

TEACHER IDENTITY AND TENSIONS OF LEARNING TO LEVERAGE STUDENT THINKING IN MATH TEACHING

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In mathematics teaching, high-leverage practices include eliciting, analyzing, and responding to students' ideas and reasoning (Kazemi, Franke, & Lampert, 2009). While a focus on student thinking in professional development can be a powerful mechanism for linking pedagogy, mathematics, and student thinking, it is less clear how to support teacher candidates (TCs) to leverage student thinking in their mathematics teaching. Findings suggest developing an understanding of self as mathematics teacher relates to TCs' capacity for leveraging student thinking as a pedagogical practice and for making sense of their relations to the complex dynamics in schools. The tensions TCs experienced when leveraging student thinking in the actual socio-political contexts and constraints of schooling and the influence of their identity on their representations of practice lead to implications for mathematics teacher education.

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There is emerging consensus in education research of importance of teachers' attention to "high-leverage practices" (e.g., Ball & Forzani, 2009). In mathematics teaching, high-leverage practices include eliciting, analyzing, and responding to students' ideas and reasoning (Kazemi, Franke, & Lampert, 2009). By focusing teachers' attention on students' reasoning and then leveraging their thinking in instruction, teachers validate students' mathematical thinking and support all students in making connections, solving authentic problems, and participating in the discipline (Windschitl, Thompson, & Braaten, 2011).

A focus on student thinking in teacher professional development has also been shown to be a powerful mechanism for linking pedagogy, mathematics, and student thinking (e.g., Franke & Kazemi, 2001). As teachers struggled to make sense of students' thinking, they elaborated on how problems were posed, asked each other questions, and learned about their students and their practice. Student work thus promoted collective inquiry into relations between teaching and learning and supported teachers' experimentation in their classrooms (Franke & Kazemi, 2001).

Objectives or Purpose of Study

While research suggests that elementary teacher preparation should support teacher candidates (TCs) in development of practices such as leveraging student thinking, research with TCs is less widely documented. Attention to student thinking in teacher education and inquiry into instructional practices has been hypothesized as a way to support TCs' understanding of teaching and student learning as well as their enactment of practices of leveraging student thinking (Windschitl et al., 2011). I contend that to support TCs in leveraging student thinking, math teacher education must prepare TCs to enact these practices *while* navigating the many social, political, and institutional dynamics in math classrooms and schools that complicate and regulate teacher practice and construct images of being a math teacher.

The following response from Laura, a teacher candidate in an intensive elementary masters' certification program, underlines this point. Laura is a White female in her late-twenties from a middle-income background. While her age, ethnicity, and socioeconomic class are consistent with what educational research labels as the "typical preservice teacher" (Lowenstein, 2009, p. 166), the following discussion is not meant to present TCs as learners who have deficient resources or experiences from which to build on when it comes to learning about issues of mathematics learning or teaching for equity. The goal, instead, is to illustrate the complexity of Laura's positioning as an elementary mathematics teacher and how she understands it.

Laura participated in a seminar on critical self-examination and mathematics teaching in context. In a written response, she described how her self-understanding as a mathematics teacher and her

understandings of her students are influenced by the way her institution frames student learning, students' abilities, and mathematics:

All the time, we refer to students as “above,” “on,” or “below.” In many ways, attaching these labels makes life easier, but it also attaches stigmas about the student's ability and desire to learn.... [In my math class] the students work in separate classrooms and with different teachers to learn the 3rd grade objectives and to practice problem solving.... My impression is that the expectations of their [problem-solving] abilities are low, and as a result, they are given rather simple problems. (May 3, 2010, Positioning statement)

She identified how labels, such as “above-grade-level” and “below-grade-level,” which are determined by students' test scores, come to characterize the students' capacity to learn and motivations. The institutional policies of grouping shape teachers' expectations, define mathematics as skills or problem solving, limit students' opportunities to learn, as well as restricted her own teaching practices:

When I suggested some word problems from the 3rd grade math textbook, I was told the numbers in the problems were too difficult and had to be changed. I recognize that for some of my students, they would really struggle using fractions with different denominators; however, I also know that many of my students could handle the challenge. Since they are not challenged to solve more difficult problems (that are still considered 3rd grade level), they do not have the opportunity to make as much progress as students in other classes who are challenged. (May 3, 2010, Positioning statement)

Teaching mathematics is fundamentally about teaching within this complexity. The consequences of leaving teachers unprepared are damaging, not only for those teachers, but also for students, as teachers who are unprepared for the realities of schooling may be unable to enact ambitious mathematics teaching practices. New teachers need to understand the dynamics mathematics teaching in their school contexts that Laura mentions, and their own relationships to these dynamics. Understandings of self and relations to these dynamics structure teacher identity.

Theoretical Framework

Teacher identity is a complex construct that is conceptualized in a multitude of ways in educational research. To explore teacher identity and teacher practice, I extended Judith Butler's (1999) premise of the performativity of gender and gender identity and sought to conceptualize identity as an agentic act as much as possible within the discourses that concurrently frame identity as a process. TCs' mathematics teacher identities are shaped by the political, social, and institutional *discourses* that provide systems of categories, terms, and beliefs that organize and structure ways of thinking and acting in relation to mathematics, teaching, and learning (St. Pierre, 2000). Prevailing discourses about mathematics teaching and learning that influence TCs' understandings of being a mathematics teacher may include: institutional discourses around curriculum and testing (Brown & McNamara, 2005); social discourses around race, class, and abilities (de Freitas & Zolkower, 2009); discourses about mathematics as skills or as practices of “making sense” (Fuson, Kalchman, & Bransford, 2005); or, discourses of teacher as “savior.”

Discourses, as theorized in poststructural feminist discussions of education, constrain and enable what teachers do, say, and even conceive of as appropriate (Britzman, 1993; Walshaw, 1999). For example, test-driven school cultures in the U.S. create institutional discourses about teaching and students, including notions of fixed student abilities and one-sided positive notions about standardization (Apple, 2004). These discourses, norms, and the way they position individuals (e.g., Davies & Harre, 1990) are understood to structure teacher identities, influence how teachers position students, and *interfere* with teachers' authentic teaching and learning relationships with children in their schools (Olson & Craig, 2009). In becoming a math teacher, Laura, for example, wondered how to navigate the ability grouping in her classroom, contest teachers' low expectations, and work within competing discourses of mathematics.

Teacher identities have been shown to shape why people teach (Britzman, 1993), how they understand the mathematics they teach (Gellert, 2000), and how they learn to teach (Horn, Nolen, Ward, & Campbell, 2008). TCs' experiences as students and with mathematics also manifest in practices of attending to

student thinking in math teaching as obstacles or resources (Neumayer DePiper & Edwards, 2009). While there are a variety of influences on new teacher practice and how TCs attend to student thinking, the relations between teacher identity and teacher practice need to be better understood and identity work needs to be fostered in teacher education (Ponte & Chapman, 2008). Building from and responding to research on teacher identity, my theoretical stance is that TCs need to understand, on one hand, that how they position themselves as mathematics teachers and are positioned by others (e.g., instructors, mentor teachers, school administration, students, etc.) is shaped by social and political discourses about mathematics and teaching, and, on the other hand, that they can use this understanding to (re)author their positions toward mathematics teaching and learning. Developing TCs' understandings of classroom dynamics may support them in negotiating their multiple positions as elementary mathematics teachers and enacting teaching practices that best support all students in learning with understanding.

Modes of Inquiry

I used design-based research, situating my stance on identity and identity work in action both to support these TCs and to theorize about identity work in mathematics teacher education. The following questions guided this study: For TCs participating in a seminar on critical self-examination and mathematics teaching in context, how are they understanding themselves as mathematics teachers and teaching in context? How are those understandings shifting?

Study Context

The study took place during the last semester of a 15-month master's certification program. Ten female TCs, between the ages of 25 and 35, volunteered to participate in the eight seminar sessions and the study. Eight TCs self-identified as White, one as an immigrant from Argentina, and one as African-American.

Seminar Design

In the seminar design, I operationalized critical pedagogy (e.g., Kumashiro, 2000) and feminist poststructuralist notions of identity in mathematics teacher education. I sought to engage TCs in determining what discourses were present and in understanding how they operate in order to think differently about *themselves* as mathematics teachers and their relations to these dynamics. The objectives of the seminar focused on: identifying and examining the many prevailing social and political discourses that shape mathematics, mathematics teaching, and their positioning; analyzing the implications; rethinking these in relation to self; and problematizing teaching in relation to them. Seminar activities included case analysis, group discussions, and reflective writing prompts about their positioning and teaching experiences.

Data and Analysis

The data included seminar video and transcripts, interviews, and TCs' written work. I used discourse analysis to analyze TCs' identity and understandings of teaching. I analyzed identity as positioning, repositioning (Davies & Harre, 1990), and being reflexive about positioning (Mauthner & Doucet, 2003). Understanding of mathematics teaching was conceptualized as problematizing, that is how TCs took up particular conversational routines that open opportunities for learning about practice (Horn & Little, 2010) and how they negotiated attention to principles of teaching, instructional strategies, and specific practices (Pollock, 2008). In each case study analysis (Yin, 2003), I followed each TCs' discursive participation across seminar sessions. In line-by-line analysis of seminar transcripts, I identified an emergent theme in relation to each TC's self-understanding and followed each TC's discursive participation about herself and her teaching in relation to this theme and TCs' shifts in participation.

Analysis and Results

The following analysis presents TCs' participation in one analytic episode and serves to illustrate TCs' representations of their practice and one of the main findings of this study.

Examining Practices of Grading and Evaluating Student Understanding

In preparation for Session 4 of the seminar, TCs analyzed an artifact of their teaching as situated within the discourses and messages that we had discussed. They submitted this analysis in writing, including their intentions and specific interactions with students, and shared their artifacts and analysis with the group during Session 4. Candice began by describing challenges with judging students' work and tensions between being supportive of "where students are" and also wanting "to get [her students] where [they] need to go" (group discussion, May 18, 2010). Analysis suggests that she felt that the pressure to maintain pace with the curriculum and the standardization of grading (on a scale of 1 to 10) were institutional constraints on her teaching and in tension with an emphasis on attending to students' individual understandings and abilities:

I don't want a kid to always get a [score of] 1. Like, you know, it's this big thing if you're not a "1 kid." You want to be a "10 boy" or a "10 girl." But if they're not doing 10 work, but they're trying their—like, it's a 10 for them, but it's not a 10 according to our rubric. And I actually had a conference about that because I was giving out too many 10's. And like, "Do you really think this is 10 work? Like on a BCR, you have to do this, this, and this." And I was like, "Okay, that was his 10 and I, he put forth effort, he sat next to me and he tried, so I don't give him a 10 on his best try? So, why would he try again?" (discussion, May 18, 2010)

Candice's comment serves as evidence that she recognized how she was positioned by both the pressures of standardized grading systems and by her desire to attend to and leverage students' thinking and self-confidence. She evidenced problematizing of grading students in her context and repositioning herself by contesting standardized grading and supporting individual learning.

In response, Brooke did not take up Candice's concerns. Rather, she suggested Candice use effort grades, specifically a "star, smiley face, and check" system to "affirm [students'] effort." Brooke stated that this communicated her goals to students: "I want [students] to know that they need to keep going and what they're doing isn't perfect yet. They should just keep working as hard as they can, just like an on-grade or above-grade level student should be pushed the exact same way" (group discussion, May 18, 2010). Analysis suggests that Brooke did not problematize how grades, either for achievement or academic behaviors such as effort, position students, but emphasized individual student responsibility.

Sarah then described how she communicated with students about their writing in language arts by creating facilitated opportunities for her students to read her comments and ask her questions. Sarah articulated a guiding principle, "You have to give them opportunity," emphasizing students' and teachers' responsibilities in grading and assessment. Although her mentor did not approve of her practice of taking class time for individual writing conferences, Sarah stated that she felt that it supported her students' understandings of their grades and their writing and repositioned students in relation to the pressures of grading. In this manner, analysis suggests that she took up some of tensions Candice felt about grading and supporting students' progress while also contesting the pressures of test-based accountability.

When Sarah described how all students "scored an A or a B on these assignments" because there were "multiple points to catch them," Laura questioned what those students' grades meant. Laura felt that there were differences in the understandings evidenced between the students who had received support and those who had completed the assignment independently but that these differences, both in her classroom and Sarah's, were glossed over in the grading system and when supporting students' learning. Laura described an incident with a particular student who had "great math assignments" after working with the assistant teacher and the tensions she felt:

But it's so hard because then, like, there were other kids that were sort of normally on like his level, that were still like maybe getting low grades, and his grade was like up here, but you knew that she

really like pulled that from him. And, I don't know. Grades are weird, right, but I always just wonder. (group discussion, May 18, 2010)

Laura felt a conflict between supporting her students, standardized grading, and seeking to understand students' independent thinking and skills. In discussion, she identified how grades influenced multiple stakeholders, including parents, next-years' teachers, and administrators, and understandings of students' abilities and progress. Thus, analysis suggests that Laura struggled to make sense of how to attend to students' thinking and differences in understanding in the actual socio-political contexts and institutional constraints of schooling.

How Personal Theories of Teaching and Learning and TC Identity Related to TCs' Analysis of Student Work and Representations of Practice

Across seminar sessions, TCs experienced tensions when seeking to leverage student thinking as a pedagogical practice in their teaching contexts, particularly TCs who demonstrated a belief in and capacity for these practice in methods courses. While the focus and framing of these tensions were different, TCs' personal theories of teaching and learning *and* their identity influenced the ways in which these tensions emerged in their analysis of student work and representations of practice.

Figure 1 presents a framework outlining three stances of how TCs' individual theories of teaching and learning and TC identity relate to analysis of student work and representations of practice. Windschitl et al. (2011) found that in guided discussion about student work, some TCs took an intellectual stance of teaching and learning as problematic and others took a stance of teaching and learning as unproblematic. They suggest that TCs' theories of teaching and learning were underlying their analysis of student work, representations of practice, and the dilemmas they felt in their classroom. Building on the analysis and frameworks of Windschitl et al. (2011), my analysis highlights another dimension, specifically that TCs' understanding of their positioning also influenced framing of practice and the questions they brought to peers.

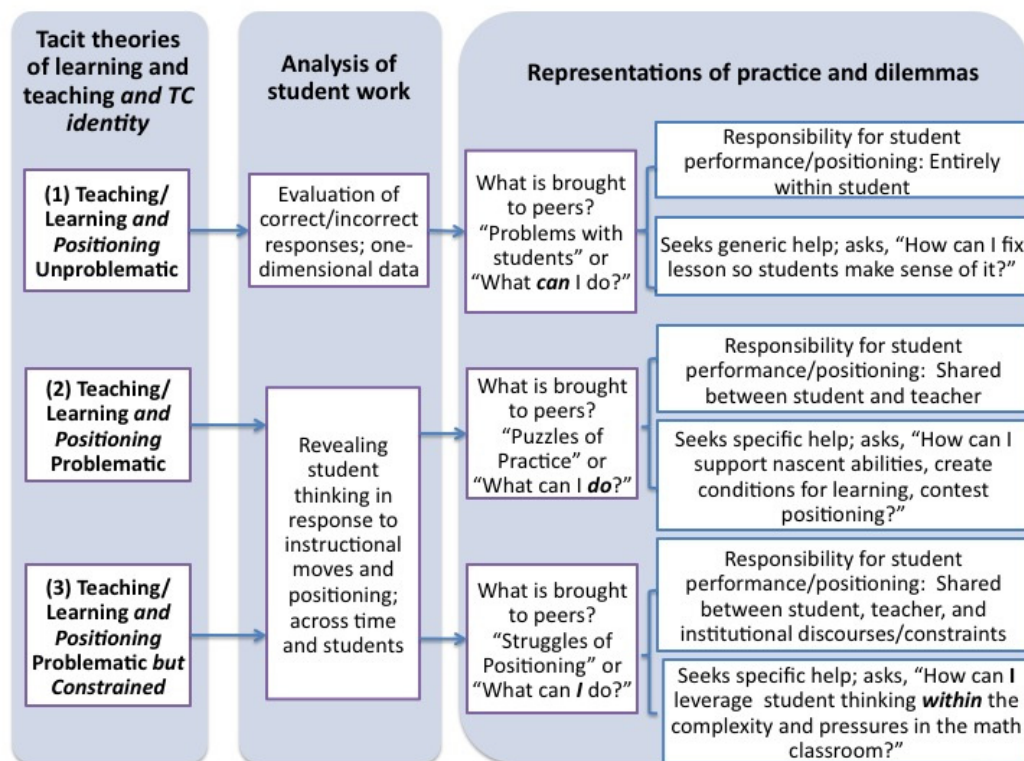


Figure 1: How personal theories of teaching and learning and TC identity related to TCs' analysis of student work and representations of practice

Brooke's participation across sessions is representative of the first intellectual stance emergent in TCs' engagement: Teaching/Learning and Positioning as Unproblematic (Figure 1). In analysis of student work, she focused on correct/incorrect responses and how there were *students* who did and did not get it, would and would not get it, and did not understand their placement in what she called the "math class hierarchy." Her comments suggest beliefs about learning mathematics as a process of skill acquisition as well as the ways in which she did not see students' positioning, her influence on students' positioning, or their positioning by grading practices as problematic.

Analysis of TCs' tensions with mathematics teaching and their representations of practice identified three iterations of the question, "What can I do?" which is also referenced by Pollock et al. (2010) in discussions of teaching teachers about race. Analysis suggests Brooke brought the question, "What *can* I do?" to her peers, questioning what she *could* do, as student performance and positioning were problems of *students* needing to understand the mathematics and take responsible for their performance and positioning. She sought generic help, not specific to students' understanding or thinking. Her positioning, in particular how she understood math abilities and students' responsibilities, framed her analysis of student work, and she struggled to interrogate her positioning towards mathematics, the framing of abilities in mathematics, and how her school framed learning and progress. This case highlights the challenges TCs have with working at the intersections of these issues and their positioning. By not seeing her positioning or her students' positioning as problematic or examining herself in relation to these issues, she struggled to problematize practice and remained focused on fixing students and lessons.

Sarah and Candice's participation is representative of an intellectual stance where both teaching and learning and their positioning were problematic, the second stance articulated in Figure 1. Sarah and Candice both analyzed student work to reveal student thinking and emphasized sense-making in her interactions with students. In analysis of student work and when discussing instruction, they identified their positioning as an intern, how students were positioned, and the discourses of test-based accountability and tensions, where standardized assessments mattered more than what was learned from students' work. In representations of practice and dilemmas, Candice and Sarah asked specific questions of practice; that is, "What can I *do*?" They engaged in puzzles of practice and demonstrated a shared responsibility for working with students to address their positioning and context. Sarah, for example, saw her positioning as problematic and asked questions about supporting students' abilities, creating opportunities to learn, and contesting discourses of test-based accountability, her positioning and her students' positioning. Understanding positioning as problematic and seeking to contest it coincided with bringing puzzles of practice and specific questions about practice to peers.

Laura also represented teaching and learning as problematic, but analysis suggests that she sought to work within how she was positioned and the complexity of institutional pressures in her mathematics classroom. As evidenced in her analysis of student work and representations of dilemmas of practice, her participation is representative of a third stance, Teaching/Learning and Positioning as Problematic but Constrained (Figure 1). During her mathematics methods course and across the seminar, Laura demonstrated a strong belief in and the capacity for attending to student thinking as a critical instructional practice and also that responsibility for student performance was shared between student, teacher, and institution, but analysis suggests that her understandings of herself left her feeling as if her options for her practice in her school context were constrained. Thus, while she problematized practice and brought these puzzles of practice to the group, analysis suggests that she felt limited and struggled with her positioning in context.

As this study and seminar were framed in relation to sociopolitical discourses of teaching, Laura's discursive participation suggests that through this attention to what is framing her positioning, more tensions about enacting this work in context emerged for her. Analysis suggests that she was asking, "What can I *do*?" The self-understanding and awareness that she evidenced may have helped her better understand how teaching context was a critical element of her practice and her positioning and how she could assert agency in choosing a teaching context, but she remained uncertain about how to engage in the instructional practices that were important to her and encouraged by her methods courses. While Windschitl et al. (2011) suggests that TCs' enactments or lack of enactment of ambitious practices related

to TCs' beliefs or knowledge, it was Laura's concern about who she was and what she could do, specifically, her understandings of herself and her identity that influenced her representations of practice.

Discussion and Conclusions

This study emphasizes the importance of attending to the many tensions TCs feel in enacting practices of leveraging student thinking in context. As Windschitl and colleagues (2011) suggest that unsophisticated views of teaching and learning underlie analysis of student work, this analysis finds that through attention to the sociopolitical dynamics of teaching, TCs articulate other tensions in their representations of practice and the ways in which they understood enacting practices such as leveraging student thinking. The framework outlining the different stances and TC representations of practice and dilemmas suggests that TCs were asking different questions about themselves, their agency, and instruction. In response, math teacher education needs to respond to the questions and tensions TCs feel about their positioning and enacting specific practices in classrooms. Specific implications are for more activities in math teacher education that help TCs contests one-sided positive notions of standardization and the category systems and grading systems prevalent in math classrooms and for continued discussions about TCs' complex positioning. In seeking to support TCs in their enactment of high-leverage pedagogical practices in context, mathematics teacher education needs to focus on the complexity of math teaching contexts and TCs' understandings of these dynamics as related to practice.

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