CONVEYING RESPECT FOR STUDENTS THROUGH THE PRACTICES OF ELICITING AND INTERPRETING STUDENT THINKING

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We examine what it might mean for preservice teachers to convey respect for students through their eliciting and interpreting of students' thinking. We report on a conceptualization of what it means to convey such respect and challenges at the beginning of teacher preparation.

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All students have the right to work with a teacher who is interested in their mathematical thinking and has the requisite mathematical knowledge, pedagogical skills, and commitment to support their day-to-day, lesson-to-lesson, task-to-task learning. Tragically for subsets of the student population – sentences like this have driven national standards (NCTM, 2000), legislation (No Child Left Behind [NCLB], 2002), and research for nearly half a century without redressing disparities in mathematics achievement. Recently scholars have argued that this "achievement gap" reflects serious "opportunity gaps" that must be rectified (Milner, 2010; Horn, 2012; Flores, 2007). Opportunity gaps are created and replicated through mathematics instruction, with instruction defined as the interaction among teachers, students, and mathematics content (Cohen, Radenbush, & Ball, 2003). Studies demonstrate that "no in-school intervention has a greater impact on student learning than an effective teacher" (p.1, NCATE, 2010). Thus, the opportunity gap is a problem of teaching and likely to be, at least in part a function of the preparation of mathematics teachers.

The professional learning of teachers often includes opportunities for preservice teachers (PSTs) to interact with students around mathematics content. Teachers need opportunities to hone their use of mathematical knowledge and practical skills to redress the bias and inequity that produce opportunity gaps. However, because opportunities to interact with children commonly occur in the context of teaching in K-12 school contexts, it is often not possible to predict, let alone ensure, that opportunities to redress the bias and inequity will manifest themselves. In a very real sense there are gaps in PSTs' opportunities to learn to teach in ways that could redress gaps for students in opportunities. Given the challenging nature of reliably providing these experiences, it is particularly important to develop options that can.

Our project focuses on the development of PSTs' capabilities with eliciting and interpreting students' mathematical thinking. The goals of this collective work include enhancing awareness of teaching that could produce opportunity gaps and developing mathematical knowledge, pedagogical practices, and dispositions that enhance equity, access, and inclusion. In particular we focus on attending to and taking up student ideas as such moves are the hallmark of responsive teaching. This is a place where it might be possible to see biased or gap-producing teaching moves. In our past work, we noticed PSTs' attending to and taking up student thinking in ways that appeared to be counter to goals of enhancing equity, access, and inclusion. For example, after learning that a student has used a non-standard (but valid) process to solving a problem, we commonly notice patterns of asking questions focused on why the student has "not done" another process, often a "standard" process with which the teacher either was more

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familiar or preferred for solving a problem. In some cases, such approaches went further with teachers telling a student that they could not use their valid process, but instead needed to use the "standard" algorithm. When interpreting student thinking, we observed that while PSTs noticed attributes of a student's process or their understanding, they characterized the student's thinking in deficit-focused ways when the student used a non-standard process. Another kind of problematic characterization, of a more general nature, entailed derogatory statements about the student's general mathematical aptitude or skill (e.g., this student is really confused and must have problems in math). We began to wonder about how we could capture the ways in which teachers were respecting students and their thinking as they engaged in the work of eliciting and interpreting student thinking. The choice of these teaching practices is strategic as they undergird much of the work that happens in classrooms. Specifically, our study examined the respect (or disrespect) for students and their mathematical knowledge that was evident when eliciting and interpreting student thinking at the beginning of teacher preparation. We next turn to our conceptualization of the teaching practices of eliciting and interpreting student thinking.

Eliciting and Interpreting Student Thinking

In teaching, "teachers pose questions or tasks that provoke or allow students to share their thinking about specific academic content in order to evaluate student understanding, guide instructional decisions, and surface ideas that will benefit other students" (TeachingWorks, 2016). We conceive of the work of eliciting student thinking as involving: (a) eliciting and probing the student's process and understanding; (b) taking up the student's ideas in questions, including respecting the student and their thinking; and (c) using mathematical language and representations. This work involves teachers listening to and interpreting what students are saying, generating and posing questions to learn more about the student thinking, listening to and interpreting what students are saying. Teachers make sense of what students know and can do based on evidence from interactions and other artifacts of student work. This practice entails: (a) making qualified claims about valued outcomes that can be used as the basis for future action, (b) using evidence to generate and test claims, (c) matching the scope and nature of the claim to the amount and type of information available (d) actively working to prevent bias or distortion, and (e) developing and/or using appropriate criteria to focus or inform judgments.

Using a Teaching Simulation to Formatively Assess Skills with Respecting the Student When Eliciting and Interpreting Student Thinking

Many practice-based professions (e.g. dentistry, law, pharmacy) use simulations to assess novices' knowledge and skill with core elements of interactive work. Simulations are "approximations of practice" that place authentic, practice-based demands on a participant while purposefully suspending or standardizing some elements of the situation. Simulations provide a predictability that cannot be replicated through live work in classrooms, interactivity that cannot replicated through video study, and access to feedback and collective work on practice not replicable through written reflection.

Since 2011, we have been using teaching simulations to study PSTs' skill with eliciting student thinking (Shaughnessy & Boerst, 2018a; Shaughnessy & Boerst, 2018b). In these simulations, a PST interacts with a "standardized student" (a teacher educator taking on the role of a student using a well-defined set of rules for responding) around a specific piece of written work. We design teaching simulations to have a consistent three-part format. First, PSTs are provided with student work on a problem and given 10 minutes to prepare for an interaction. The task for the PST during the interaction is to determine the process the student is using to solve the problem and the student's understanding of the core mathematical ideas involved. Second, PSTs have five minutes to interact with the standardized student, eliciting and probing the "student's" thinking to understand the steps they took, why they performed particular steps, and their understanding of the key mathematical ideas involved. The role of the "student" is carried out by a teacher educator whose words and actions are guided by a detailed profile of a particular student's thinking and rules that govern this student's interactional norms. To ensure standardization of the role, the "student" is trained to follow the highly specified rules for reasoning and responding, including responses to questions that are commonly asked by PSTs. Third, PSTs respond verbally to a set of questions that are designed to probe their interpretations of the "student's" process and understanding and their prediction about the "student's" performance on a similar problem.

We designed this simulation to be one in which a student uses an alternative algorithm for solving subtraction problems (see Figure 1). The process involves writing the value of the minuend and subtrahend in expanded form and then making any necessary trades. When trading, the student works from right to left. The student then subtracts the numbers place-by-place in expanded form, starting with the hundreds place. This student has conceptual understanding of expanded form, the meanings of addition and subtraction, and when, how, and why to make trades. We selected this algorithm because it is one that we anticipated would be unfamiliar to our PSTs. This enabled us to learn about the ways in which they respected the student and their thinking in a context in which the student work was unfamiliar.

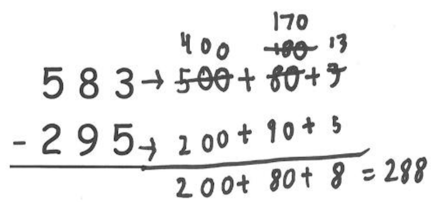

Figure 1: Student Work

Methods

Thirty-two PSTs enrolled in a university-based teacher education program in the United States participated at the beginning of their teacher education program. The simulations were video-recorded. Our analysis focused on respecting students and their thinking. For eliciting student thinking, we used the literature and our research on the work of teaching to identify two characteristics that show respect for students and their thinking: (1) establishing and maintaining a focus on the student's approach while refraining from directing the student to a different process in a way that competes with the student's process; and (2) establishing and maintaining a non-evaluative space in which students can openly share their thinking. For interpreting student thinking, we focused on PSTs' use of a non-deficit focused language to describe the student and their thinking. We focused on three characteristics: (1) characterizing the student's process in asset-focused terms (or ways that are not in deficit terms); (2) talking about the student's process itself without repeated reference to a different process; and (3) characterizing the student's mathematical knowledge and skills in asset-based terms or ways that are not deficit-focused. Two independent coders applied all of the relevant codes to each performance. Disagreements were resolved through discussion and by referencing a code book.

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Results

Eliciting Student Thinking

We examined the eliciting of the PSTs to see whether it had characteristics that show respect for students and their thinking. We found that 78% of the PSTs (25 of 32) established and maintained a focus on the student's process. This means that 22% of the PSTs directed the student to a different process in a way that competed with the student's initial reasoning. For example, one PST quickly launched into a series of questions focused on getting the student to solve the subtraction problem without expanding the numbers. Another PST asked a series of questions about the student's process and then told the student that a way to do the problem differently (that would make it easier) would be trade from right to left (rather than left to right). The student indicated that she had seen people do it that way but preferred to trade from left to right. Seventy-five percent of the PSTs (24 of the 32) established and maintained a non-evaluative space in which students could openly share their thinking while 25% of the PSTs employed moves that showed repeated evaluation of the student's thinking such as characterizing as "correct" or "incorrect" each step shared by the student.

Interpreting Student Thinking

We examined the PSTs' interpretations of the student's thinking. In other words, the ways in which they characterized the student and their thinking when we asked them to talk about the student's process, including the student's understanding of the process and the generalizability of the process from a mathematical perspective. We found that 69% of the PSTs (22 of the 32) characterized the student's process in asset-focused ways or ways that were not deficit-focused. In contrast, 31% of the PSTs characterized the student's process using deficit terms. Ninety-one percent of the PSTs (29 of the 32) talked about the student's process itself without repeated reference to a different process meaning that the remaining 9% repeatedly talked about the student's process in terms of a different process. Eighty-four percent of the PSTs (27 of the 32) characterized the student's mathematical knowledge and skills in asset-based terms or ways that were not deficit-focused while 16% characterized the student's mathematical knowledge and skills in deficit terms. When we looked across the characteristics of respecting the student when characterizing their thinking, we found that 38% of the PSTs used one or more moves that we considered to be problematic related respecting the student's thinking.

Discussion

Our study examines an approach for noticing and naming the ways in which PSTs convey respect for students and their thinking when eliciting and interpreting student thinking. As shown in this study, simulations can be designed to raise teaching dilemmas that will surface PSTs' teaching practices, mathematical knowledge, and potential biases, thereby making them available for noticing and addressing. In addition to naming ways to notice the respect of students that can unfold in the work of eliciting and interpreting student thinking, the findings suggest that PSTs at the beginning of teacher preparation are in need of interventions focused on respecting students and their thinking in order to teach in ways that promote access, equity, and inclusion. Further, even those PSTs who did not characterize the student and their thinking in deficit-focused ways were not always carrying out an asset-based approach to characterizing student thinking. In future work, we seek to leverage the simulation to support professional learning at the interactive intersection of teachers, students, and content.

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