is interviewed to learn about their interpretations of the student thinking
- Developed "student thinking" profiles as well as structures for preparing, engaging, and evaluating performances within the simulation
- Created training materials to support teacher educators in enacting the simulations including assuming the role of the student as defined by the profile

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EXAMINING SIMULATION AS A MEANS FOR WORKING ON INTERPRETING

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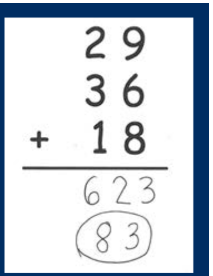
THE “STUDENT” IN THE SIMULATION

Following a set of response guidelines, a professional developer takes on the role of a student. These guidelines include:



- what the student is thinking, such as
  - uses an alternative algorithm (column addition), except the student is working from left to right
  - applies the method correctly and has conceptual understanding of the procedure
- general orientations towards responses such as
  - talk about digits in columns in terms of the place value of the column (e.g., 23 ones)
  - give the least amount of information that is still responsive to the question
- responses to anticipated questions

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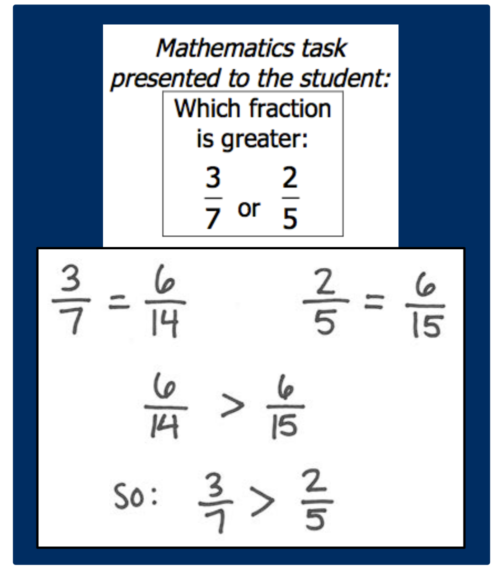
STRUCTURE OF THE SIMULATION

1. Teachers analyze one piece of student work guided by the goals of
   - Describing a student's process
   - Characterizing a student's mathematical understanding
   - Anticipating how a student would solve another problem and understand the ideas behind it
2. The simulation occurs:
   - One teacher interacts with the professional developer who takes on the role of the student
   - Other teachers note the evidence of student thinking and how the teacher elicited that information
3. Teachers (a) make evidence-based interpretations and (b) discuss the eliciting moves and their implications for making claims



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ENGAGING IN PART 1

Mathematics task presented to the student:

Which fraction is greater:

$\frac{3}{7}$ or $\frac{2}{5}$

The student's work:

$\frac{3}{7} = \frac{6}{14}$ $\frac{2}{5} = \frac{6}{15}$

$\frac{6}{14} > \frac{6}{15}$

So: $\frac{3}{7} > \frac{2}{5}$

- What are the key mathematical ideas you suspect may be involved?
- What would the student need to say or do for you to make particular claims about their understandings?
- What are some moves you could make as a teacher to elicit this information?

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CORE MATHEMATICAL IDEAS BEHIND THE COMMON NUMERATOR METHOD

Process

1. The selection of a common numerator
2. The generation of equivalent fractions
3. The comparison of the two fractions once they have a common numerator
4. The final conclusion, relating back to the original fractions

Understanding

- Why the process for generating equivalent fractions works
- Why comparing with a common numerator works
  - Specific case
  - General case

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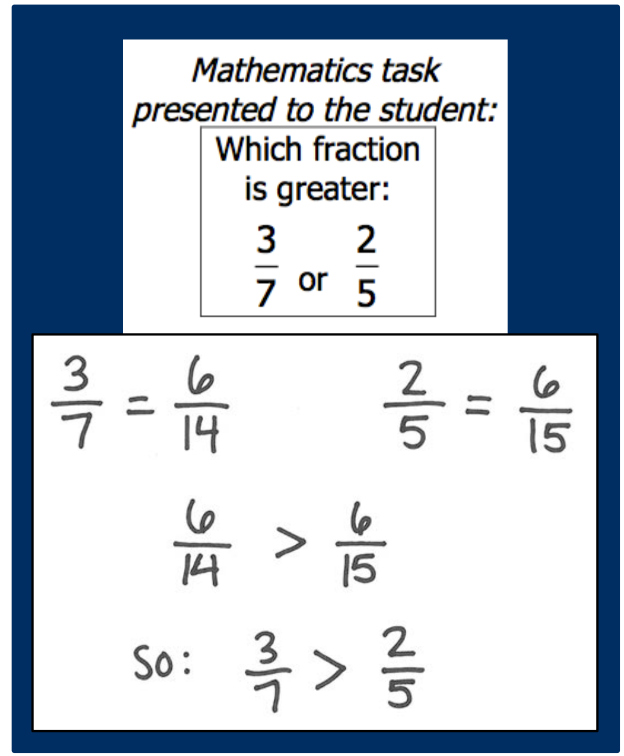
ENGAGING IN PART 2

As you observe, note the following:

- the information that the student shares about their process or their understanding of the process
- the moves or techniques that the teacher uses to elicit that information from the student



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ENGAGING IN PART 3: WHAT CLAIMS CAN BE SUPPORTED

- What evidence do you have to support interpretations about core ideas in the student's process and their understanding?
- What evidence-based claims can we make about the student's process and understanding?
- What eliciting moves allowed us to make each of these claims?

CORE IDEAS OF THE METHOD

- Process
  - The selection of a common numerator
  - The generation of equivalent fractions
  - The comparison of the two fractions once they have a common numerator
- Understanding
  - Why the process for generating equivalent fractions works
  - Why comparing with a common numerator works (specific case & general case)

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ENGAGING IN PART 3: WHAT CLAIMS CANNOT BE SUPPORTED

- What claims cannot be supported by evidence from the interaction?
- What evidence are we missing?
- Is there anything else you would ask to better understand or confirm the student's thinking?

CORE IDEAS OF THE METHOD

- Process
  - The selection of a common numerator
  - The generation of equivalent fractions
  - The comparison of the two fractions once they have a common numerator
- Understanding
  - Why the process for generating equivalent fractions works
  - Why comparing with a common numerator works (specific case & general case)

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DISCUSSION

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DISCUSSION QUESTIONS

- What affordances do you see for using this activity structure in professional development settings?
- What limitations of the structure might exist and how might we manage those limitations?
- What questions do you have about the use of simulations?

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