INTERPRETING STUDENTS' THINKING: PRESERVICE TEACHERS' INFERENCES AND THEIR USE OF SUPPORTING EVIDENCE

Timothy Boerst, Meghan Shaughnessy, &
Deborah Loewenberg Ball

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Acknowledging our colleagues: Susanna Owens Farmer, Sarah Kate Selling, Merrie Blunk, Emily Theriault-Kimmey, Rosalie DeFino, and Xueying Prawat

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TAKING STOCK, AND TAKING RESPONSIBILITY

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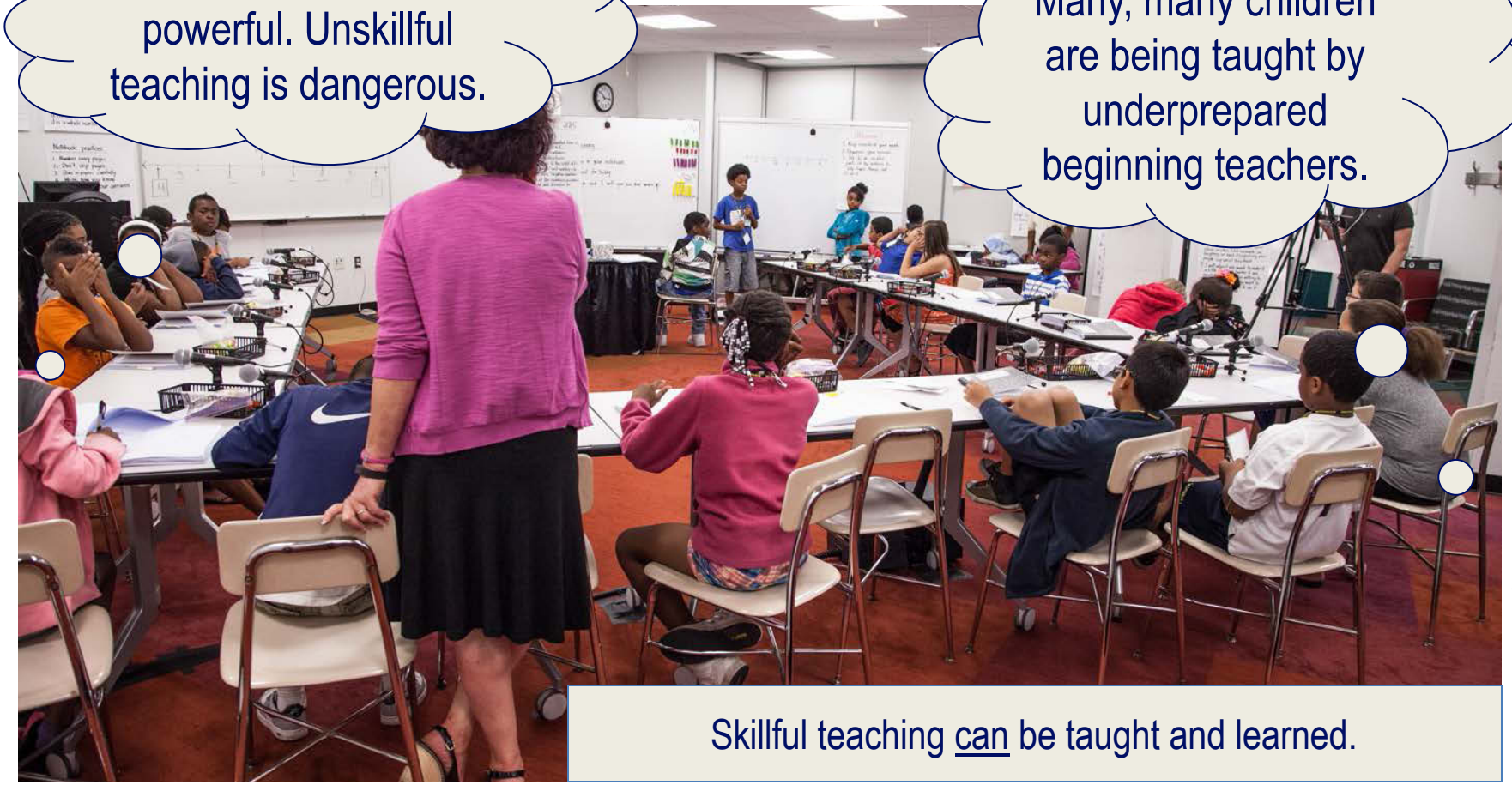
TAKING STOCK, AND TAKING RESPONSIBILITY

Skillful teaching is powerful. Unskillful teaching is dangerous.

Many, many children are being taught by underprepared beginning teachers.



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

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ORIENTING PROFESSIONAL PREPARATION TO OUR STUDENTS

- Teaching should be oriented to the prior knowledge and skills of learners, at any level or any context
- This is just as true of teacher education
- Knowing what preservice teachers already believe, are inclined to do, and patterns can help make professional education more effective

CONSIDERING ONE TEACHING PRACTICE: INTERPRETING STUDENT THINKING

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

- 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)

FOCUSING ON INTERPRETING FROM THE BEGINNING OF TEACHER EDUCATION

Early attention to interpreting student thinking is crucial, because:

- People are likely to develop ways of doing this in everyday life
- Figuring out what students think is foundational to teaching
- Errors in focus, scope and/or evidence are likely to result in teaching that is less supportive of student learning

ASSESSING THE INTERPRETING OF PRESERVICE TEACHERS

Many methods can and have been used to assess the interpretive skill of preservice teachers, including:

- Analyzing written cases
- Applying rubrics to student work samples
- Scrutinizing classroom video
- Conducting student thinking interviews
- Producing a reflective essay based on an observation

USING STANDARDIZED SIMULATIONS TO ASSESS INTERPRETING

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

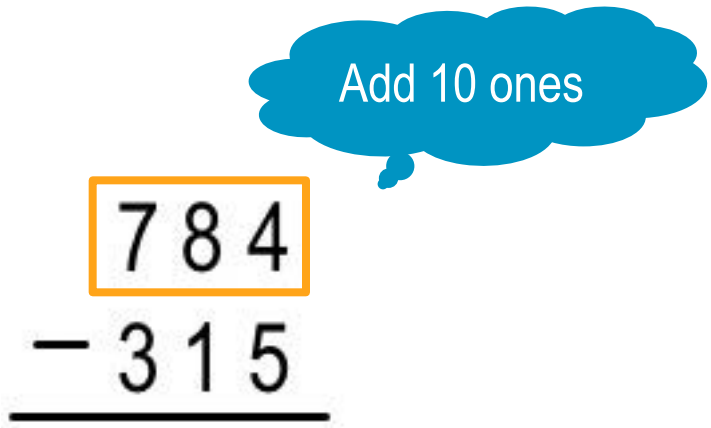
Simulations:

- 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

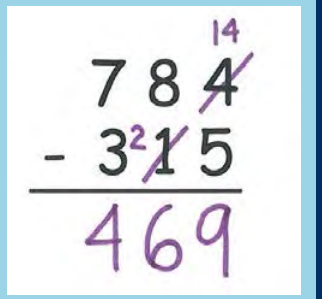
SETTING THE STAGE FOR ELICITING AND INTERPRETING

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



Correct answer, alternative algorithm, degree of understanding is unclear

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SETTING THE STAGE FOR ELICITING AND INTERPRETING

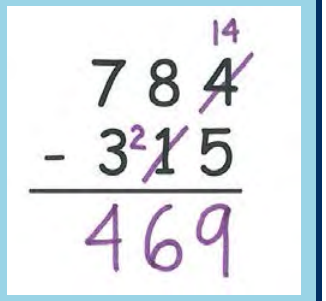
The preservice teacher:

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

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

$$\begin{array}{r} {\scriptstyle 14} \\ 7\,8\,\cancel{4} \\ -\,3\,1\,5 \\ \hline \end{array}$$

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.



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SETTING THE STAGE FOR ELICITING AND INTERPRETING

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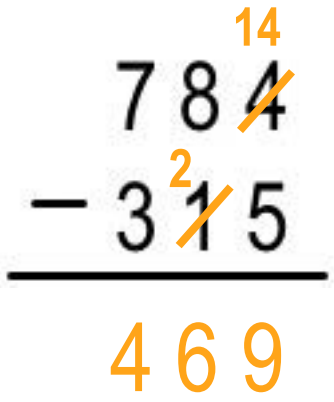

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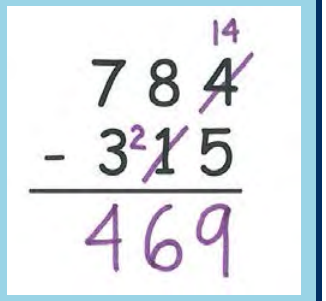

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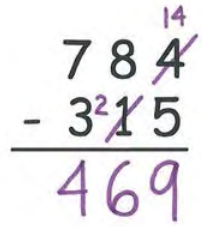
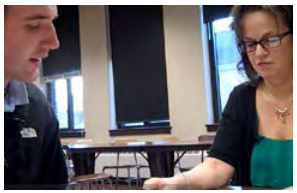
HOW IS EVIDENCE OF ELICITING SKILLS AND MKT OBTAINED?



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 STUDENT THINKING: VIEWING FOCUS

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

ELICITING A STUDENT'S THINKING

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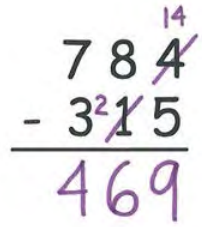
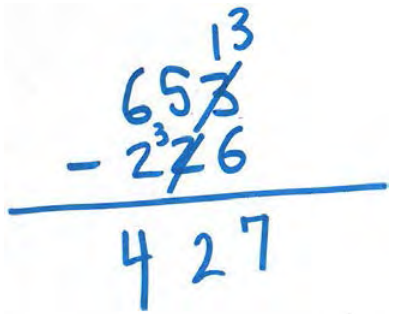
ELICITING STUDENT THINKING: VIEWING FOCUS



What opportunities exist to assess the preservice teacher'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



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HOW IS EVIDENCE OF INTERPRETATION?

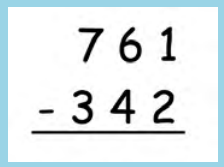
The teaching intern:

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

Preservice teachers 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

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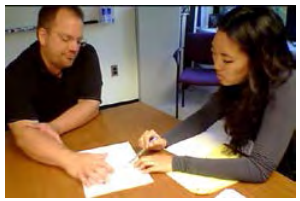
INITIAL SKILL IN INTERPRETING STUDENT THINKING

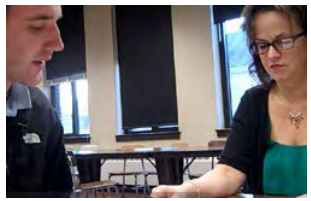
Context:

- Simulation assessment (23 preservice teachers)
- Data collected during the first week of the teacher education program

Analyzing the nature and prevalence of interpretations:

- Focusing on mathematical process used by the student
- Focusing on the student's understanding of the process
- Anticipating method and understanding of work on a similar problem
- Marshalling available evidence to support claims





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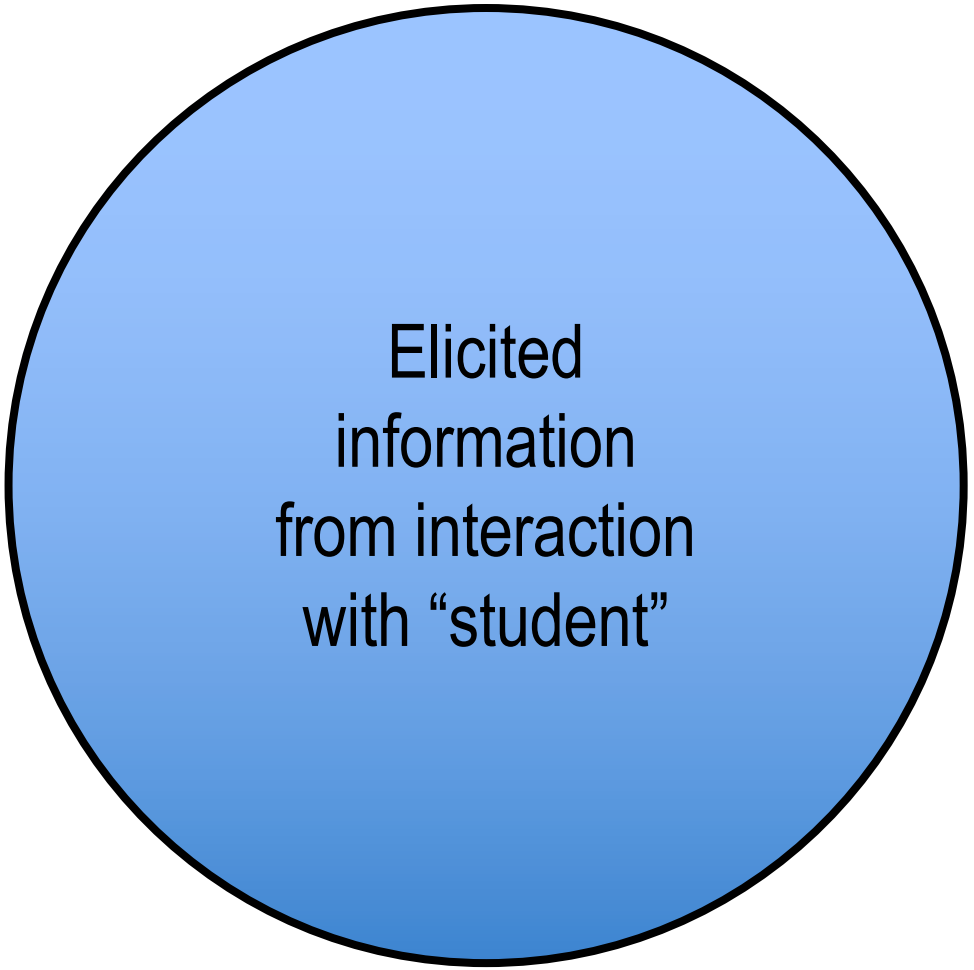
SOME TYPES OF INTERPRETATIONS



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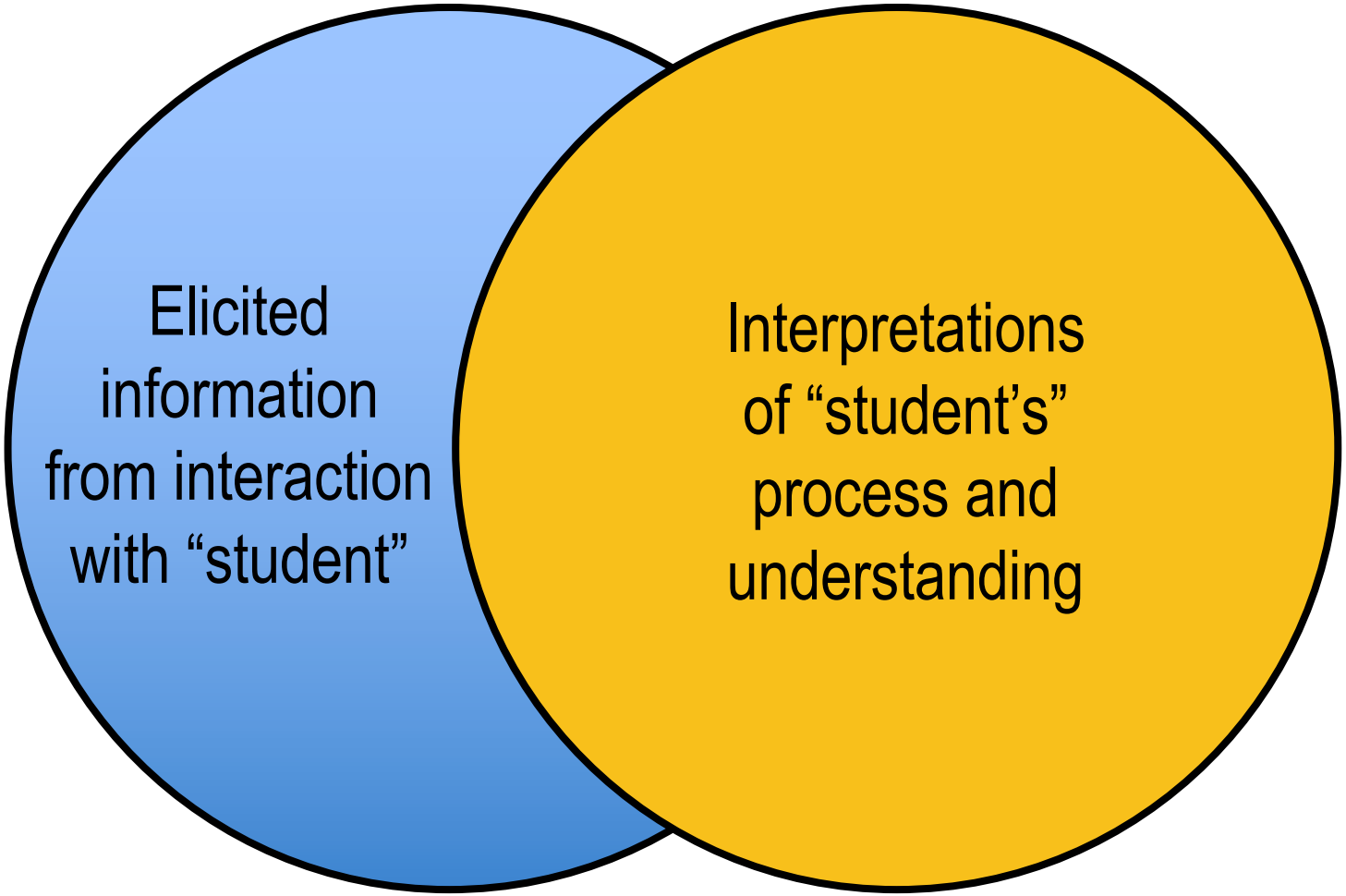

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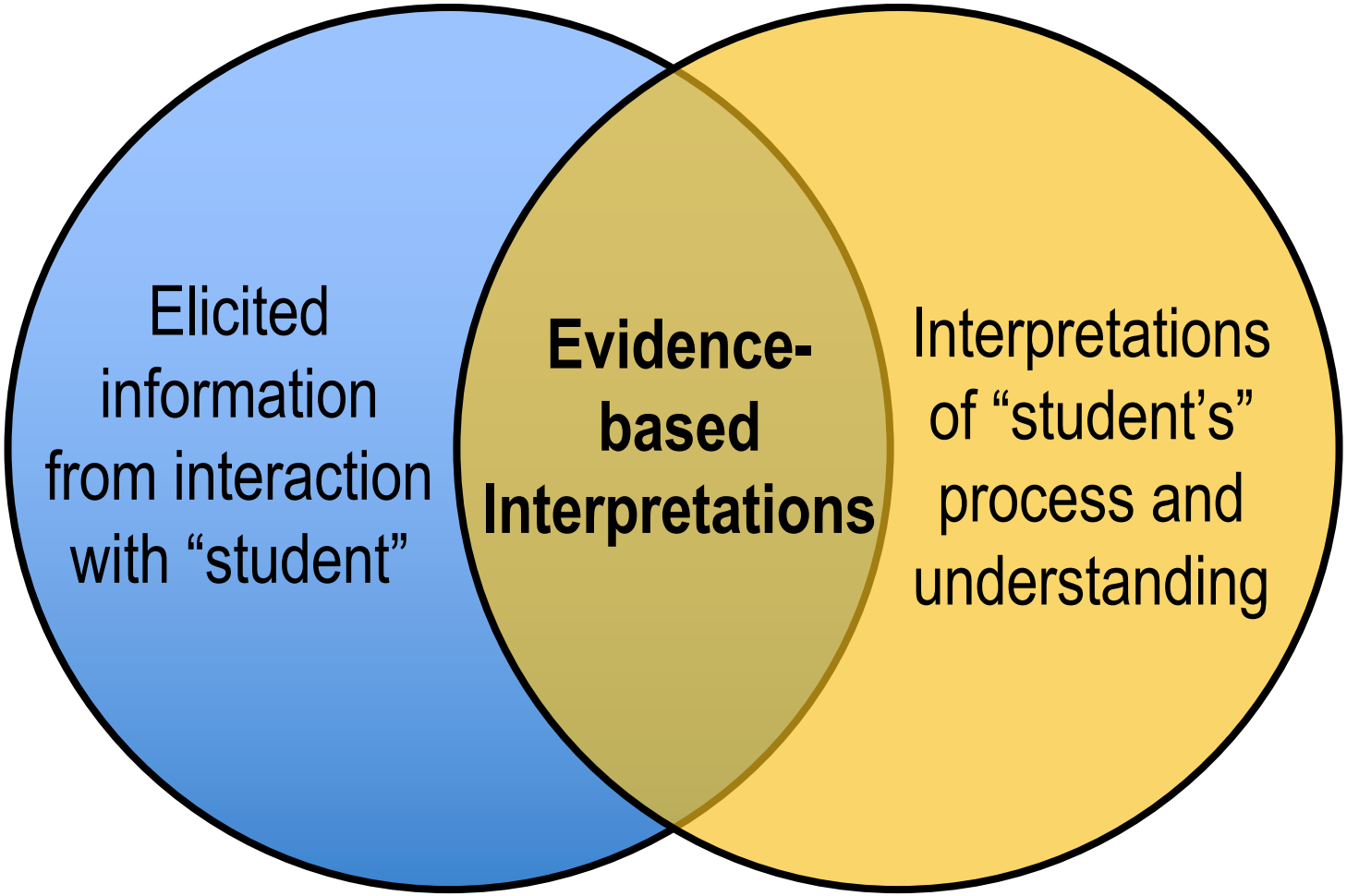

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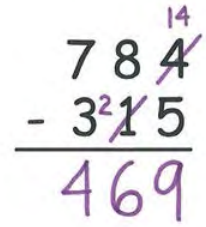
PREVALENCE OF INTERPRETATIONS



0%
(no preservice teachers)

50%
half of preservice teachers

100%
(all preservice teachers)

Describes the process
(87%)

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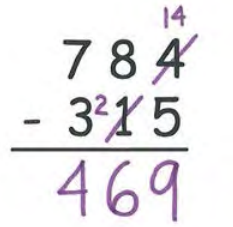
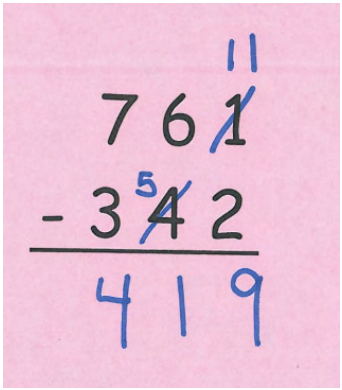
PREVALENCE OF INTERPRETATIONS

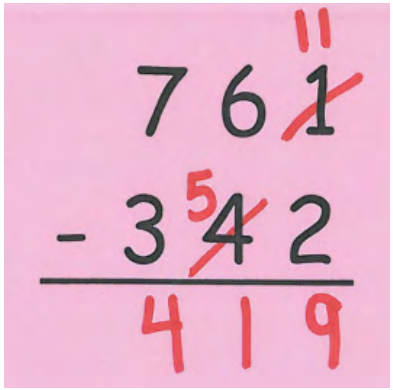


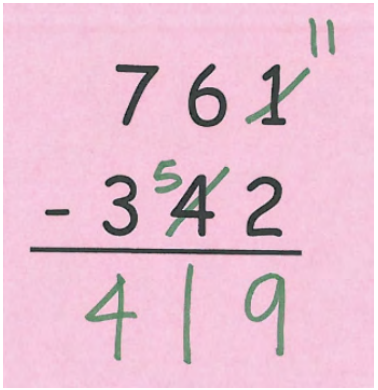
$$\begin{array}{r} 761 \\ -\ 342 \\ \hline \end{array}$$

Based on your interaction with the student, how do you think the student would solve this problem if the student used the same process?

96% of preservice teachers correctly anticipated the student's process







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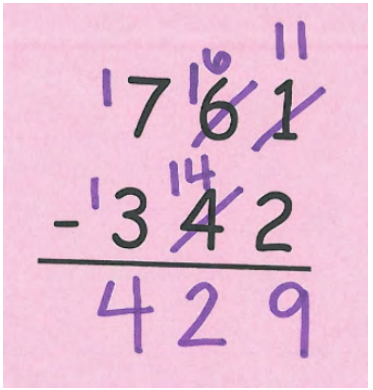

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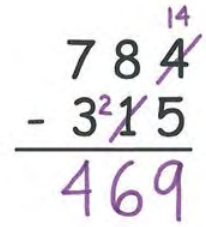

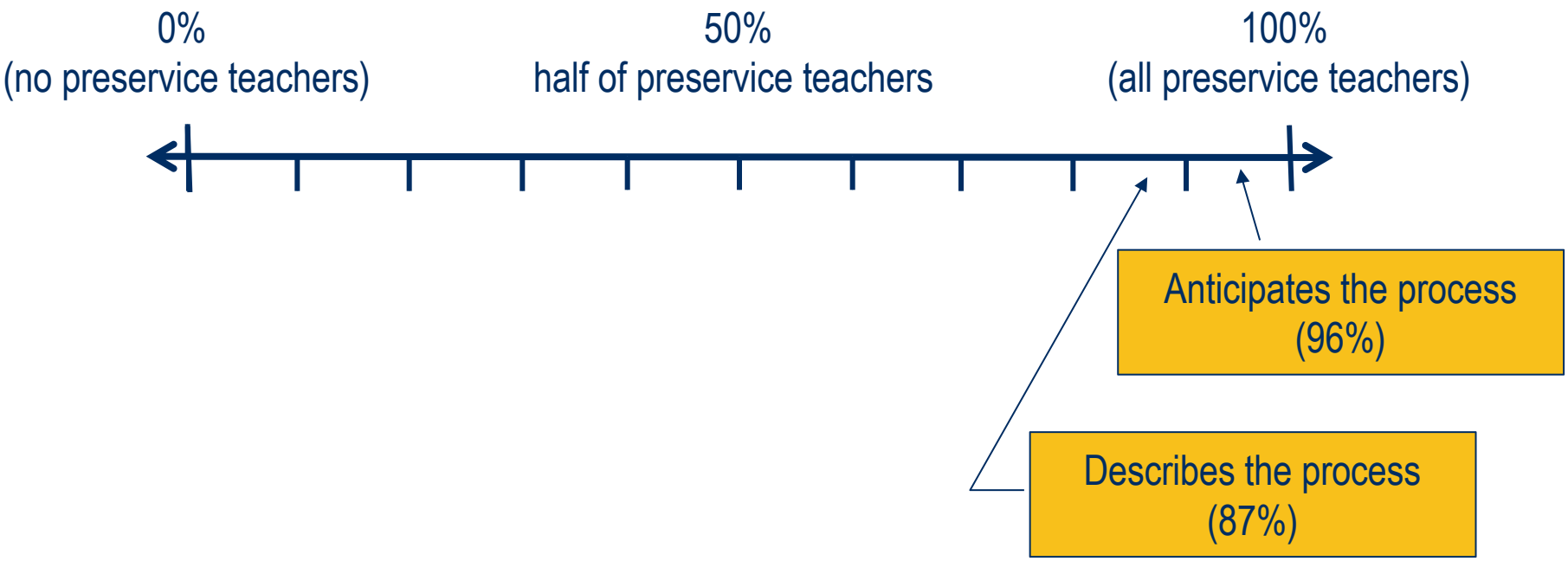

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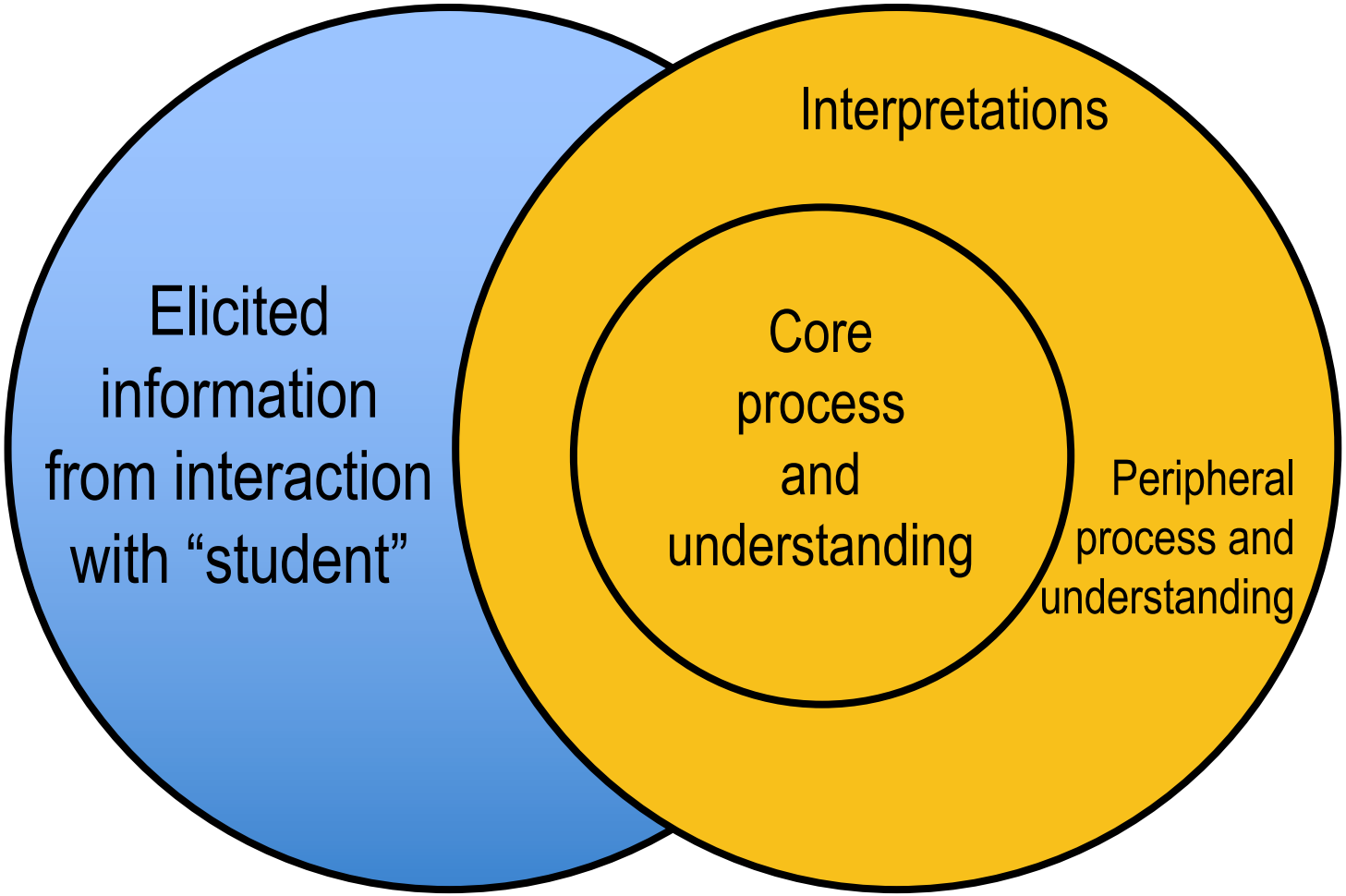
SOME TYPES OF INTERPRETATIONS



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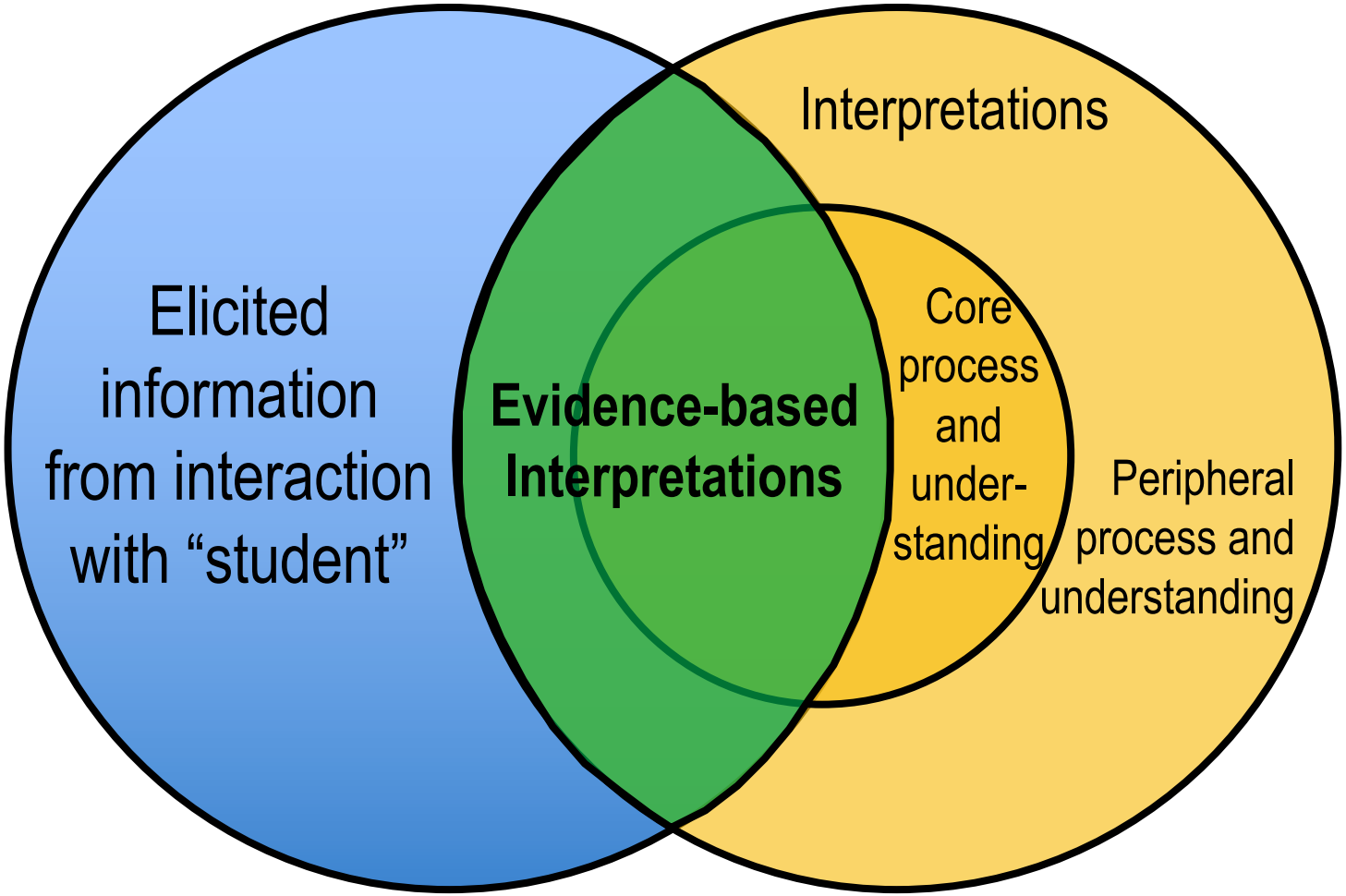

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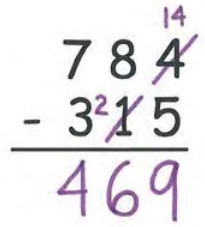

0%
(no preservice teachers)

50%
half of preservice teachers

100%
(all preservice teachers)

Indicates “core” understanding with evidence (4%)

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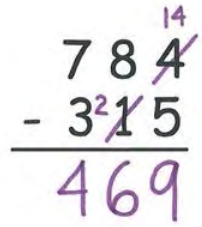
PREVALENCE OF INTERPRETATIONS



0%
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100%
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Indicates peripheral understanding with evidence (43%)

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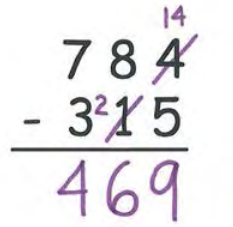
PREVALENCE OF INTERPRETATIONS



0%
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100%
(all preservice teachers)

Indicates understanding incorrectly (22%)

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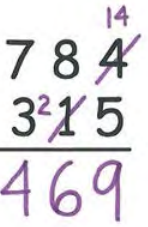
PREVALENCE OF INTERPRETATIONS



0%
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50%
half of preservice teachers

100%
(all preservice teachers)

Indicates peripheral understanding with evidence (43%)

Anticipates the process (96%)

Indicates understanding incorrectly (22%)

Describes the process (87%)

Indicates "core" understanding without evidence (22%)

Indicates "core" understanding with evidence (4%)

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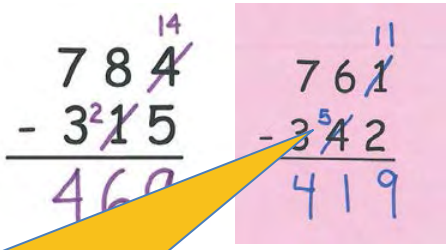
PREVALENCE OF INTERPRETATIONS



What would the student understand about this [points to the little 5]?

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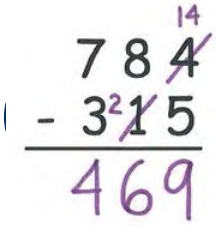
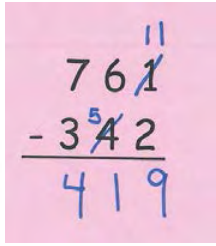
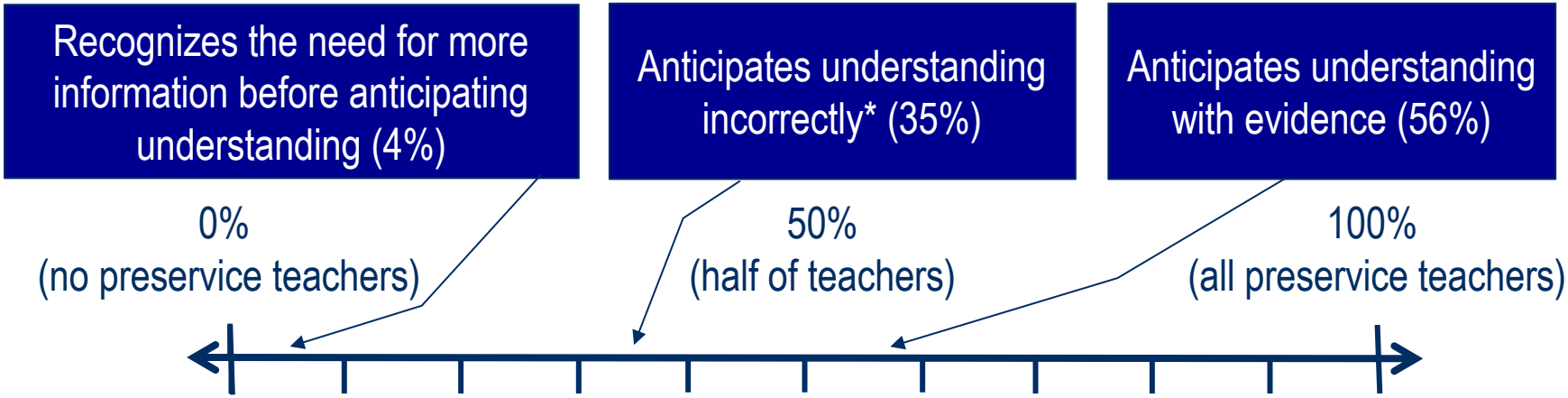
PREVALENCE OF INTERPRETATI







Understanding of digit values *96% of interns elicited evidence of understanding of digit values*

* includes incorrect claims and making a claim without having gathered evidence

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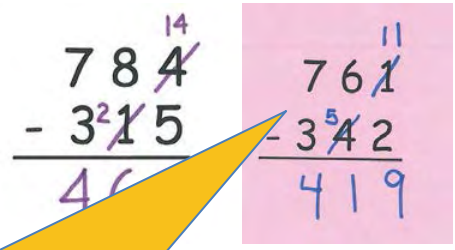
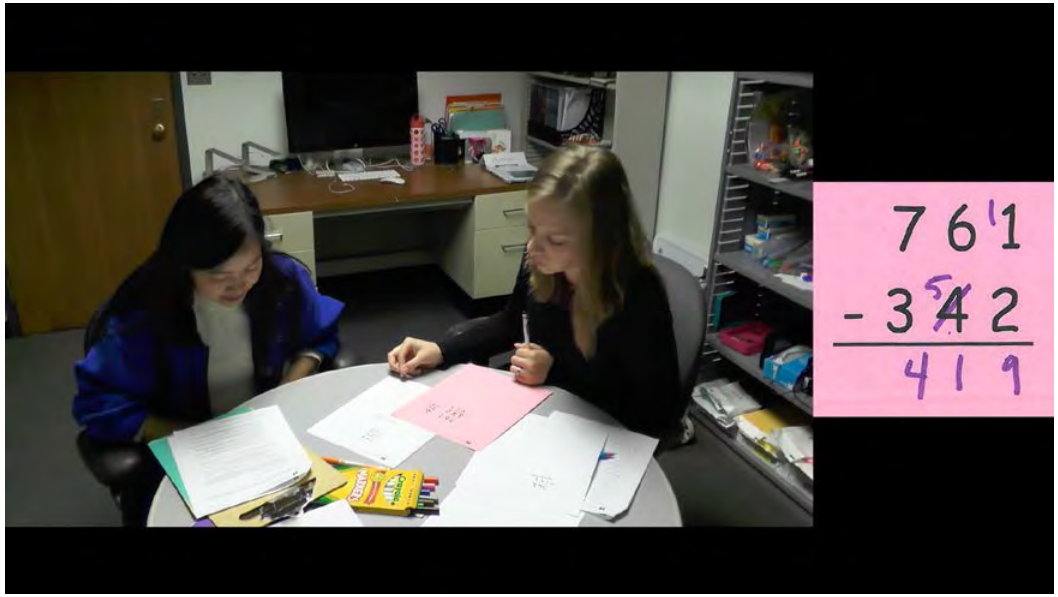


Why does the student change both the top and bottom numbers?



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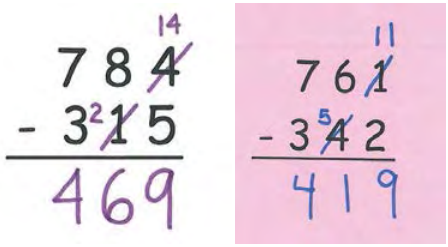

Recognizes the need for more information before anticipating understanding (4%)

Anticipates understanding incorrectly* (35%)

Anticipates understanding with evidence (56%)

0% (no preservice teachers)

50% (half of teachers)

100% (all preservice teachers)

Anticipates understanding with evidence (4%)

Recognizes the need for more information before anticipating understanding (30%)

Anticipates understanding incorrectly* (61%)

Understanding of compensation 30% of interns elicited evidence of understanding of compensation

Understanding of digit values *96% of interns elicited evidence of understanding of digit values*

* includes incorrect claims and making a claim without having gathered evidence

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WHAT CAN BE LEARNED FROM THE SKILLS THAT NOVICES BRING?

This small study of preservice teachers at the outset of their TE experiences illustrates that:

1. Preservice teachers can use written work and interaction with a "student" as the basis for:
   a) Later describing the student's process
   b) Anticipating the application of the process to a similar case

2. Preservice teachers may experience more challenges in interpreting a "student's" understanding, such as:
   a) Identifying core components of understanding in need of attention
   b) Using evidence to support claims about understanding
   c) Remembering information that could be used as evidence for claims about core components of understanding

IMPLICATIONS FOR MATHEMATICS TEACHER EDUCATION

When teacher education is focused on the practice of teaching, we need:

- Information about the skills with teaching practices that novices bring to teacher education
- Ways of using such information to inform teacher education design
- Ways of thinking about how teaching practices are defined AND connected
- To better understand how the mathematical knowledge of teachers plays into interpreting students' mathematical processes and students' understanding of those processes