

SIMULATING TEACHING: NEW POSSIBILITIES FOR ASSESSING TEACHING PRACTICES

Meghan Shaughnessy
University of Michigan
mshaugh@umich.edu

Timothy Boerst
University of Michigan
tboerst@umich.edu

Deborah Loewenberg Ball
University of Michigan
dball@umich.edu

This paper argues that successful practice-based teacher education requires innovations in assessment that can better inform preservice teachers and those who prepare them. Such assessments must focus directly on specific teaching practices of novice teachers, as well as offer opportunities to assess the use of content knowledge for teaching. Simulations, an assessment type used in other professional fields, hold promise as one means for gathering data about and providing feedback on teaching. To explain how this could work, we describe an assessment that focuses on preservice teachers' ability to elicit and interpret a student's mathematical thinking, and we appraise what it makes possible.

Keywords: Assessment and Evaluation; Instructional Activities and Practices; Teacher Education-Preservice

The Need for Assessments of Practice

The increasing focus on specific instructional practices in initial teacher preparation means that there is a need to develop ways to assess preservice teachers' teaching in new and more precise ways. Assessing preservice teachers' ability to describe, analyze, or reflect on practice does not provide sufficient insight into their development. Further, novice teachers need specific feedback about their practice (Grossman, 2010).

Assessment of teaching practice is not new in teacher preparation. Approaches have focused on appraising preservice teachers in real context of practice, such as in field placements and during student teaching, and have included microteaching, field-based performance tasks, and systematic field observation of lessons (e.g., Hamerness, Darling-Hammond, & Bransford 2005; NCATE, 2003). In field-based assessments, however, contextual factors affect preservice teachers' performance. Although context is a reality of practice, field placement contexts are unique for each preservice teacher, which makes it more difficult for teacher educators to obtain reliable estimates of their preservice teachers' teaching capabilities. For example, our teacher preparation program, like many, used interviews conducted in their field placements to assess our preservice teachers' skill with eliciting and interpreting student thinking. They probed children about their mathematical thinking and then they later analyzed the interviews to make claims about the children's understandings (Sleep & Boerst, 2012). Using video records, instructors were able to see and provide feedback on the types of questions posed, how well they attended to and used children's mathematical ideas, as well their manner with the children. We were also able to assess the quality of their interpretations of the children's thinking. However, issues of fairness arose because some children were less forthcoming with their thinking than others and required different sorts of probing questions to elicit their thinking. Further, because instructors did not know the children themselves, they could not determine whether the preservice teachers were accurately uncovering children's thinking. As a result, it was also not possible to detect patterns in preservice teachers' skills overall within the program. This paper describes work we have been doing since 2011 to develop and investigate the use of simulations as a complementary form of assessment that can address some of the shortcomings of previous approaches.

The Use of Simulations in Professional Preparation

Simulations are used in many other professional fields. In many medical schools, doctors in training engage in simulations of physical examinations, patient counseling, and medical history taking by interacting with “standardized patients,” adults who are trained to act as patients who have specified characteristics. Evaluation of medical students’ interactions with standardized patients makes possible common appraisal of candidates’ knowledge and skills. In medicine, simulations have been used for formative assessment for over 40 years and are currently used in high-stakes medical licensure examinations (Boulet, Smee, Dillon, Gimpel, 2009). In nursing schools, simulations are used to develop and practice clinical skills, including skills difficult to develop and practice on an actual patient. Many of these simulations make use of mannequins (robots) that can be programmed to behave in particular ways and to exhibit particular symptoms. Simulations have not been widely used in education, for either learning opportunities or assessment purposes. There are beginning to be examples of programs using them to support the learning of skills such as managing a classroom (Dieker, Straub, Hughes, Hynes, & Hardin, 2014), conducting a parent conference (Dotger & Sapon-Shevin, 2009), and school leader development (Dotger, 2014); however, the use of simulations for assessment has been limited.

A Simulation Assessment of Skill with Eliciting and Interpreting Student Thinking

To concretize ideas of simulations in assessing teaching practice, we turn now to describe an assessment that we developed and are now using of preservice teachers’ ability to elicit and interpret student thinking. The assessment makes use of a standardized student (i.e., someone playing the role of a student) and takes about 25 minutes to complete.

In the first part of the assessment, preservice teachers are given a copy of the standardized student’s work on a problem (see Figure 1) and they have 10 minutes to prepare for an interaction with one standardized student about her work. Because the student’s work produces the correct answer, the task is to determine how the student reasoned about the problem and what she understands. Students can use an array of methods different from those familiar to adults, and an important task of teaching is to probe and make sense of students’ mathematical processes and understanding, both when they seem obvious and when they do not. This is particularly demanding for novice teachers who are likely to know less about non-standard approaches.

$$\begin{array}{r}
 29 \\
 36 \\
 + 18 \\
 \hline
 63 \\
 \textcircled{83} \\
 \text{Final answer } \underline{83}
 \end{array}$$

Figure 1.A Student Work Sample on an Addition Problem

In the second part of the assessment, preservice teachers have five minutes to interact with the standardized student. Preservice teachers are told that they should elicit and probe the standardized student’s thinking to understand the steps she took, why she performed particular steps, and her understanding of the key mathematical ideas involved. To ensure consistency, the role of the standardized student is guided by carefully articulated rules for reasoning and responding, including responses to questions that are commonly asked, referred to as the “student profile” (see Figure 2). In this case, the student uses an alternative algorithm to solve the problem. The student added the digits

in each column, starting with the tens. The student interpreted the 623 in the written work as 6 “tens” and 23 “ones” and produced the final answer of 83.

In the third part of the assessment, the assessor asks a series of questions to elicit the preservice teacher’s interpretation of the student’s process and her understanding. Further, the preservice teacher is asked to predict, based on what the interaction revealed, how the student would solve $27 + 48$ and what she would understand about several key mathematical ideas.

<p>Student work:</p> $\begin{array}{r} 29 \\ 36 \\ + 18 \\ \hline 623 \\ \textcircled{83} \\ \text{Final answer } \underline{83} \end{array}$ <p>General orientation to responses:</p> <ul style="list-style-type: none"> do not make basic facts errors give the least amount of information that is still responsive to the preservice teacher’s question if a question is confusing, say something like, “What do you mean?” do not write unless you are asked to write <p>Specific responses (a subset of them):</p> <table border="1"> <thead> <tr> <th><i>Preservice teacher prompt</i></th> <th><i>Response</i></th> </tr> </thead> <tbody> <tr> <td>What did you do first?</td> <td>I added the tens: $2 + 3 + 1$ and I got 6.</td> </tr> <tr> <td>How did you get from 623 to 83?</td> <td>I had to combine the 6 and the 2.</td> </tr> <tr> <td>Why did you need to combine those numbers?</td> <td>Because they’re both tens.</td> </tr> </tbody> </table>	<i>Preservice teacher prompt</i>	<i>Response</i>	What did you do first?	I added the tens: $2 + 3 + 1$ and I got 6.	How did you get from 623 to 83?	I had to combine the 6 and the 2.	Why did you need to combine those numbers?	Because they’re both tens.	<p>The student:</p> <ul style="list-style-type: none"> uses the column addition method, except that the student is working from left to right correctly applies the column addition method for solving addition problems can use the same process to solve addition problems with more than two digits, understands when/why/how to “combine” has conceptual understanding of the procedure (e.g., “six hundred and twenty-three” is not the answer because we have to combine the tens) is thinking about 623 as 6 tens and 23 ones can tell that the sum of 83 is reasonable
<i>Preservice teacher prompt</i>	<i>Response</i>								
What did you do first?	I added the tens: $2 + 3 + 1$ and I got 6.								
How did you get from 623 to 83?	I had to combine the 6 and the 2.								
Why did you need to combine those numbers?	Because they’re both tens.								

Figure 2. An Excerpt from the Standardized Student Profile

The assessment is scored using checklists with the criteria for proficient performance, including both mathematical and pedagogical aspects as it is being completed. Criteria for eliciting are keyed to specific parts of the task (e.g., probes for why the student combines the 6 and the 2) as well as how the preservice teacher takes up specific things that the student did or said. The interpreting criteria focus on the accuracy of the explanation of the student’s thinking and the use of evidence to predict the student’s performance on a similar problem.

Features of the Assessment Situation

In designing assessment scenarios, we make choices about the authenticity and familiarity of the context. Although the teaching context itself is a simulation, some features are nonetheless authentic. For example, the student work is ambiguous with respect to the student’s process (e.g., How did the student get from 623 to the final answer of 83?) and understanding of the core mathematical ideas (e.g., What does the student interpret the “623” to mean?). This means that preservice teachers cannot know in advance how the interaction will unfold. In addition, just as in actual classroom practice, the interaction occurs in real time, which requires teachers to generate questions on the fly in response to the student.

The inauthentic aspects of the assessment actually enable more systematic evaluation of skills. First, all preservice teachers elicit student thinking about the same mathematics content, which avoids the issue of some content being easier or harder to elicit student thinking about. Second, that our preservice teachers are all interacting with a standardized student means that we are able to see their skills under the same conditions. Third, we are able to focus this particular assessment squarely

on eliciting and interpreting student thinking, not on other aspects of teaching — also important — such as building relationships with students.

What Simulation Assessments Can Offer

Simulation assessments present one promising possibility for improving assessment of teaching practice. We use these in our program to learn about how our preservice teachers are developing and how we can support improvement in their skills. But we also assess their skills on entry to the program and this, too, has been useful. One year, for example, we found that almost all our entering preservice teachers asked about the student's process for solving a mathematics problem; however, fewer than half of them asked about the student's understanding. Further, they rarely posed follow-up problems (6%) to confirm the student's process or understanding. When asked to produce a problem that could be used to confirm the student's approach, only 54% of preservice teachers were able to generate a numerical example that would present the same conditions as the original problem. These baseline data provided crucial information as we set out to develop our preservice teachers' skills. We are also finding that these assessments support us in providing more detailed and specific feedback to our preservice teachers that can help them improve their practice. In our current work, we are continuing to investigate the validity and practicality of simulation assessments, including exploring their feasibility and design entailments. We are also conducting validation studies that examine the relationship between performances in simulations with performances in classroom contexts.

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