EXAMINING THE DEVELOPMENT OF CAPABILITIES WITH ELICITING AND INTERPRETING STUDENT THINKING OVER TIME

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SITUATING OUR STUDY

- Recent shifts towards **practice-based teacher education** have resulted in new pedagogies and new assessments focused on preservice teachers' skills in practice, such as:
  - Pedagogies of enactment (Grossman, Hammerness, & McDonald, 2009)
  - Rehearsals (e.g., Lampert et al., 2013)
- Our question: **What does it look like to develop skill with specific teaching practices over time?**

OUR FOCUS: THE PRACTICES OF ELICITING AND INTERPRETING

- **Eliciting:** posing questions or tasks that provoke or allow students to share their thinking about specific academic content (TeachingWorks, 2011)
- **Interpreting:** Characterizing what a student thinks based on evidence from the student's words, actions, or writing (Developed drawing on Stiggins, 2001)

In actual teaching, eliciting and interpreting student thinking are interwoven and often happen simultaneously. (Shaughnessy & Boerst, 2017)

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WHY FOCUS ON ELICITING AND INTERPRETING STUDENT THINKING?

The teaching practices of **eliciting and interpreting student thinking** are crucial, because:

- Teachers need to ascertain what students know and understand to design instruction that responds to and builds on students' strengths
- Teachers' questions and conclusions about students' thinking can expand or constrain learning opportunities
  - Deficit orientations can lead teachers to discount student ideas or pursue less ambitious learning goals
  - Curiosity and openness to student thinking can affirm students' sense-making and advance their mathematical reasoning

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LEARNING ABOUT TEACHERS' SKILL WITH ELICITING AND INTERPRETING

Simulations are **approximations of practice** that can be used for assessing professional learning.

Simulations:

- are commonly used in many professional fields
- place authentic, practice-based demands on a participant
- purposefully suspend or standardize some elements of the practice-based situation
- can provide insights that are not possible or practical to determine in real-life professional contexts

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SIMULATION STRUCTURE

- Each simulation:
- is designed around a specific piece of student work
- involves a teacher educator taking on the role of a student
- includes a detailed student profile to support standardization of the student
- consists of **three parts**

Part 1: Teacher Prepares → **Part 2:** Simulated Interaction → **Part 3:** Interview

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PART 1: PREPARATION

The teacher:

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

29
36
\+ 18
623
(83)

Final answer 83

Your goal is to elicit and probe to find out what the “student” did to produce the answer as well as the way in which the student understands the steps that were performed

29
36
\+ 18
623
(83)

Final answer 83

Correct answer, alternative algorithm, degree of understanding is unclear

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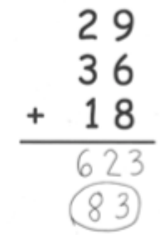
PART 2: ENGAGE IN SIMULATION



The teacher:

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

A Standardized Student

Developed response guidelines focused on:

- 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

PART 3: TEACHER IS INTERVIEWED

The teacher:

1. Prepares for an interaction with a standardized student about one piece of student work
2. Interacts with the student to probe the standardized student's thinking
3. **Responds to questions about their interpretation of the student's thinking**

Interviewing about interpretations

Teachers are asked to

- Describe the student's process
- Indicate what the student does and does not understand about the process

Teachers are asked to apply what they learned to

- Anticipate how the student would solve a similar problem
- Provide interpretations of understandings that are at the core of the process
- Generalize about the mathematical validity of the student's process

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METHODS

- **Participants**: 4 teachers, all White women, all graduates of the same 2-year undergraduate teacher education program
- **Data sources:** Each teacher completed 4 simulations at three points in time, which were video-recorded
  - *Baseline:* Entry into the teacher education program
  - *Midpoint:* At the end of Year 1 of the teacher education program
  - *Practicing Teacher:* After 2-3 years of teaching (2 simulations)
- **Analysis:**
  - Wrote qualitative memos, developed and refined a coding scheme
  - Used Studiocode © software to parse videos into Q-A clips and apply codes. All videos were double-coded, discussed to reach consensus
  - Examined trends in codes, triangulated with memos and across cases

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CONSIDERING A SAMPLE CASE

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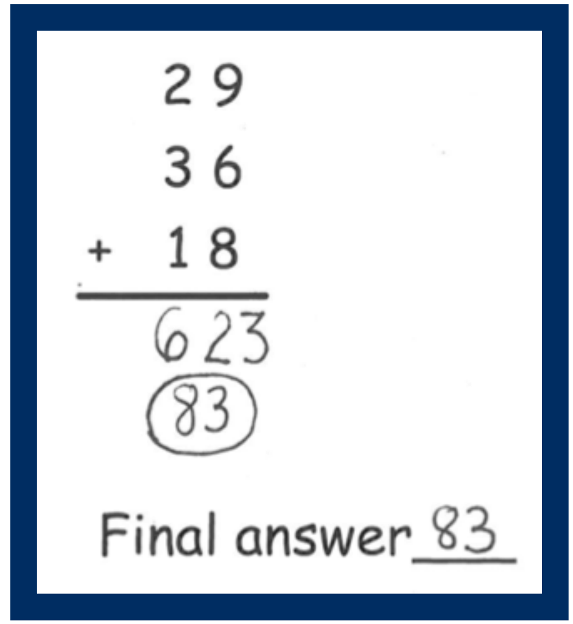
CONTEXT FOR VIDEO 1

- Baseline assessment (Fall 2012)
  - Administered the first week of the TE program
- Student's mathematical strategy: Column addition, adds ones then tens, combines tens
- Excerpt of the simulation (opportunity to see eliciting); Does not include interview

Student work



FRAMING QUESTIONS – VIDEO 1

- What do you notice about the teacher's use of **eliciting moves**?
  - Ex: posing open-ended questions, clarifying student language, having the student write or draw
- What does the teacher seem to think "**doing math**" entails?
- What awareness, if any, does the teacher indicate about patterns in student thinking or the broader mathematical landscape?
- What **orientation** does the teacher seem to have towards the student's thinking?

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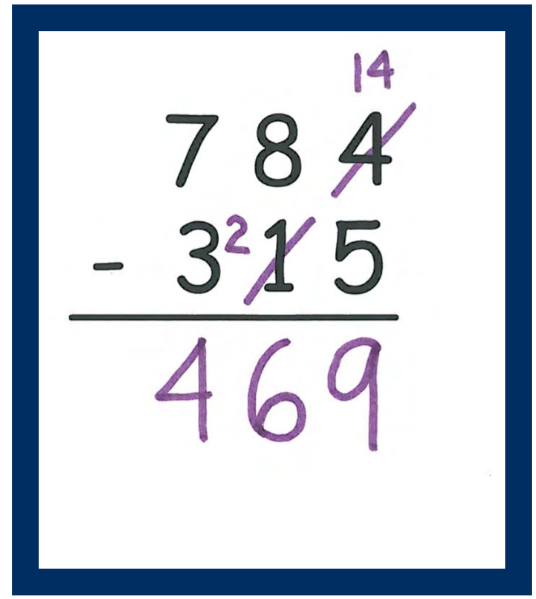
CONTEXT FOR VIDEO 2

- Same teacher, 4.5 years later
  - 3 years of experience teaching math
  - Teaching Kindergarten
- Practicing Teacher assessment – European Subtraction (January 2017)
- Student's mathematical strategy: Alternative subtraction algorithm using constant difference
- Excerpt of the simulation (opportunity to see eliciting); Does not include interview

Student work



FRAMING QUESTIONS – VIDEO 2

- What do you notice about the teacher's use of **eliciting moves**?
  - Ex: posing open-ended questions, clarifying student language, having the student write or draw
- What does the teacher seem to think "**doing math**" entails?
- What awareness, if any, does the teacher indicate about patterns in student thinking or the broader mathematical landscape?
- What **orientation** does the teacher seem to have towards the student's thinking?

What similarities or differences do you notice from video 1?

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FINDINGS FROM FOUR CASES

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METHODS OF ANALYSIS

- First pass:
  - Watched videos in chronological order by case
  - Wrote qualitative memos
- Developed and refined a coding scheme
- Second pass:
  - Used Studiocode © software to parse videos into Q-A clips and apply codes
  - Double-coded videos and discussed disagreements to reach consensus
- Examined trends in codes, triangulated with memos and across cases

HOW DID ELICITING AND INTERPRETING CAPABILITIES CHANGE OVER TIME?

1. From the baseline to the practicing teacher assessments, teachers demonstrated increased fluency with eliciting student thinking.

- Increase in number of distinct eliciting moves used
- Decrease in frequency of “clunky questions” *(questions that were unclear or repeatedly rephrased)*
- Decrease in frequency of “fills” *(when a teacher assumes or “fills in” steps or understandings without having elicited the information from the student)*

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HOW DID ELICITING AND INTERPRETING CAPABILITIES CHANGE OVER TIME?

2. From the baseline to the practicing teacher assessments, teachers indicated greater awareness of patterns in student thinking and the broader mathematical landscape.

- Increase in frequency of "patterns in student thinking" and "math landscape" codes (0s at baseline)
- Example: "You couldn't subtract 5 from 4 *and end up with a positive number*"

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HOW DID ELICITING AND INTERPRETING CAPABILITIES CHANGE OVER TIME?

3. There was some change, but also some persistence in teachers' orientations towards student thinking and conceptions of math.

- Sample case (from videos): Shift from trying to direct student to standard algorithm to being genuinely curious about student thinking, open to unfamiliar methods
- Another case: Teacher consistently conveyed that there is one right way to solve a given math problem

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IMPLICATIONS & NEXT STEPS

- Simulations are useful for assessing the development of specific teaching practices
- Some reasonable expectations for developing skill with eliciting and interpreting student thinking:
  - Increased fluency with eliciting moves
  - Interpretations informed by greater awareness of patterns in student thinking & math landscape
- How might we design TE courses and experiences to more reliably shift teachers' orientations toward student thinking and conceptions of math as a discipline?