PRE-SERVICE SECONDARY MATHEMATICS TEACHERS' PERCEPTIONS OF ABILITY, ENGAGEMENT, AND MOTIVATION DURING FIELD EXPERIENCES

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We conducted a self-study to learn more about how to support the first author's pre-service teachers (PSTs) during their field experiences in an introductory secondary mathematics methods course. The findings highlight how the PSTs' perceptions of the secondary students' mathematics ability was closely related to how they viewed the students' levels of engagement and interest. The data also indicated that PSTs often diminished the role that the cooperating teachers played in co-constructing student ability, motivation and engagement, particularly in situations where the students displayed unfavorable behaviors. The findings inform curricular development for methods courses and field experiences, both for the authors and for the mathematics educators who support PSTs in diverse school settings.

Keywords: Teacher Education-Preservice, Equity and Diversity, Teacher Beliefs

Background and Purpose of the Study

Preparing mathematics pre-service teachers (PSTs) includes supporting them as they develop dispositions toward equity (Hand, 2012), particularly in schools that are labeled as high needs. *High-needs school* is a marker used to describe schools with one or more of the following characteristics: a student population comprised primarily of students of color, a high concentration of English language learners, or a high concentration of students from families with lower socioeconomic status. At times, this label perpetuates deficit-oriented thinking about the students who attend these schools. PSTs often enter mathematics education courses well versed in popular deficit-laden discourse about high-needs schools and the challenges of working in them, deemed as "lay culture norms" by Tatto (1996). This line of thinking often leads to PSTs framing their students' experiences and ways of knowing as unfamiliar (and possibly subordinate) to their own, which negatively impacts PSTs' mathematics teaching practices. In turn, this limits students' academic trajectories and opportunities to learn. Mathematics educators must support PSTs in recognizing and challenging this deficit-oriented thinking.

I, the first author of this work, designed an introductory secondary mathematics methods course with the goal of not only promoting rigorous and standards-based mathematics teaching methods, but also in the hopes of supporting students in unpacking issues of privilege, equity, and ability in the context of diverse mathematics classrooms. One important component of this course is the field experience. Upon analyzing my program's survey data as part of a larger study of programmatic change in our Secondary Education program (Samaras, Frank, Williams, Christopher, & Rodick, in press), I learned that former students found their field experiences unbeneficial. Thus, my graduate assistant and second author, Monique, and I designed a field experience that we hoped students would find relevant and that would highlight aspects of equitable teaching in action.

This self-study (Samaras, 2011) examined the challenges the first author faced as a new mathematics teacher educator in designing a meaningful field experience opportunity for PSTs who were observing mathematics teaching and learning in a high-needs high school. The following question guided our research: What can we learn from the PSTs' field experiences to provide more meaningful fieldwork in secondary mathematics methods courses? The findings gleaned from the PSTs' reflections and observations revealed the tacit labels assigned to students in high-needs schools rooted in PSTs lay culture norms about ability, motivation, and engagement. Our findings

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challenge us to find new ways to disrupt these lay culture norms and to help PSTs acknowledge the co-constructed nature of mathematics ability and participation between students and teachers in mathematics classrooms (Hand, 2010).

Theoretical Perspective

Integrated Perspective

This study is grounded in sociocultural and sociopolitical perspectives about mathematics teaching and learning, acknowledging that mathematics classrooms are cultural and political spaces. A sociocultural perspective highlights the role of participation, social interaction, and negotiation in teaching and learning, and it highlights the norms and discourse practices of educational settings and how they influence learning (Cobb & Yackel, 1996). Context is central to learning from a sociocultural perspective, meaning one cannot separate what one learns from the context in which it happens and the people with whom the learning takes place.

We also draw on Nasir and McKinney de Royston's (2013) notion of sociopolitical perspectives in mathematics education. These authors define a sociopolitical perspective as distinct from a sociocultural one in that it accounts for "how…power operate[s] in learning settings, especially as [it] may relate to privilege and marginalization" (p. 266). Sociopolitical attention to mathematics teaching and learning addresses not just how activity is organized, but also how issues of power permeate learning contexts. In this study, we see the political nature of mathematics permeating mathematics learning at three levels – at the school level as well as at the state- and national-levels where policies such as accountability mandates inform instructional choices.

We adopted an integrated theoretical lens to understand the PSTs interpretations of their field experience observations. This means that while the cultural and contextual features of the classrooms our PSTs observed were important, we also accounted for the political nature of mathematics education, which had significant influence over teachers' instructional choices.

Teacher Noticing

As a complement to our integrated perspective, we also draw on contemporary research about teacher noticing, which encompasses "not only the attention that [PSTs] give to classroom actions and interactions, but also their reflections, reasoning, and decisions based on this noticing" (McDuffie, et al., 2014). Mason (2008) noted two facets of teacher noticing which are central to our study, (a) attention, or what teachers notice as they observe practice, and (b) awareness, or how teachers make sense of or interpret what they observe. Given that PSTs' attention and awareness are culturally situated, informed by participation and negotiation in methods class and the classrooms they observed, and influenced by context, we see noticing as complementary to our theoretical perspective.

Methodology

The purpose of self-study methodology is for educators to explore issues directly relevant to the context to which it is applied (Samaras, 2011). The theoretical underpinnings of self-study acknowledge that knowledge production and development is context and cultural sensitive (LaBoskey 2004). Thus, self-study honors teacher voice, in that it allows teachers to respond "to the needs and concerns of *their* students in *their* contexts" (Kosnik, Beck, Freese, & Samaras, 2006, p. x). The five tenants of self-study research include: being self-initiated and focused, aimed at improvement, being interactive, utilizing multiple, primarily qualitative methods, and using validation procedures that are exemplar-based (Samaras, 2011). In our efforts to maintain fidelity to the characteristics of self-study, we initiated this self-study project to improve the field experiences component of the methods course. This study was highly interactive, as we served as critical friends

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who provided insider (first author) and outsider (second author) perspectives during data collection and analysis.

Participants

This study examined the perceptions of four PSTs from the first author's introductory methods course who were assigned to a racially, linguistically, and socioeconomically diverse school. The group ranged in age from early 20s to late 50s. Two male and one female PST identified as White and one as an Asian immigrant woman. Three PSTs decided to teach mathematics after having careers in mathematics-related fields. One had recently earned an undergraduate mathematics degree. In their mathematics mathematics autobiographies, each of them expressed comfort and ease with mathematics throughout their K-12 schooling

It is important to note that while we are not direct participants in this study, our roles as instructor and graduate assistant are central. We entered this study aware of the power dynamics between researchers and educators when conducting research (Kvale, 2006), especially when one researcher is also the instructor of the participants. For this reason, the second author led the focus groups, though the first author probed for deeper understanding at times. Since this study, the second author has served as a teaching assistant for a subsequent introductory mathematics methods course and will be the instructor of record for future methods courses. Thus, we both have personal interests in improving this major component of the course.

Context

The context for this study was an introductory secondary mathematics methods course. The goals of the course were to introduce students to reform-minded mathematics teaching and learning via the National Council for Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics* (NCTM, 2000) and state standards, which encourage student-centered, conceptual approaches to teaching. PSTs had to complete 15 hours of observations in secondary mathematics classrooms. The first author only required PSTs to observe in this introductory course, as they are required to take an active and participatory role in a secondary mathematics classroom during their second methods course. They were encouraged to visit as many classrooms as they could to get a sense of how mathematics instruction varied both across a schools' mathematics department and within a teacher's practice as she worked with different groups of students.

The university's clinical experiences office organized the field experience placements. The PSTs completed their fieldwork at an ethnically, linguistically, and socioeconomically diverse high school in a nearby local district, which according to state-level data, is the lowest performing high school in the district. In fact, at the time of the study, the school faced sanctions for not meeting accountability standards.

Data Sources

Multiple sources of data in this study serve as a means of data triangulation to provide corroborating evidence to support our findings (Miles & Huberman, 1994). Data sources included two focus groups at the beginning and end of the field experience that ranged from 45 minutes to an hour. We also collected each PST's autobiographies where PSTs reflected on their personal experiences as mathematics learners. We also collected their final reflection papers that provided detailed accounts of their field experiences using writing prompts that encouraged PSTs to consider school and community contexts and classroom interactions among students and between students and teachers.

Given the focus on the researcher in self-study, I as the first author and instructor kept detailed personal memos. These memos were written following both focus groups. They focused on the big ideas that I heard and wonderings that I had as I listened and probed PSTs during the focus groups.

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As I read my PSTs' reflection papers, I also kept memos of the themes that I noticed as I read. I shared my memos with the second author as we analyzed the data.

Data Analysis Procedures

We employed qualitative methods for this study, including document analysis and focus groups. Document analysis is a systematic procedure for evaluating printed and electronic documents that "requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge" (Bowen, 2009, p. 27).

Data analysis began with pre-coding the data (Saldaña, 2009), meaning that we read the focus group transcripts and reflections and flagged, highlighted, or underlined portions that we believed would be important to this study and in need of attention during the coding process. Upon several reads and annotations of the transcripts, these themes eventually became codes and sub-codes about the nature of the PSTs observations. Once we established our initial codes via axial coding (Miles & Huberman, 1994), we used Dedoose software to code the corpus of data. With the help of the interactive data visualization tool in Dedoose, we were able to observe patterns and themes. We each coded the data sets on our own, then came together to share the patterns that emerged as well as our interpretations. We strived to validate our findings by check-coding our ongoing analysis and interpretations of the data and by meeting frequently to share our coding and to resolve discrepancies.

Approaching this work from the theoretical lens described above, we analyzed the PSTs' participation in focus groups as well as what they shared in their written reflections to explore how they drew upon artifacts, tools, fellow PSTs, and us, as faculty and graduate assistant, to make sense of their experiences and to develop new understandings (Putnam & Borko, 2000).

Findings

PSTs' Perceptions of Student Ability, Motivation and Engagement

Ability and reform-based teaching practices. An emergent theme from the data was that the PSTs' assumption that reform-minded mathematics was mainly suitable for advanced students. PSTs wondered if reform-based instructional approaches were suitable for all types of learners, or whether these practices only worked with students who were viewed as "motivated," "smart," or "high flyers" as some PSTs described them. For example, when discussing his frustration with the lack of reform-minded practices in a low-tracked Algebra class he observed, one PST shared, "I would like to see classrooms where [reform-based practices] actually work. I think that would be really interesting. What (sic) are those students? What are the demographics?" Implicit in this excerpt is the PSTs' understanding that the kind of student-centered teaching emphasized in the methods class is suited for particular learners, namely those who are considered to be advanced or "smart."

Ability related to motivation and engagement. In a similar vein, the PSTs' perceptions of student motivation and engagement were often predicated on the academic level of the class. We found numerous instances of this in the corpus of data. PSTs frequently adopted a deficit-oriented perspective when describing unfavorable student behavior or learning outcomes. Peppered throughout the focus group conversations regarding student motivation and ability were phrases such as "Some of these kids don't care," while other PSTs expressed sentiments that students who appeared unmotivated "don't want to learn."

When reflecting on observations in an advanced (International Baccalaureate [IB]) class, one PST shared, "Every single student was paying attention and doing their work. And it could be the fact that it is an IB class, which I would probably think most of the reason is." Given that this PST's reasoning for students being engaged and paying attention in class was because the class was designated for advanced students is another example of how perceptions of student ability influenced

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the PSTs' perceptions of motivation and engagement. The PSTs often referred to the students in lower-tracked classes as unmotivated and disengaged, while the students placed in the higher-level courses were frequently posited as focused and on-task. These claims were made based on behaviors that the PSTs' observed, not on the students' work or grades in the course. Even when advanced students displayed similar behaviors as those in lower-tracked classrooms, PSTs interpreted the behavior differently. One PST recounted the following:

> Until [lower-tracked students] were called on, they were just sitting there [absorbing] whatever information made it through their skin, and the instructor said, "Look you know you guys have to care"... The [higher tracked] Probability and Statistics course, they were all very focused. So [the instructor] could lecture to the students who wanted to pay attention. There was a girl right in front of me flipping through her magazine and two students on my right on their phones. [The teacher] says, "They are good students, and they will take care of their homework after class."

This excerpt is especially salient. PSTs noticed behaviors that they believed indicated that the lower-tracked students were disinterested and not concerned with learning mathematics (i.e., "waiting for information to seep into their skin"). In the excerpt above, higher-tracked students exhibited similar behaviors, yet because of their status as higher-tracked and "good" the teacher ignored their disinterest during class.

The Impact of Accountability Mandates

PSTs who observed at this particular high school noted the disengagement of the students in lower-tracked classrooms as described above. Upon further exploration, we found that most of the classes where the PSTs noted disengagement were typically remedial or for standardized testing preparation. Cooperating teachers in these classes opted to drill subject matter, while others struggled with pacing and covering all of the necessary material for testing. Ultimately, all of these choices resulted in teacher-centered instruction and selection of materials that emphasized procedures rather conceptual understanding. When looking across all 4 PSTs' reflection papers as well as the focus group data, all of the PSTs mentioned how the pressures of standardized testing influenced their observed teachers' instructional choices; However, most missed the opportunity to connect these instructional choices to student disengagement. This finding also points to a third theme that emerged from the data, the limited acknowledgement of the cooperating teachers' role in co-constructing ability, engagement, and motivation, which we discuss in the next section.

Limited Unpacking of the Cooperating Teacher's Role

We surmise that the PSTs did not see how their cooperating teachers, through discourse, interactions with their students, and curricular choices *positioned* (Herbel-Eisenmann, 2015) students to take up or resist particular opportunities to learn in their classroom interactions. When we questioned the PSTs about how the cooperating teachers' instructional decisions contributed to their students' disengagement and perceived low mathematics ability, most PSTs admitted that they had not considered the role of each teacher in co-constructing these negative interactions that they had mostly attributed to students. This is reminiscent of the teachers in Hand's (2010) study of how secondary teachers were often unaware of how their behaviors toward their students aided in co-constructing opposition in their low-tracked mathematics classrooms.

As we noted this pattern in the data, we began to ponder why the PSTs consistently missed the opportunities to notice their cooperating teachers' roles in co-constructing behaviors they saw as unfavorable. Upon a closer look at the data, we found that PSTs expressed apprehension in framing their cooperating teachers as being ineffective. In fact, during the last focus group, several of them noted that they felt guilty about reporting what they observed. They were afraid of being "teacher bashers" as one PST explained. It is important to note that in our analysis, we found that the PSTs

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gave far less attention to how they framed students in their discussions, particularly when describing unfavorable student behavior or learning outcomes. Unknowingly, the PSTs rested the responsibility for learning and engagement squarely on the students' shoulders.

When PSTs had the opportunity to consider the role of their cooperating teacher in co-constructing negative interactions, they gained deeper understanding of the teacher's role in impacting student motivation and engagement in tasks. One PST noted how even something that seemed minimally important on the surface, the way a teacher sets up her classroom, could foster unproductive participation and possibly encourage student disengagement. He shared, "All the desks were in groups of four, which meant that about half the students for the entire class period had their backs to the teacher...and those students were facing the opposite wall and were some of the ones that were the most disengaged. This no doubt encouraged the talkativeness of his class." Another PST admitted that he had not considered the role that teachers play in co-constructing student disengagement or lack of understanding of the content. When reflecting on his experiences in the two classes observed, the PST noted in his final reflection:

> "Good" teachers often create a desire in students to learn. I really enjoyed Mr. O's class. He employed the use of real world problems and all of his students were actively learning...I did not get this sense from Mrs. V's class. Hardly any of the students paid attention, which she did nothing about. I couldn't blame the students because she made Algebra I seem boring."

These quotes show that some of the PSTs had an emerging understanding of how teachers' decisions either afford or constrain opportunities for engagement and motivation.

Implications

As this is a self-study, the findings and analysis inform our practice as instructor and graduate assistant of this course. However, we believe that the implications for this work are meaningful for other mathematics teacher educators. From the findings emerged important factors to consider when designing field experiences for future methods courses. We are also grappling with how we as university-based teacher educators affect fieldwork that often takes place in our absence and under the purview of cooperating teachers.

Within our methods courses, It is essential that we provide opportunities for PSTs to make sense of the contexts of their field experience location sites, especially when placed in high-needs schools. The PSTs needed more time to work through the deficit-laden discourse that influences what they notice and attend to when observing practice. Past research has shown that PSTs who only have one-time or minimal field experiences in high-needs schools tend to deepen their deficit perspectives due to the lack of exposure to unfamiliar communities (Sleeter, 2008). Rushton (2000) argued that new teachers could begin to shift their thinking about students in these settings if they work in these communities over a sustained period of time. Further, shifts in PSTs' deficit perspectives also have implications for what they notice as they observe instruction. McDuffie et al. (2014) note, "Teachers need support in learning to attend to, or notice, students' mathematical thinking and important classroom events and interactions—in other words, noticing is a practice that needs to be developed" (p. 246).

Additionally, unpacking the accountability milieus in which teachers have to make instructional decisions must become a more explicit component of PSTs reflecting upon their field experiences. Since data collection and analysis, we co-taught another introductory methods course. We tried to make noticing with respect to issues of, ability, engagement, and motivation more explicit with respect to our reading selections and class discussions about equity, race and ethnicity, and language. Only one PST explicitly discussed race in his reflection and two directly addressed issues of language, yet most of them noted that the drastic demographics between remedial classes that were primarily Black and/or Latin@ and advanced classes that were predominately White. We also spend

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time discussing how mathematics educators can shift from discussions of mathematics ability to discussions of student status (Horn, 2007). Additionally, in the subsequent advanced methods course, the first author has revised the curricular component on assessment to address the political nature of teaching mathematics in addition to more traditional mathematics assessment issues. We discuss how policies regarding mathematics assessment have very distinct outcomes for non-dominant groups of students.

Closely related to the need for PSTs to make sense of school contexts, where accountability mandates permeate mathematics instruction, we are now making space, in class and in the field, for students to think about how the political nature of teaching mathematics impacts teacher agency and instructional choices. Noting how the PSTs were reticent about sharing their observations of less desirable teaching for fear of teaching bashing pushes us to think of how we help students productively critique the cooperating teachers' practices. We ponder whether their reticence could be attributed to the PSTs' status as students who are learning to teach. Their positioning as novices could have led to them deferring to their cooperating teachers' pedagogical and relational choices. While we want our PSTs to implement more reform-minded strategies, we also want them to understand the complex nature of teaching mathematics and all of the factors that impact it. We are also pushing this work outside of the university-based methods course and working toward adopting a model of field experience where we, as instructors, visit classrooms with our PSTs and engage in conversations with cooperating teachers about their pedagogical and relational choices with respect to accountability.

With the attention to classroom context and the larger political forces that shape classroom activity, we believe that we are building a foundation for PSTs to move beyond static, one-sided characterizations of students as not caring about their mathematics courses. We hope that through our curricular changes based on this research, our PSTs come to see mathematics classrooms as dynamic spaces where teachers are co-constructing student engagement, behavior, and their students' mathematics identities. We strive to help them understand that learning mathematics cannot be viewed as a one-sided endeavor where students are framed as not interested in learning and, as a result, teachers are excused from providing effective instruction.

Conclusion

Helping secondary mathematics PSTs shift their dispositions toward teaching and learning mathematics in high-needs schools is complicated and complex work. It is essential as dispositions influence the moment-to-moment decisions mathematics teachers make in their classrooms (Hand, 2012). Supporting PSTs in this way requires attention to content, beliefs, and affect, and it requires PSTs to challenge and confront their own assumptions. Field experiences are viable spaces for doing some of this work. They give students authentic spaces to wrestle with the challenges that practicing teachers face daily. Finding new ways within methods courses to support this type of work continues to be a challenge we pursue.

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