CONNECTING TEACHER CANDIDATES' MKT AND THEIR ELICITING OF STUDENT THINKING

Timothy Boerst, Meghan Shaughnessy, &
Emily Theriault-Kimmey

NCTM Research Conference • San Antonio, TX • April 4, 2017

Acknowledging our colleagues: Susanna Owens Farmer, Sarah Kate Selling, Merrie Blunk, Rosalie DeFino, Xueying Prawat, and Deborah Loewenberg Ball

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.

SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

@Practice
Assessing Teaching Practice

TAKING STOCK, AND TAKING RESPONSIBILITY

@Practice Assessing Teaching Practice

EDUCATION

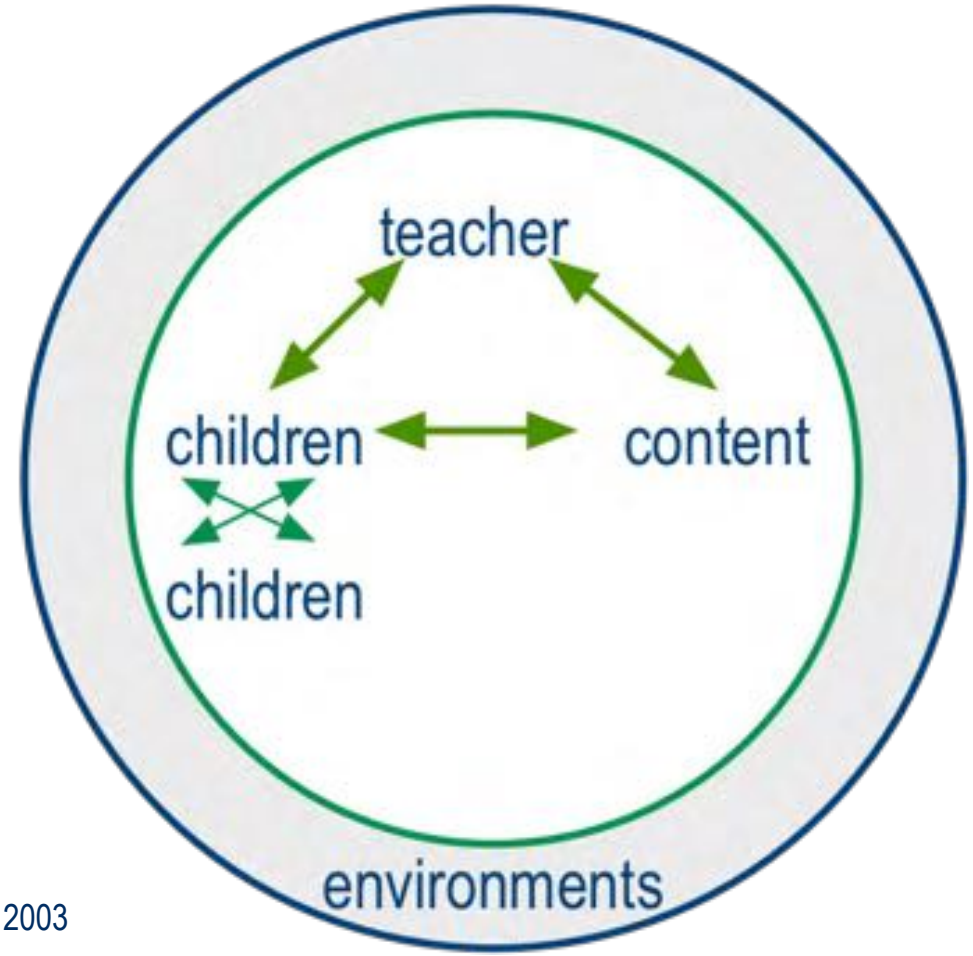
TAKING STOCK, AND TAKING RESPONSIBILITY

Skillful teaching <u>can</u> be taught and learned.

@Practice Assessing Teaching Practice

EDUCATION

TEACHING AS INTERACTION



Cohen, Raudenbush, & Ball, 2003

ELICITING STUDENT THINKING

A core teaching practice: to find out what students know or understand, and how they are thinking/reasoning

- Establishing an environment in which a student is comfortable sharing his/her thinking
- Posing questions to get students to talk
- Listening to and hearing what students say
- Probing students' responses
- Developing an idea of what a student thinks
- Checking one's interpretation

MATHEMATICAL KNOWLEDGE FOR TEACHING

Mathematical knowledge as it is used in the work of teaching, for example:

- Choosing examples
- Developing follow-up problems
- Explaining ideas to students and supporting explanations
- Using representations and materials to show the meaning of mathematical ideas
- **Posing questions**
- **Interpreting students' thinking and choosing what to say or do in response**

BETTER CONNECTING PRACTICE AND KNOWLEDGE

- Teachers' skill in being able to elicit and interpret student thinking is critical for supporting learning
- Mathematical Knowledge for Teaching is pivotal in enhancing mathematics that children learn
- The relationship between MKT and eliciting needs to be better understood
- Data from teacher education assessments could advance our understanding of this relationship

ASSESSING THE ELICITING OF TEACHER CANDIDATES

Many methods can and have been used to assess the eliciting skill of teacher candidates, including:

- Analyzing a classroom video and identifying the questions that were asked to elicit student thinking
- Analyzing a student work sample and planning a set of questions to ask a student
- Conducting an interview with a student and producing a report with reflection
- Leading a discussion of a small math task in a classroom which is video-recorded for later observation by an instructor (or observed live)

USING SIMULATIONS TO ASSESS ELICITING AND INTERPRETING

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

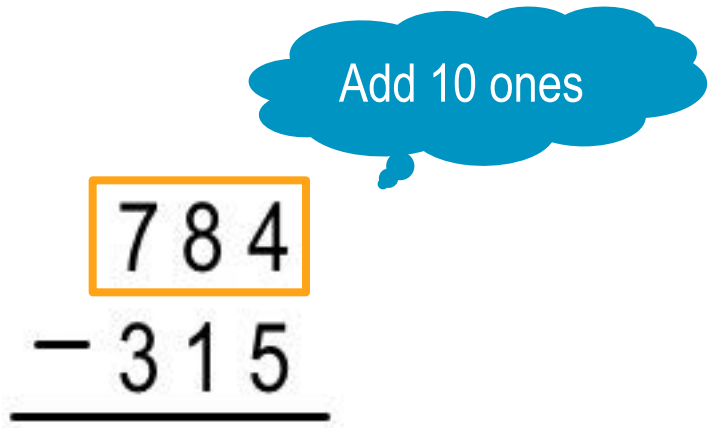
Simulations:

- 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

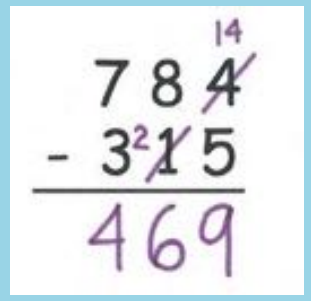
SETTING THE STAGE FOR ELICITING AND INTERPRETING

The teacher candidate:

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 as well as the way in which the student understands the steps that were performed.



Correct answer, alternative algorithm, degree of understanding is unclear

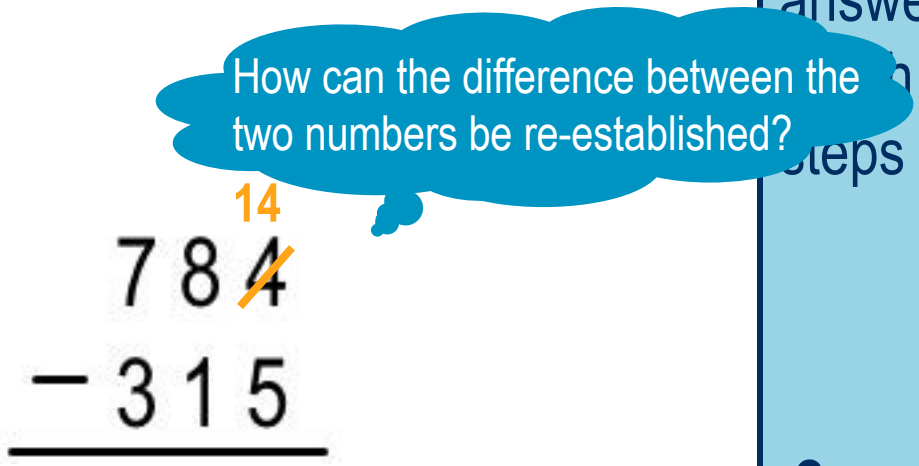
@Practice Assessing Teaching Practice

EDUCATION

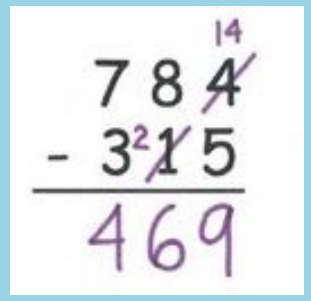
SETTING THE STAGE FOR ELICITING AND INTERPRETING

The teacher candidate:

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 as well as the way in which the student understands the steps that were performed.



Correct answer, alternative algorithm, degree of understanding is unclear

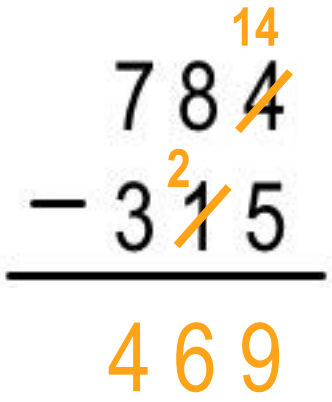
@Practice Assessing Teaching Practice

EDUCATION

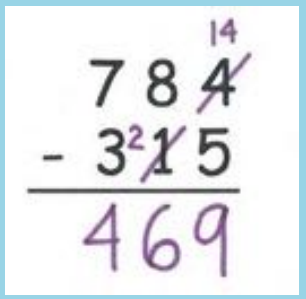
SETTING THE STAGE FOR ELICITING AND INTERPRETING

The teacher candidate:

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 as well as the way in which the student understands the steps that were performed.



Correct answer, alternative algorithm, degree of understanding is unclear

@Practice Assessing Teaching Practice

EDUCATION

HOW IS EVIDENCE OF ELICITING SKILLS AND MKT OBTAINED?

The teacher candidate:

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

@Practice Assessing Teaching Practice

EDUCATION

ELICITING STUDENT THINKING: VIEWING FOCUS

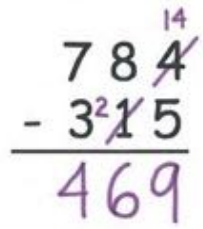
What opportunities exist to assess the teacher candidate's skill with eliciting and mathematical knowledge for teaching?

ELICITING A STUDENT'S THINKING

@Practice Assessing Teaching Practice

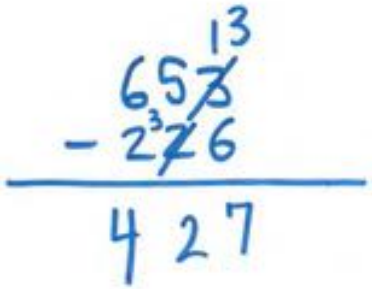
EDUCATION

ELICITING STUDENT THINKING: VIEWING FOCUS



What opportunities exist to assess the teacher candidate's skill with eliciting and mathematical knowledge for teaching?

- Probes mathematics that is crucial for understanding the method
  - Does the student understand why adding 10 ones to the minuend and 1 ten to the subtrahend results in the same difference?
- Poses an additional task that is useful for confirming the student's method



@Practice Assessing Teaching Practice

EDUCATION

HOW IS EVIDENCE OF INTERPRETATION?

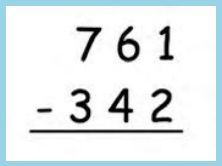
The teacher candidate:

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
3. **Responds to questions about her/his interpretation of the student's thinking, including predicting the student's response on a similar task**

Interviewing about interpretations

Teacher candidates are asked to

- Summarize the student's process
- Indicate what the student does and does not understand about the process
- Anticipate how the student would solve a similar problem

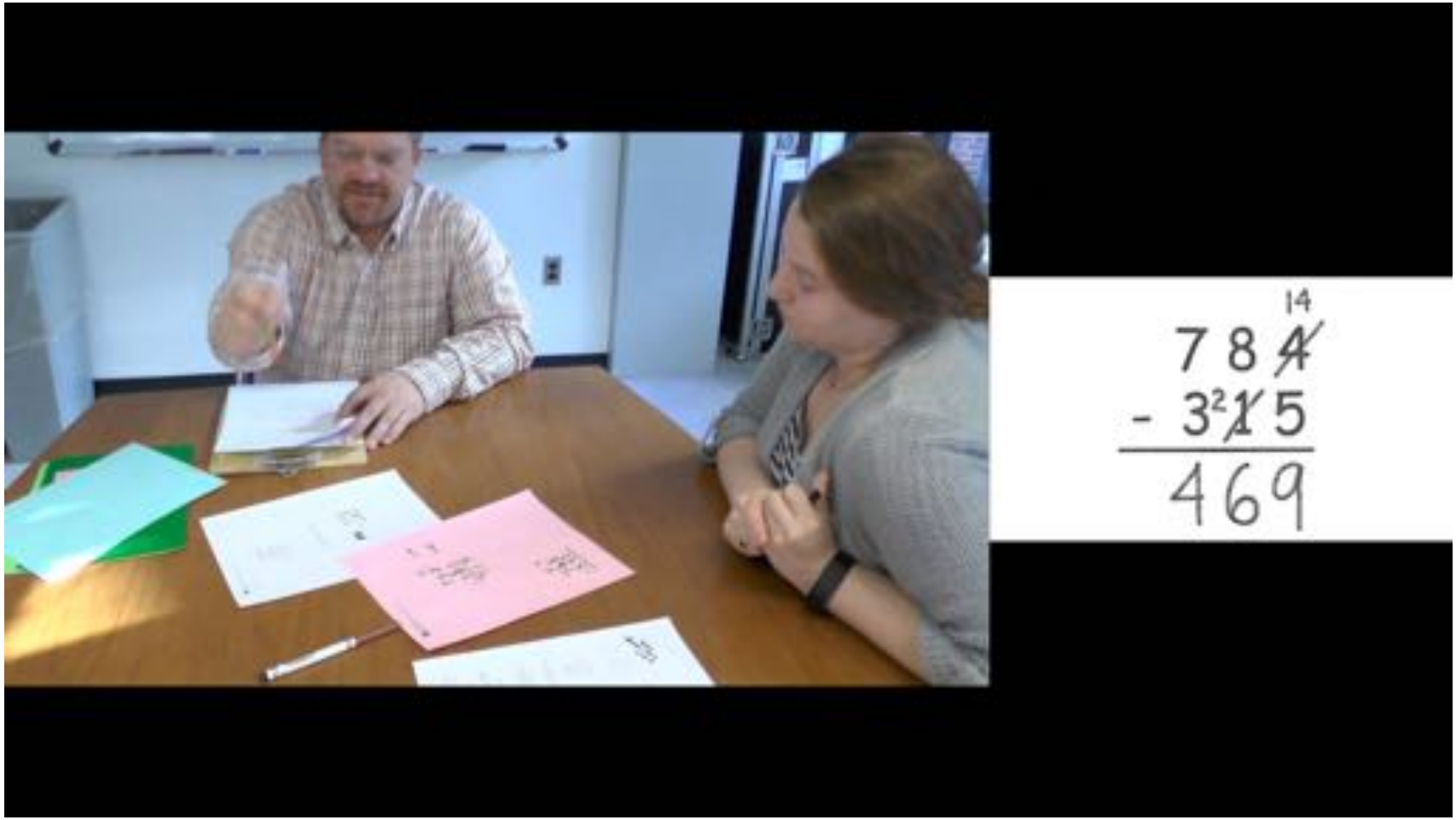


- Provide interpretations of understandings that are at the core of the process
- Generalize whether the method will always work and why or why not

@Practice Assessing Teaching Practice

EDUCATION

INTERPRETATION OF THE STUDENT'S METHOD: AN INSIGHT INTO MKT



@Practice Assessing Teaching Practice

EDUCATION

EXPLORING CONNECTIONS: ELICITING AND MKT

SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

@Practice
Assessing Teaching Practice

RESEARCH CONTEXT

Context:

- Simulation assessment
- Data collected from candidates at different points in the program (23 “midpoint” and 20 “end of program”)

Capturing evidence of teaching practice and MKT:

- Eliciting of mathematical process used by a “student” and the “student’s” understanding of the process
- Formulating mathematical generalizations about a “student’s” method



EXAMPLE 1:
ELICITING OF THE STUDENT'S THINKING

@Practice Assessing Teaching Practice

EDUCATION

CONNECTING ELICITING AND MKT

Focus question:

- Based on the information that was elicited, what do you think this teacher candidate will be able to generalize about the "student's" method?

EXAMPLE 1:
GENERALIZING ABOUT STUDENT'S METHOD

@Practice Assessing Teaching Practice

EDUCATION

EXAMPLE 2:
GENERALIZING ABOUT STUDENT'S METHOD

@Practice
Assessing Teaching Practice

EDUCATION

CONNECTING ELICITING AND MKT

Focus question:

- Based on the teacher candidate's generalization, what type/amount of information do you think she elicited from the "student?"

EXAMPLE 2:
ELICITING OF THE STUDENT'S THINKING

@Practice Assessing Teaching Practice

EDUCATION

EXAMPLE 3:
GENERALIZING ABOUT STUDENT'S METHOD

@Practice Assessing Teaching Practice

EDUCATION

CONNECTING ELICITING AND MKT

Focus question:

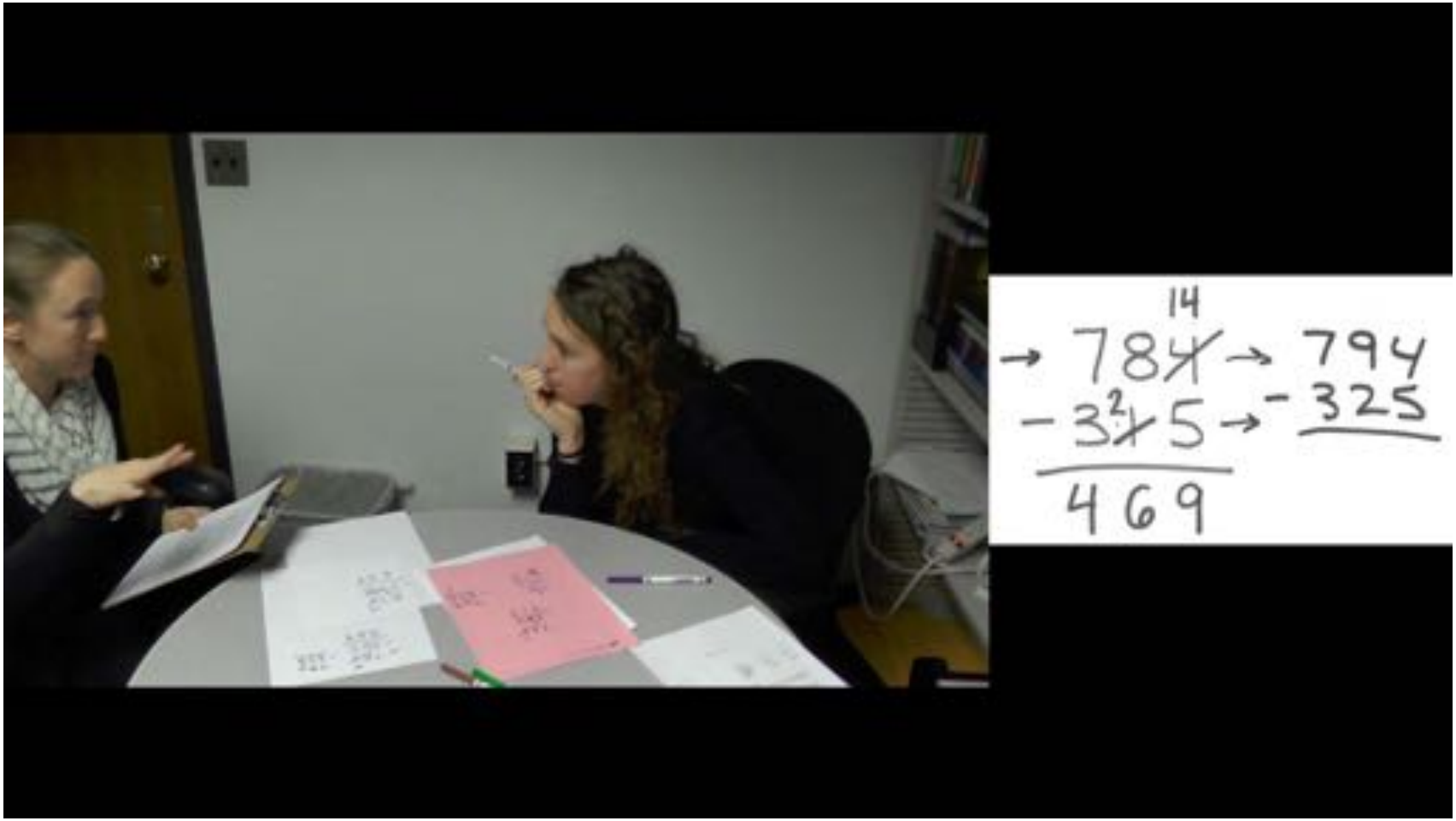
- Based on the teacher candidate's generalization, what type/amount of information do you think she elicited from the "student?"

EXAMPLE 3:
ELICITING OF THE STUDENT'S THINKING

@Practice Assessing Teaching Practice

EDUCATION

EXAMPLE 4:
GENERALIZING ABOUT STUDENT'S METHOD



@Practice Assessing Teaching Practice

EDUCATION

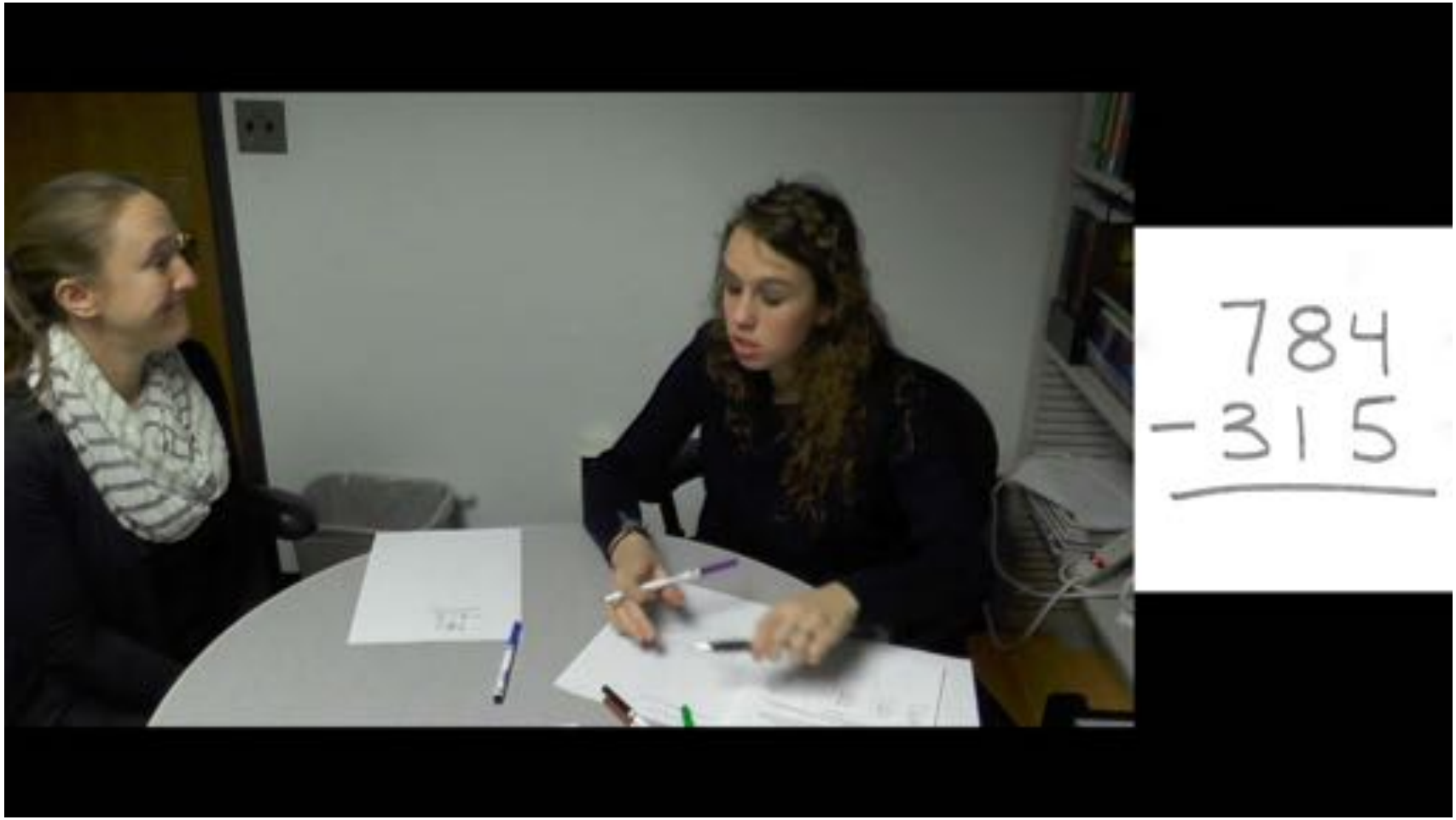
CONNECTING ELICITING AND MKT

Focus question:

- This teacher candidate had an “aha moment” as she considered the extent to which the student’s method would generalize.

  What type/amount of information do you think she elicited from the “student?”

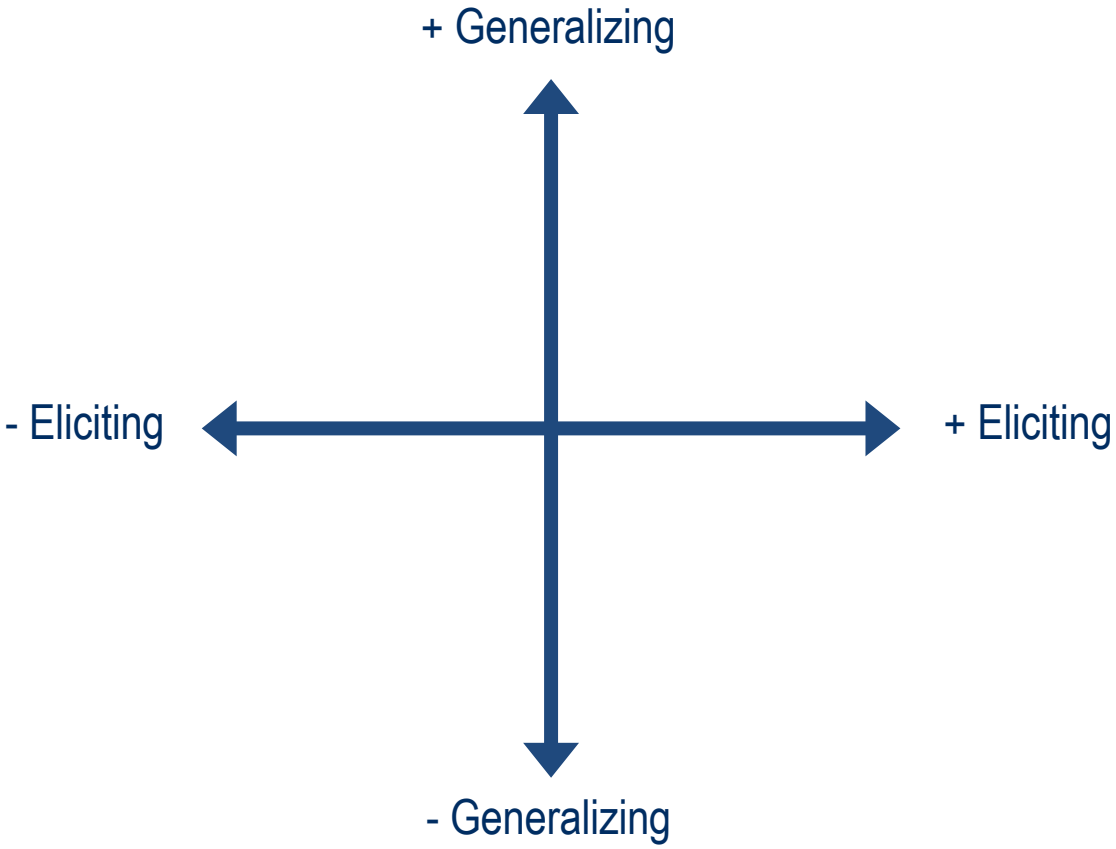
EXAMPLE 4:
ELICITING OF THE STUDENT'S THINKING



@Practice Assessing Teaching Practice

EDUCATION

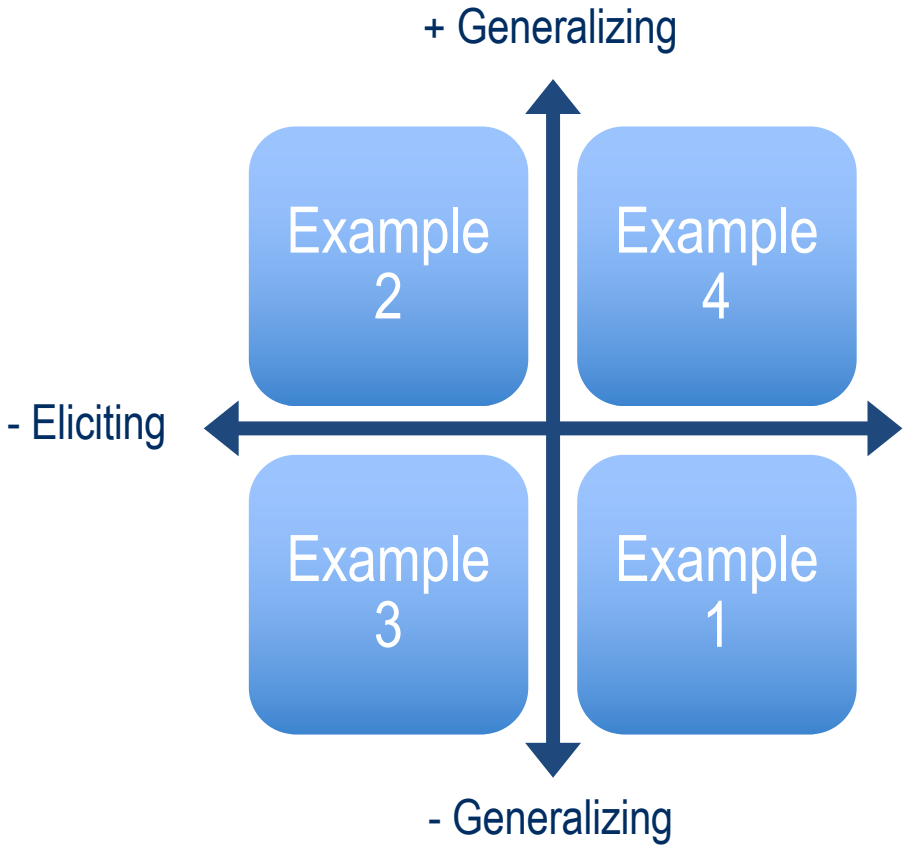
PERFORMANCE PAIRINGS MATRIX



@Practice Assessing Teaching Practice

EDUCATION

PERFORMANCE PAIRINGS MATRIX



How prevalent do you think the different pairings would be among large populations of teacher candidates? What makes you think that?

@Practice Assessing Teaching Practice

EDUCATION

POSSIBLE INTERPRETATIONS OF THE CONNECTIONS BETWEEN MKT AND ELICITING

What could explain eliciting and mathematical generalizing "performance pairings" in teacher candidates' performances?

- Depth of their general mathematical knowledge
- Extent of their familiarity with a particular mathematical approach
- Skill in making sense of mathematics "on the fly"
- Extent of the information elicited from the student
- Extent to which they comprehend what the student is saying
- Preference for a particular approach:
  - Why don't you borrow from the ____?
  - Couldn't you borrow from the ____?

OUR NEXT STEPS

One route for studying the relationship between eliciting student thinking and MKT:

- Select a particular mathematics topic
- Assess teacher candidates' overall MKT, knowledge of particular methods, and preference related to particular methods
- Assess teacher candidates' eliciting skills in three contexts through simulations:
  - Student is using the teacher candidate's preferred method
  - Student is using a method that the teacher candidate knows about, but does not prefer
  - Student is using a method that is unknown to the teacher candidate
- Interview the teacher candidate to determine how well the teacher candidate can explain the extent to which the student's method will generalize

CREDITS

Graphic on slide 3:
Cohen, D. K., Raudenbusch, S., & Ball, D. L. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis*, *25* (2), 119-142.