ASSESSING TEACHING PRACTICE: NEW WAYS OF THINKING ABOUT WHY, WHEN, AND HOW

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CHALLENGES FOR TEACHER PREPARATION

- Students, families, and schools need beginning teachers who are ready for classroom practice.
- Teacher education needs to focus on core practices of teaching (Ball & Forzani, 2009; Grossman et al., 2009; Lampert & Graziani, 2009)
- Teacher educators would benefit from knowing more about the knowledge and skills that candidates bring to teacher preparation
ORIENTING PROFESSIONAL PREPARATION TO WHAT TEACHER CANDIDATES BRING

If we knew more about the skills of those entering teacher education, we could reconsider:

- The curriculum (things that need to be learned and “unlearned”)
- Settings for teacher learning and needed resources
- Recruitment

We could also better track on their developing skill
LEARNING WHAT CANDIDATES BRING

- To have such information, we must assess practice: actual skills and knowledge for doing teaching
- Information gathered must:
  - Provide information about the skills that teacher candidates bring to initial teacher preparation
  - Provide information about their instructional needs
- Results will enable efficient and wise use of time and other resources
PROGRAM LEVEL ASSESSMENT

UM’s redesigned Elementary Undergraduate Teacher Education Program includes program level assessment:

- Focus on high leverage teaching practices, content knowledge for teaching, and professional ethical obligations
- Serve multiple purposes
- Involve and inform core stakeholders
- Infused into the program at multiple points in time
  - Beginning, midpoint, and conclusion of the program
  - Within courses and in designated assessment windows
ELICITING AND INTERPRETING 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
FOCUSING ON ELICITING AND INTERPRETING FROM THE BEGINNING OF TEACHER EDUCATION

Early attention to eliciting and interpreting student thinking is crucial, because:

- People are likely to develop ways of doing this in everyday life
- Caring about what students think is foundational to teaching
- It is foundational to many other teaching practices
USING STANDARDIZED SIMULATIONS TO ASSESS ELICITING AND INTERPRETING

- **Efficient**: Standardization allows for the assessment of many teaching candidates in a compressed timeframe
- **Parity**: Makes possible fairness with respect to specific contextual aspects
- **Detail**: Enables specification of content, situation, teaching “problem” to ensure that important aspects of teaching are being assessed
ASSESSING SKILLS WITH THE CORE PRACTICES OF ELICITING AND INTERPRETING CHILDREN’S MATHEMATICAL THINKING
SETTING THE STAGE FOR ELICITING

The teaching intern:

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
HOW IS EVIDENCE OF ELICITING SKILLS OBTAINED?

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

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
ELICITING STUDENT THINKING: VIEWING FOCUS

What can we notice about this teaching intern’s skill with eliciting student thinking?

Evaluate whether the teaching intern:

- Launches the interactions with a question that is neutral, open, and focused on student thinking
- Elicits the specific steps of the student’s process
- Elicits the student’s understanding of the steps
- Attends to the students’ ideas in follow-up questions
- Uses appropriate tone and manner
② SKILLS OF TEACHING INTERNS UPON ENTRY TO THE PROGRAM
INITIAL SKILL IN ELICITING STUDENT THINKING

Context:

- 2013 baseline simulation assessment (48 interns)
- Data collected during the first week of the TE program

Analyzing the prevalence of eliciting moves:

- Eliciting components of the student’s process
- Probing the student’s understanding of the process
- Encouraging and attending to what the student says and writes
- Posing a purposeful follow-up problem
Which of the moves listed would you expect to see the most often/least often at the beginning of a teacher education program?
PREVALENCE OF MOVES:
POSING A FOLLOW-UP PROBLEM

0% (no interns)

Fills in student thinking (50%)
Eliciting the process to determine tens (88%)
Eliciting the sequence of the process (88%)
Eliciting the process to determine ones (65%)
Eliciting description of trading (63%)
Eliciting the process to determine tens (88%)
Eliciting the sequence of the process (88%)
Eliciting the process to determine ones (65%)
Eliciting description of trading (63%)

50% (half of interns)

Probes meaning of the regrouping (31%)
Encourages writing to illustrate process (27%)
Probes why regrouping is needed (19%)
Poses purposeful follow-up problem (6%)

100% (all interns)
③ MAKING USE OF INFORMATION ABOUT SKILLS AND CAPABILITIES THAT INTERNS BRING
DISCUSSION

- For what purposes might information about the knowledge and skills that beginners bring to teacher education be used?
POSSIBLE PURPOSES

- Recruitment
- Curriculum, including settings and other needed resources
- Identification of teaching interns in need of particular supports
- Program effectiveness
THREE CHALLENGES

Filling in: Stating what the student is doing/knows

Posing questions that enable a student to share his/her thinking

My method is the “right way” – Why aren’t you …?

Considering processes/approaches that differ from one’s own and carefully evaluating them

Knowing what to ask about

Unpacking the mathematics
AN EXAMPLE: CHILDREN AS SENSE-MAKERS

- Nine-week course focused on developing the following practices:
  - Eliciting and interpreting children’s mathematical thinking
  - Explaining mathematical content, with a focus on fractions
  - Using assessment information to inform instruction
- Course is in the 2nd semester of the 4-semester undergraduate elementary program
- Includes work in a 5th grade classroom and in interns’ field placements (3rd – 5th grade classrooms)
SEQUENCE OF WORK ON ELICITING

Teaching interns:

1. Unpack the work of eliciting

**Viewing focus**

- What questions does the teacher pose?
- What appears to be the purposes of those questions?
- What does the teacher do to establish an environment that encourages the student to share her thinking?

**Eliciting student thinking**

Observable components:
- Initially eliciting student thinking
- Asking following up questions
  - Probing to learn about a student's understanding of key mathematical ideas
  - Probing to learn about the student's process for solving fractions problems
  - Connecting to the student's thinking
- Establishing a supportive environment
- Maintaining a focus on eliciting student thinking
- Representing mathematics accurately

Not directly observable components:
- Developing an hypothesis about how the student is reasoning and understanding and checking it
SEQUENCE OF WORK ON ELICITING

Teaching interns:
1. Unpack the work of eliciting
2. Assignment #1: Interview a student in field placement
SEQUENCE OF WORK ON ELICITING

Teaching interns:
1. Unpack the work of eliciting
2. Assignment #1: Interview a student in field placement
3. Assignment #2: Interview a fifth grade student about work on a fractions quiz

4. Look at the number line below.

What fraction is the big arrow pointing to? \( \frac{1}{2} \)

5. Look at the number line below.

What fraction is the big arrow pointing to? \( \frac{2}{4} \)
SEQUENCE OF WORK ON ELICITING

Teaching interns:
1. Unpack the work of eliciting
2. Assignment #1: Interview a student in field placement
3. Assignment #2: Interview a fifth grade student about work on a fractions quiz
4. Assignment #3: Targeted instruction session

Instructional Sequence

<table>
<thead>
<tr>
<th>Time</th>
<th>Main components</th>
<th>Steps Describing What the Teacher and Student Will Do:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes and Reminders (including management considerations)</td>
<td></td>
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</tbody>
</table>

- Opening: Introduce yourself (again). Set the purpose and let the student know what you will be doing together.
  - e.g., Last week, you shared your thinking about your fractions quiz. [Summarize some things that came up in the interview.]
  - e.g., Today, we're going to [explain what you are going to be working on].

- Explanation: Give a clear and detailed explanation of the target of your instruction. You need to make use of a model (like an area model, number line, etc.) in your explanation.
  - Additional problems:
  - Prepare a collection of problems that you can use with the student to work on your targeted instruction goal. (You might be able to just change the numbers in the initial quiz problem.)
  - Think about how you can vary the numbers in the problems to make them more/less difficult, and to get at the authentically challenging nature of fractions in your chosen instruction.
  - As time allows, have the student work on the additional problems. As the student works, ask questions to probe their understanding and to support the student in giving explanations.

- Summary: Explain the main mathematical idea one
INTERNS’ WORK ON ELICITING IN THE CONTEXT OF INTERVIEW ASSIGNMENTS

Prepare to elicit a student’s thinking

<table>
<thead>
<tr>
<th>Problem</th>
<th>Specific questions tied to student’s written work</th>
<th>Notes and Reminders</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What fraction of the rectangle below is shaded red?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. What fraction of the rectangle below is shaded red?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Look at the big rectangle below.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What fraction of the big rectangle is shaded green? What fraction of the big rectangle is shaded yellow?

Beginning Repertoire of Teacher Questions

1) Initial eliciting of students’ thinking
   - What was your first step in solving this problem?
   - Show us your solution and explain your steps.
   - What were your initial thoughts about this problem?
   - Have there been any changes in the problem?
   - Would anyone be willing to explain one of the solutions they found?

2) Probing students’ answers
   a. Trying to figure out what a student means or is thinking when you don’t understand what he or she is saying
   b. Checking whether right answers are supported by correct understanding
   c. Probing wrong answers to understand student thinking
      - Tell us more about that.
      - How did you arrive at that answer?
      - Can you elaborate on that?
      - Can you repeat that?
INTERNS’ WORK ON ELICITING IN THE CONTEXT OF INTERVIEW ASSIGNMENTS

Prepare to elicit a student’s thinking

Enact the practice of eliciting in the field
PREPARE TO ELICIT A STUDENT’S THINKING

ANALYZE THE VIDEO RECORD OF THE ENACTMENT

ENACT THE PRACTICE OF ELICITING IN THE FIELD

INTERNS’ WORK ON ELICITING IN THE CONTEXT OF INTERVIEW ASSIGNMENTS
INTERNS’ WORK ON ELICITING IN THE CONTEXT OF INTERVIEW ASSIGNMENTS

Prepare to elicit a student’s thinking

Consider instructor feedback on the enactment

Analyze the video record of the enactment

Enact the practice of eliciting in the field
OTHER COURSE FEATURES THAT SUPPORT INTERNS’ ELICITING

- Work on relevant mathematics content alongside working on practices of eliciting, including
  - Definition of a fraction
  - Area model and number line representations
  - Strategies for comparing fractions, generating equivalent fractions
  - Fraction computation
- Learn common patterns of student thinking about fractions
ACROSS THESE EXPERIENCES

- Filling in: Stating what the student is doing/knows
- My method is the “right way” – Why aren’t you …?
- Knowing what to ask about

Learn to pose questions that enable a student to share his/her thinking

Develop an inclination to consider processes/approaches that differ from one’s own and carefully evaluating them

Develop mathematical knowledge for teaching
SKILLS OF TEACHING INTERNS AT THE MID-POINT OF THE PROGRAM
ASSESSING SKILLS OF ELICITING AND INTERPRETING STUDENT THINKING (AGAIN)

CONTEXT

- **Focus**: Eliciting and interpreting student thinking with particular mathematics content
- **Timing**: End of the first year in the program; after coursework focused on eliciting and interpreting student thinking

ASSESSMENT PROMPT

Which fraction is greater: \( \frac{3}{7} \) or \( \frac{2}{5} \)

\[
\frac{3}{7} = \frac{6}{14} \quad \frac{2}{5} = \frac{6}{15}
\]

\[
\frac{6}{14} < \frac{6}{15}
\]

So: \( \frac{3}{7} < \frac{2}{5} \)
PREVALENCE OF ELICITING MOVES: ELICITING PROCESS MID-PROGRAM

- Elicits common numerator comparison process (94%)
- Elicits the process of generating equivalent fraction for 2/5 (96%)
- Elicits the process of generating equivalent fraction for 3/7 (98%)
- Eliciting description of trading (63%)
- Eliciting the process to determine ones (65%)
- Eliciting the sequence of the process (88%)
- Eliciting the process to determine tens (88%)

Mid-program assessment
Baseline assessment

0% (no interns)
50% (half of interns)
100% (all interns)
PREVALENCE OF ELICITING MOVES: ELICITING UNDERSTANDING MID-PROGRAM

Probed understanding of why $6/14 < 6/15$ (50%)
Probes understanding of equivalent fractions (50%)
Probes method of finding equivalent fractions (58%)

0% (no interns)
50% (half of interns)
100% (all interns)

96% probed understanding of at least one component
46% probed understanding of at least one component
PREVALENCE OF ELICITING MOVES:
OTHER ELICITING MOVES MID-PROGRAM

- Fills in student thinking (19%)
- Poses purposeful follow-up problem (35%)
- Encourages writing to illustrate process (46%)

- Poses purposeful follow-up problem (6%)
- Encourages writing to illustrate process (27%)
- Fills in student thinking (50%)

Mid-program assessment
Baseline assessment
5 NEXT STEPS
NEXT STEPS: SUPPORTING THE LEARNING OF INTERNS

Instructors can support interns as they:

- Work on particular aspects of their teaching
- Become more discerning about which aspects of student thinking to crucial to probe
- Enhance their skill with eliciting in the context of other teaching practices in subsequent semesters
NEXT STEPS: ASSESSMENT DEVELOPMENT

- Explore different simulation design features and combinations
  - Changing the student’s “way of being”
  - Juxtaposing different mathematical approaches (invented/standard) with different outcomes (correct/incorrect)
- Develop scaffolds for those learning the role of the standardized student
- Develop performance thresholds for different points in teacher development
- Explore different ways of designing simulations
  - Select generative cases of actual student approaches
  - Select from research on student thinking
NEXT STEPS: RESEARCH

- Validation studies that connect performance in simulations with performance in classroom contexts
- Studies of how different simulation scenarios function (relative difficulty, comparability)
- Studies of the intersection between mathematical knowledge and the practices of eliciting and interpreting