HOW DO PRESERVICE TEACHERS ELICIT THE THINKING OF A STUDENT WHO HAS MADE A MISTAKE?

Meghan Shaughnessy, Rosalie DeFino, Erin Pfaff, & Merrie Blunk

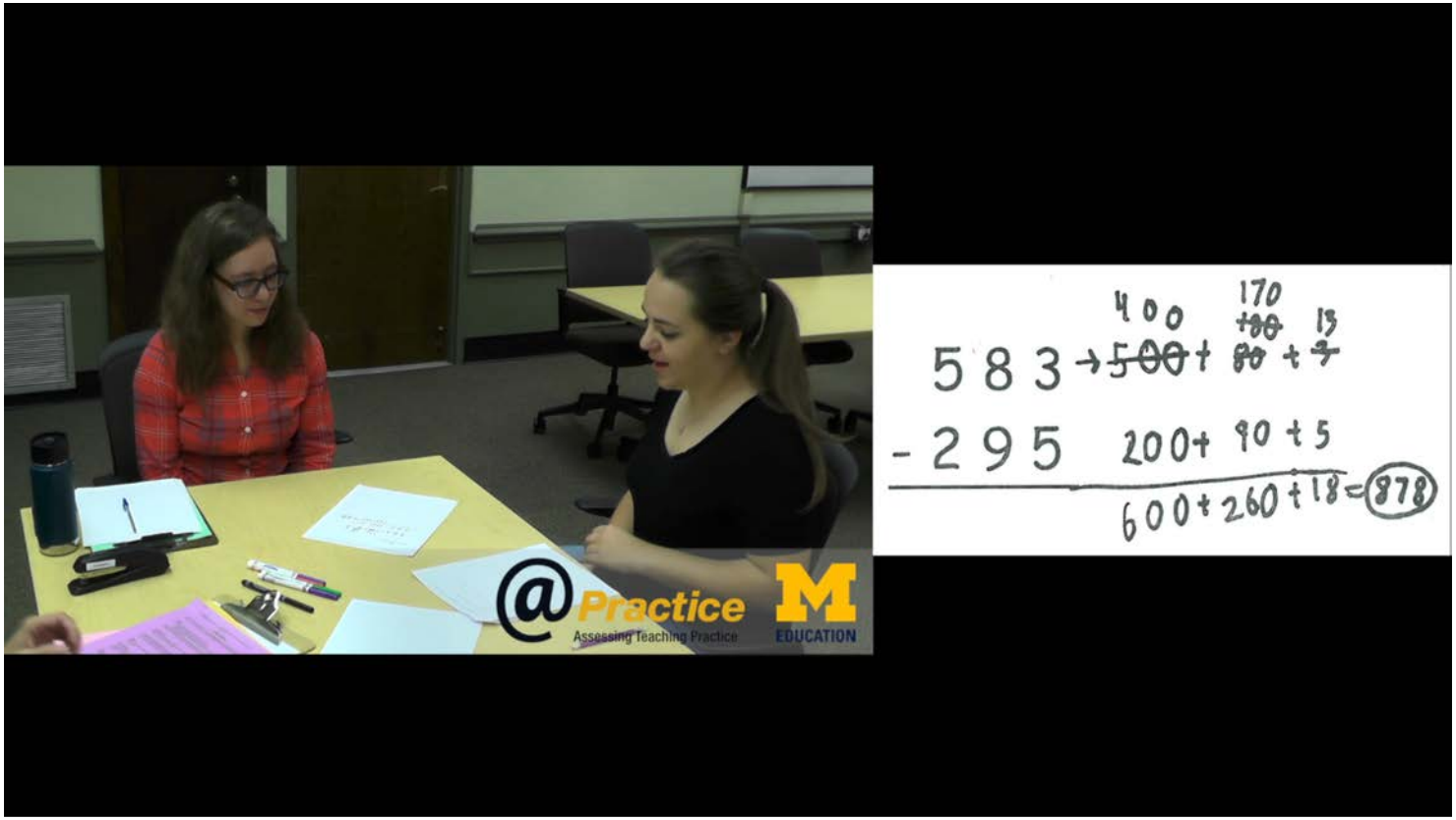
PME-NA • Greenville, SC • November 16, 2018

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

ELICITING A STUDENT'S THINKING: A SAMPLE SIMULATION



A PROBLEM OF PRACTICE: INTERPRETING AND RESPONDING TO APPARENT MISTAKES

- Students often produce unexpected responses, including apparent mistakes (e.g., mis-executions of a process)
- Interactions around mistakes have the potential to be powerful sites of learning for both teachers and students
- Productive interpretation and responses to mistakes depend on skillful eliciting of student thinking

Our question: *How do preservice teachers elicit the thinking of a student who has made a mistake?*

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

WHY FOCUS ON ELICITING STUDENT THINKING WITH PRESERVICE TEACHERS?

Early attention to eliciting student thinking is crucial, because learning and attending to what young people think is foundational to teaching.

- Teachers need to ascertain what students know and understand **to design responsive instruction**
- Teachers' determinations about students' thinking **can expand or constrain learning opportunities**

METHODS

SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

@Practice
Assessing Teaching Practice

USING SIMULATED INTERACTIONS TO ASSESS ELICITING

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

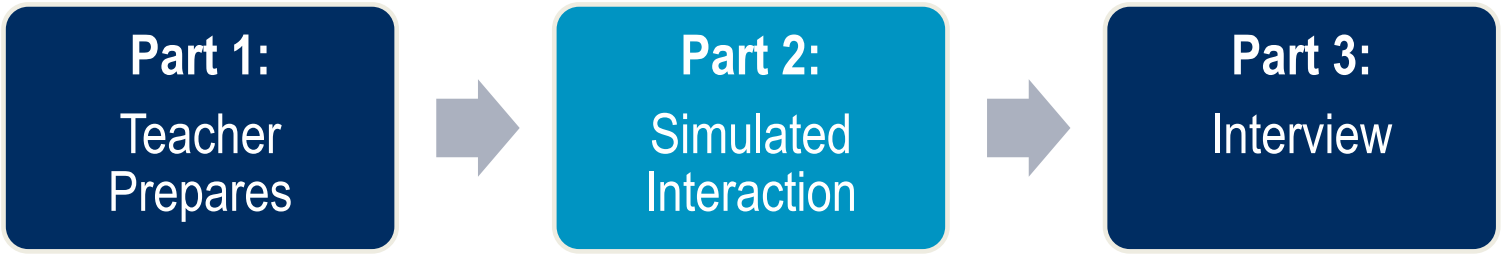
Simulations:

- engage participants in authentic demands of practice
- strategically hold still some elements of the practice-based situation
- are common in many professional fields
- can provide information that is difficult to access in the context of classroom practice

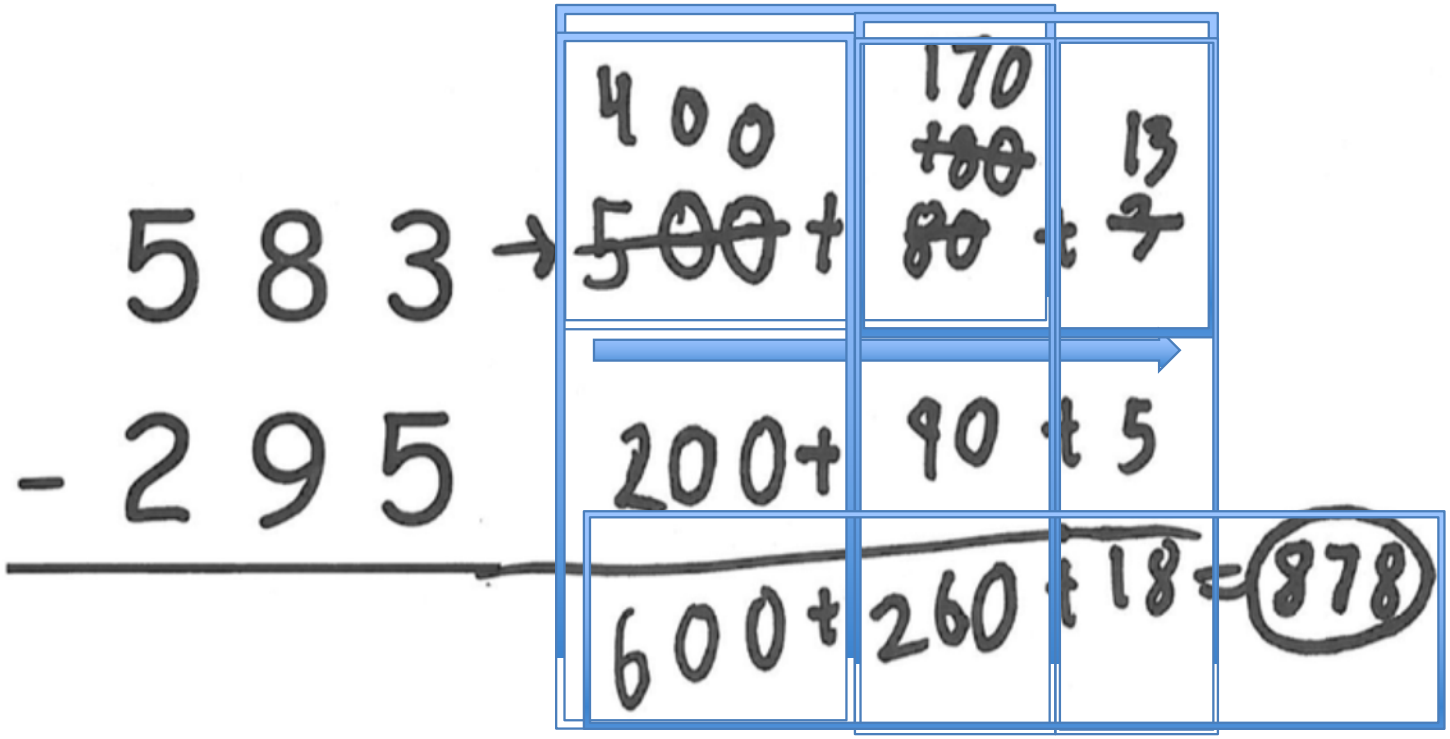
SIMULATION STRUCTURE

The 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 (eliciting takes place in Part 2)



THE STUDENT WORK



KEY FEATURES OF THE STUDENT PROFILE

- The student *does* have conceptual understanding of place value, expanded numbers, what trading means, why trading works, and when to trade
- The student makes the mistake of adding instead of subtracting because they lose track of the process, seeing the addition signs in expanded form
- There are several "triggers" that will prompt the student to say, "I think I made a mistake"

ADDITIONAL BACKGROUND

Context:

- Simulation administered with 30 preservice teachers
- Data collected during the first week of a 2-year undergraduate teacher education program
- Video records were coded using *Studiocode* © software

Coding and analysis focused on three areas:

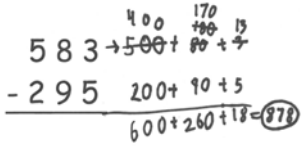
- Eliciting components of the student's original process
- Probing the student's understanding of the original process
- Eliciting and probing the student's mistake and revised process

RESULTS

SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

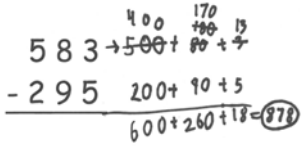
@Practice
Assessing Teaching Practice

ELICITING THE ORIGINAL PROCESS



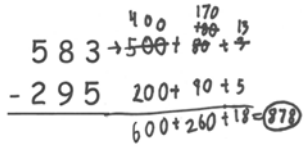
Step in Process	Student's Description of Step	Percentage of PTs
Expanded 583 and/or 295	"I expanded 583 and got 500 + 80 + 3. Then I expanded 295 and got 200 + 90 + 5."	70%
Compared the numbers in each place	E.g., "I looked at the hundreds and saw that 500 was more than 200."	90%
Traded 100 for 10 tens and/or 10 for 10 ones	E.g., "I looked at the tens and saw that 80 was less than 90, so I made a trade."	80%
Added numbers by place in expanded form	"I did 400 plus 200 and got 600. I did 170 plus 90 and got 260. Then I did 13 plus 5 and got 18."	53%
Added the partial sums	"I added 600, 260, and 18 and got 878."	10%

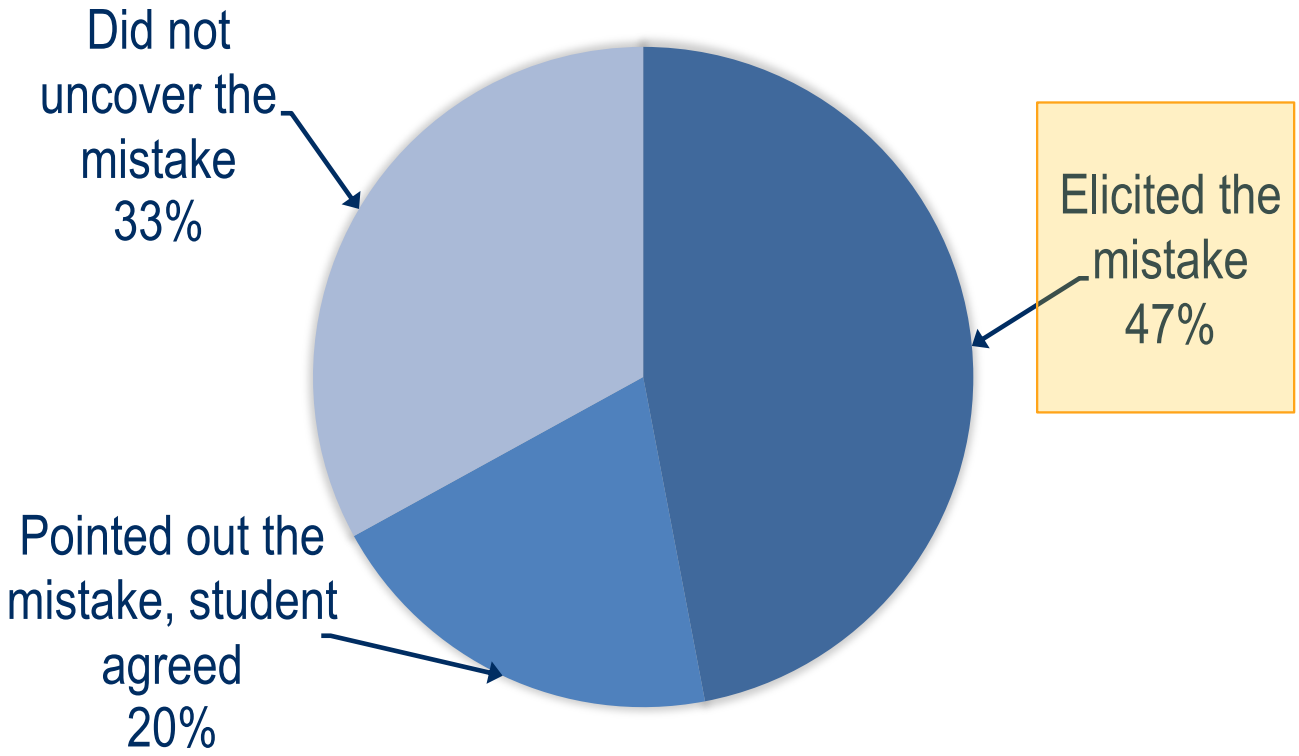
PROBING UNDERSTANDING OF THE ORIGINAL PROCESS



Understanding	Student's Description of Understanding	Percentage of PTs
Why the student expands	"It helps me see what I'm doing when I make trades."	37%
Equivalence of the expanded and the "original" number	"If you add 500 + 80 + 3, you get 583 back."	7%
Why the student trades	"When you don't have enough, you can get more by making trades."	27%
What trading means	"You're keeping the same amount just moving it from the hundreds to the tens."	0%
The operation in the problem	"It's a subtraction problem."	27%
Reasonableness of the answer	"That's strange. My answer is way too big."	7%

ELICITING FROM THE STUDENT: "I THINK I MADE A MISTAKE"



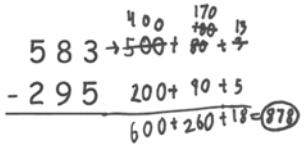


Percentage of Preservice Teachers

@Practice Assessing Teaching Practice

EDUCATION

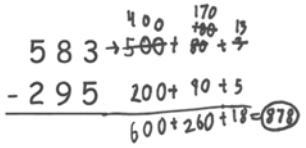
HOW DID PRESERVICE TEACHERS ELICIT "I THINK I MADE A MISTAKE"?



14 PTs (47% of sample) elicited recognition of the mistake

- 11 of 14 pressed on the operation in the problem
  - Ex: One PT pointed to the subtraction sign in the original problem and asked why the student switched to adding 200 and 400 in the hundreds place
- 2 of 14 posed another problem or had the student re-solve the original problem
- 1 of 14 pressed on why the student had made the trades

WHAT DID PRESERVICE TEACHERS DO *AFTER* UNCOVERING THE MISTAKE?



20 PTs (67% of sample) uncovered the mistake, either by eliciting or by pointing it out and getting the student to agree

- Eliciting a revised process:
  - 15 of 20 elicited some or all of the revised process
  - 10 of 20 elicited a revised final answer
- Probing why and how the student made the mistake
  - 5 of 20 made statements based on inferences and got the student to agree
  - 3 of 20 asked probing questions (e.g., “How did you make a mistake?”)
  - 12 of 20 did not follow-up about how or why the mistake was made

DISCUSSION

SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

@Practice
Assessing Teaching Practice

WHAT DID WE LEARN?

1. This group of preservice teachers was more fluent with eliciting procedural aspects of the student's thinking (e.g. "What did you do next?") than conceptual aspects (e.g. "Why did you do that?").
2. Many preservice teachers seemed hesitant to ask or talk about the mistake with the student.
3. This group of preservice teachers focused more on eliciting the revised method and/or solution than asking about why the mistake was made.

This suggests two **areas for growth**:

- probing student's understanding (in general)
- deliberate eliciting to learn about the source of mistakes

QUESTIONS FOR FUTURE RESEARCH

- In what ways do preservice teachers' skills with eliciting student thinking in the context in which a student has made a mistake develop over time?
- What teacher education course activities might cultivate an inclination to probe how and why students make mistakes?
- How does preservice teachers' eliciting around a mistake with a conventional algorithm compare to that with an alternative algorithm?