TOWARDS LEARNING TRAJECTORIES FOR CORE PRACTICES IN TEACHER PREPARATION: ELICITING STUDENT THINKING

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American Educational Research Association • Washington, DC • April 8, 2016

The research reported here was supported by the National Science Foundation, through a grant to the University of Michigan. The opinions, findings, and recommendations expressed are those of the authors and do not represent views of the National Science Foundation.

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TOWARDS LEARNING TRAJECTORIES IN TEACHER EDUCATION

- High-leverage teaching practices in teacher education ➔ Need to understand more what it means to support new teachers to learn to enact these practices
  (e.g., Ball & Forzani, 2009; Grossman et. al., 2009; McDonald et al., 2013)
- Learning trajectories at the K-12 level
  (Carpenter et al. 1989; Clements & Sarama, 2014)
- Potential role of learning trajectories for high-leverage practices to inform the design and improvement of teacher preparation

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ZOOMING IN ON ONE PRACTICE: ELICITING STUDENT THINKING

To find out what students know or understand, and how they are thinking/reasoning, a teacher must:

- Establish an environment in which a student is comfortable sharing his/her thinking
- Pose questions to get students to talk
- Listen to and hearing what students say
- Probe students' responses
- Develop ideas about what a student thinks
- Check one's interpretation

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USING SIMULATIONS TO INVESTIGATE TRAJECTORIES FOR PRACTICE

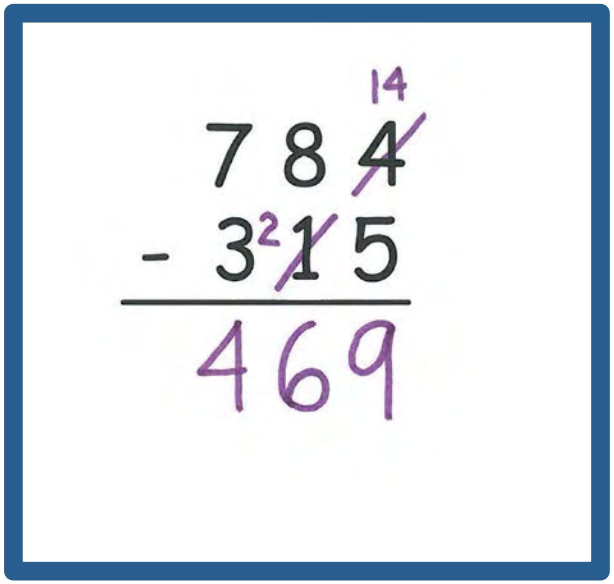
Simulations are approximations of practice that can be used for both assessing and supporting ongoing learning.

Simulations:

- Place authentic, practice-based demands on a participant
- Purposefully suspend or standardize some elements of the practice-based situation
- Are commonly used in many professional fields
- Can provide insights that are not possible or practical to determine in real-life professional contexts
- Allow for comparisons across time

EXPLORING THE TASK

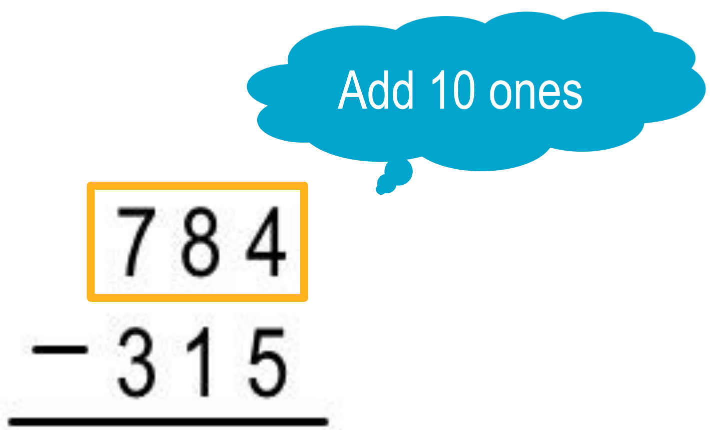
- Examine the fourth grade student's work
- Anticipate what the student was likely thinking
- Generate questions to ask the student to:
  - Elicit *what* the "student" did to produce the answer
  - Probe what the student *understands* about the process used and the mathematical ideas underlying that process.



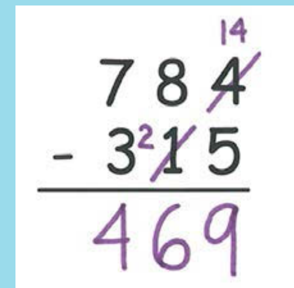
SETTING THE STAGE FOR ELICITING

The preservice teacher:

1. **Prepares for an interaction with a standardized student about one piece of student work**



Your goal is to elicit and probe to find out what the "student" did to produce the answer



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Correct answer, alternative algorithm, degree of understanding is unclear

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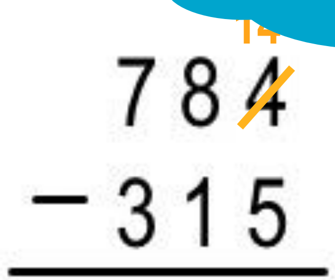
How can the difference between the two numbers be re-established?



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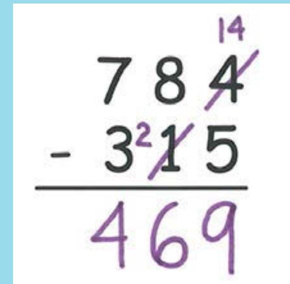

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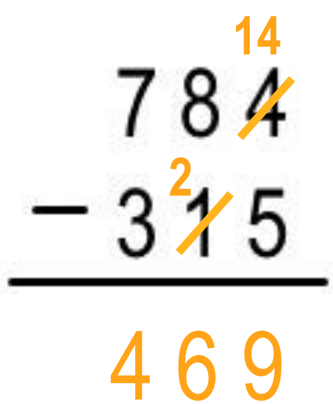

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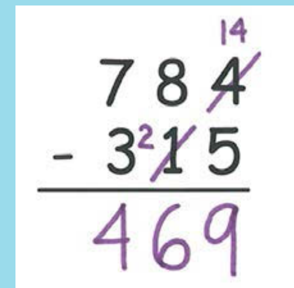

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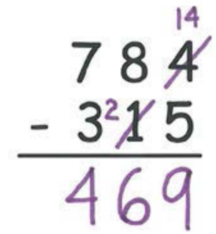
HOW IS EVIDENCE OF ELICITING SKILLS OBTAINED?



The preservice teacher:

1. Prepares for an interaction with a standardized student about one piece of student work
2. **Interacts with the student to probes the standardized student's thinking**

A Standardized Student

Developed response guidelines focused on:

- What the student is thinking such as
  - Uses a method not conventional in the U.S. (but that is standard in many European and South American countries)
  - 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., 14 ones)
  - Give the least amount of information that is still responsive to the question
- Responses to anticipated questions

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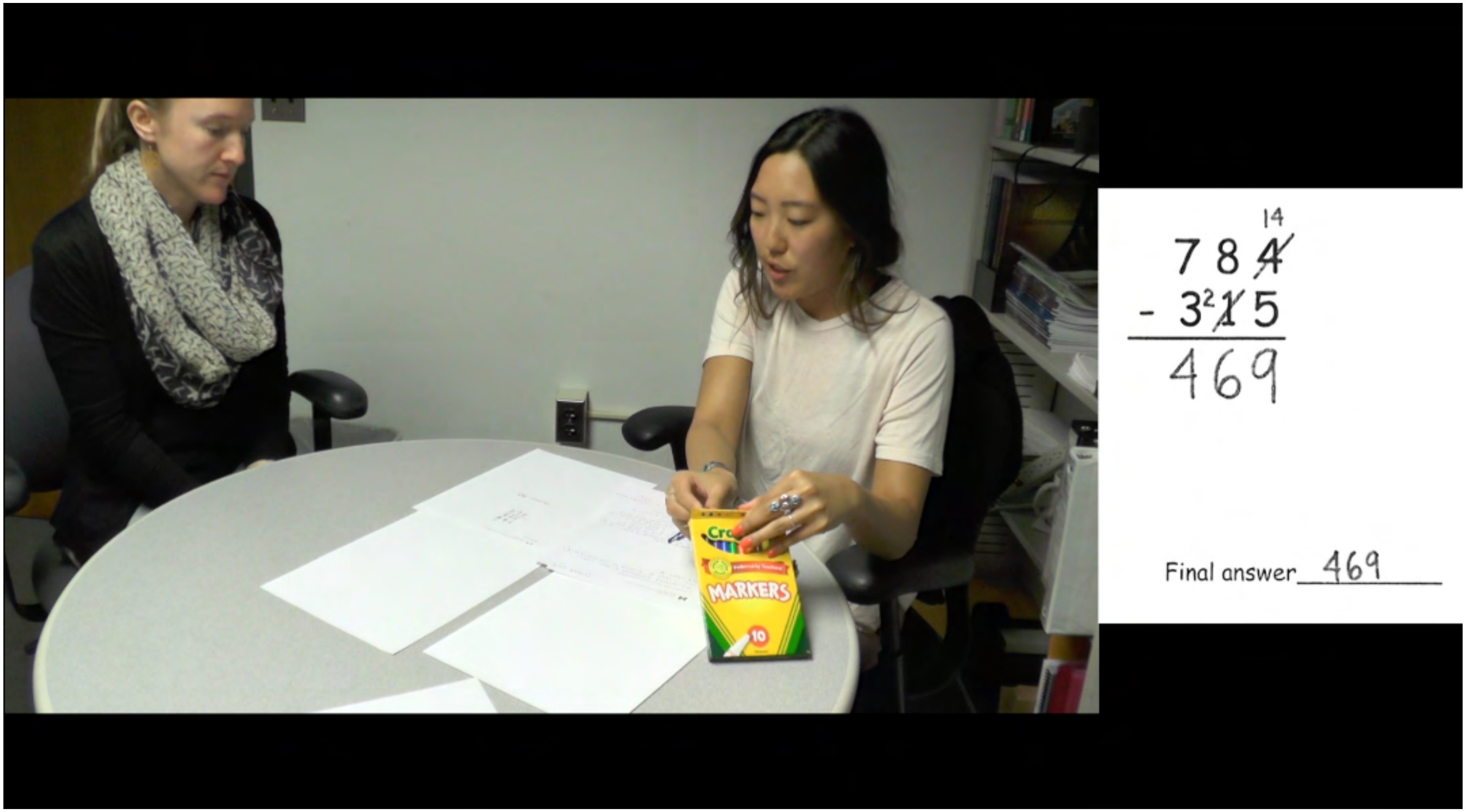
ELICITING A STUDENT'S THINKING



METHODS

Context

- Practice-based elementary teacher education program
- Simulation assessment
  - Year 1: Preservice teachers after one semester of the program (n = 23)
  - Year 2: Preservice teachers at the end of four semesters (n = 19)

Data sources

- Video records of eliciting

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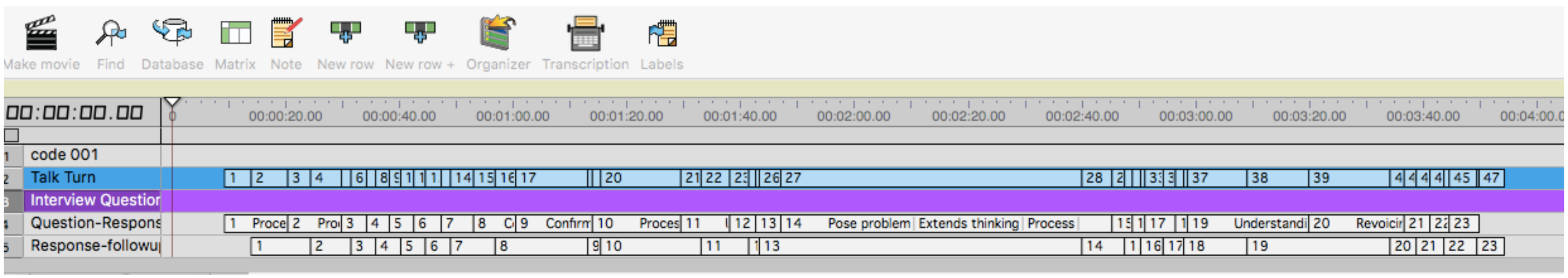
ANALYSIS OF ELICITING WITH STUDIOCODE

- Unit of analysis: question and response



- Coded the instances for a variety of features:
  - Type of move (e.g., process, understanding, clarifying, filling, posing a problem, revoicing)
  - Other features (e.g., extending thinking, pauses, clunky question, connecting to algorithm)
- Compared within and across groups to identify patterns

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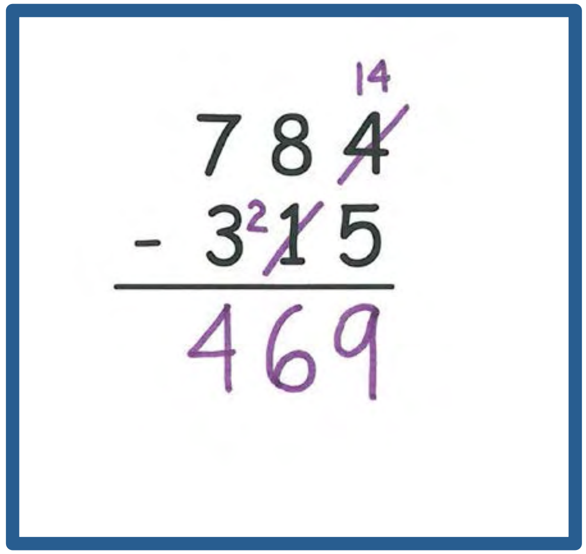
FINDINGS:
MATHEMATICAL FOCUS OF THE QUESTIONS

- The Y2 preservice teachers made fewer **connections to the standard algorithm** than Y1 (21% vs. 52%)
- **Persistent questioning** around the standard algorithm by Y1 preservice teachers
  - "Why did do something to the 1 here instead of doing something to the 8?"
  - "If you were to do something to the 8, would you know what to do?"
  - "If you were going to do something to the 8, what would you do?

Why did you change the 1 instead of the 8?



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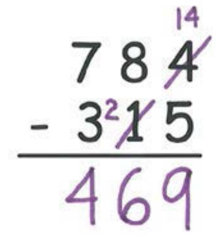
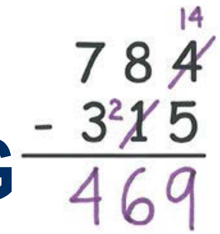
FINDINGS:
TIMING, EFFICIENCY, AND FLUENCY



On average, Year 1 preservice teachers spent more time eliciting - 208 seconds (Year 1) v. 157 seconds (Year 2)

- Fluency
  - More Y1 preservice teachers had **noticeable pauses**: 35% v. 11%
  - More Y1 preservice teachers had questions which were coded as **"clunky"**: 48% v. 32%
- Inefficient use of time
  - Posing several possibly less strategic problems (e.g., two subtraction and one addition problem)
  - Posing ill-defined tasks (e.g., negative answer, three numbers)
  - Drawing base ten blocks without engaging the student with them

FINDINGS:
RESPONSIVENESS TO STUDENT THINKING



- Both groups used revoicing and clarifying moves
- Y2 preservice teachers used clarifying moves more often and strategically

Student:	Then I crossed out the one and wrote a two.
Preservice teacher:	Why did you do that?
Student:	I added 10 ones to 784 so I need to add ten to the other number.
Preservice teacher:	What other number?
Student:	The 315.
Preservice teacher:	Okay, and why did you have to add a ten to the other number?
Student:	Because if you make one number bigger, you have to do the same thing to the other number to keep the problem the same.
Preservice teacher:	And what do you mean by the same?
Student:	Like you have to keep the difference between the numbers the same.

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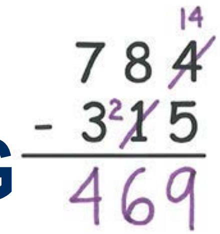

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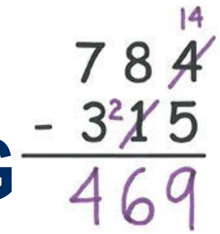

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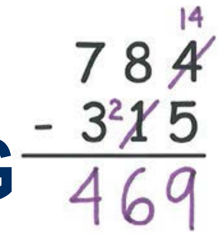

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CONCLUSION AND DISCUSSION

- Differences between groups
  - Mathematical focus – standard algorithm
  - Timing and fluency
  - Responsiveness to student thinking
- Simulation allowed for comparisons between groups
- Affordances of using an alternative algorithm to learn about preservice teachers' eliciting

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EMERGING QUESTIONS

- What is the role of instruction in these trajectories? Are some aspects developmental?
- How can simulations help us investigate trajectories?
- What is the role of mathematical knowledge for teaching in learning trajectories for eliciting student thinking? Would it look different around a different scenario with a more familiar algorithm?

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